
**JULY
2025 IEEE
Thesaurus**

**Version
1.04**



**Created by
The Institute
of Electrical
and
Electronics
Engineers
(IEEE)**

JULY 2025 IEEE Thesaurus

The IEEE Thesaurus is a controlled vocabulary of almost 12,420 descriptive engineering, technical and scientific terms, as well as IEEE-specific society terms [referred to as “descriptors” or “preferred terms”].* Each descriptor included in the thesaurus represents a single concept or unit of thought. The descriptors are considered the preferred terms for use in describing IEEE content. The scope of descriptors is based on the material presented in IEEE journals, conference papers, standards, and/or IEEE organizational material. A controlled vocabulary is a specific terminology used in a consistent and controlled fashion that results in better information searching and retrieval.

Thesaurus construction is based on the ANSI/NISO Z39.19-2005(2010) standard, *Guidelines for the Construction, Format, and Management of Monolingual Controlled Vocabulary*. The Thesaurus vocabulary uses American-based spellings with cross references to British variant spellings. The scope and structure of the IEEE Thesaurus reflects the engineering and scientific disciplines that comprise the Societies, Councils, and Communities of the IEEE in addition to the technologies IEEE serves.

IEEE has developed its controlled vocabulary through consultation with subject matter experts (specialists in a particular field) and specialists in information analysis. The IEEE Thesaurus thus provides a controlled vocabulary of subject headings to help people categorize or search for engineering and computing concepts, especially IEEE published content.

The IEEE Thesaurus also provides a conceptual map through the use of semantic relationships such as broader terms (BT), narrower terms (NT), 'used for' relationships (USE/UF), and related terms (RT). These semantic relationships identify theoretical connections between terms. *Italic text denotes Non-preferred terms.* **Bold text is used for preferred headings.**

Abbreviations used in the Thesaurus:

BT - Broader term
NT - Narrower term
RT - Related term
USE- Use preferred term
UF - Used for

*Refer to ANSI/NISO NISO Z39.19-2005 (R2010) Sections 5 through 8 for detailed information on controlled vocabularies, display formats, usage and spelling, and selection criteria for descriptors
(<http://www.niso.org/kst/reports/standards>).



JULY 2025 IEEE Thesaurus

1/f noise

UF: 1f
Pink noise
BT: Noise

1f

USE: 1/f noise

2 DOF

USE: 2-DOF

2-D displays

USE: Two-dimensional displays

2-d hole gas

USE: Two dimensional hole gas

2-D photonic crystals

USE: Photonic crystals

2-DOF

UF: 2 DOF
two degrees of freedom
BT: Robot motion

21CN

USE: Next generation networking

21st century networks

USE: Next generation networking

2D displays

USE: Two-dimensional displays

2d hole gas

USE: Two dimensional hole gas

2D photonic crystals

USE: Photonic crystals

3 degrees of freedom

USE: 3-DOF

3 DOF

USE: 3-DOF

3-D displays

USE: Three-dimensional displays

3-D modeling

USE: Three-dimensional displays

3-D modelling

USE: Three-dimensional displays

3-D reconstruction

USE: Three-dimensional displays

3-DOF

UF: 3 DOF
3 degrees of freedom
BT: Robot motion
RT: 5-DOF
6-DOF
Motion analysis

3D accelerators

USE: Hardware acceleration

3D audio

BT: Audio systems
Augmented reality
RT: Ambisonics
Virtual reality

3D displays

USE: Three-dimensional displays

3D integrated circuits

USE: Three-dimensional
integrated circuits

3D integration

USE: Three-dimensional
integrated circuits

3D interconnect

USE: Three-dimensional
integrated circuits

3D modeling

USE: Three-dimensional displays

3D modelling

USE: Three-dimensional displays

3D printing

USE: Three-dimensional printing

3D reconstruction

USE: Three-dimensional displays

3DI

USE: Three-dimensional
integrated circuits

3G

USE: 3G mobile communication

3G mobile communication



JULY 2025 IEEE Thesaurus

UF:	3G	broadband	Enhanced mobile
communication	3rd generation mobile		
	IMT-2000		Long Term Evolution
communication	Third generation mobile		Next generation networking
	UMTS	communication	Radio access networks
telecommunication service	Universal mobile		Spread spectrum
BT:	Cellular technology	computing	Telecommunication
	Mobile communication		Time division synchronous
RT:	4G mobile communication	code division multiple access	
	Ambient networks		
	Cellular radio	4K UHD	USE: UHDTV
	MIMO		
	Multiaccess communication	4th generation mobile communication	
	Next generation networking	USE: 4G mobile communication	
	OFDM		
	Radio access networks	5 degrees of freedom	
communication	Spread spectrum	USE: 5-DOF	
	Telecommunication	5 DOF	
computing		USE: 5-DOF	
	Time division synchronous		
code division multiple access		5-day biochemical oxygen demand	
		USE: BOD5	
3G partnership project		5-day BOD	
USE: 3GPP		USE: BOD5	
3GPP		5-DOF	
UF:	3G partnership project	UF: 5 DOF	
project	3rd generation partnership	5 degrees of freedom	
BT:	Standards organizations	BT: Robot motion	
RT:	New Radio	RT: 3-DOF	
		6-DOF	
3GPP Standards		Motion analysis	
BT:	Standards publications		
NT:	Long Term Evolution	5G	
		USE: 5G mobile communication	
3rd generation mobile communication		5G mobile communication	
USE: 3G mobile communication		UF: 5G	
		5th generation mobile	
3rd generation partnership project		systems	
USE: 3GPP			
		5th generation systems	
4G mobile communication		5th generation wireless	
UF: 4th generation mobile		systems	
communication		BT: Cellular technology	
BT:	Cellular technology	Mobile communication	
	Mobile communication	RT: 4G mobile communication	
RT:	3G mobile communication	6G mobile communication	
	5G mobile communication	Aerial computing	
	Cellular radio	Cellular radio	
		Edge computing	



JULY 2025 IEEE Thesaurus

broadband	NT:	Land mobile radio	<i>802.11n</i>	USE:	IEEE 802.11n Standard
		Next generation networking			
		Tactile Internet			
		Ultra-dense networks	<i>802.15</i>		
		Enhanced mobile			
				USE:	IEEE 802.15 Standard
		New Radio	<i>802.16</i>	USE:	IEEE 802.16 Standard
		Sidelink			
<i>5IR</i>	USE:	Fifth Industrial Revolution	<i>802.3</i>	USE:	IEEE 802.3 Standard
<i>5th generation mobile systems</i>	USE:	5G mobile communication	<i>8K UHD</i>	USE:	UHDTV
<i>5th generation systems</i>	USE:	5G mobile communication	<i>9/11</i>	USE:	Terrorism
<i>5th generation wireless systems</i>	USE:	5G mobile communication	<i>9/11 attack</i>	USE:	Terrorism
<i>6 degrees of freedom</i>	USE:	6-DOF	<i>911 attack</i>	USE:	Terrorism
<i>6 DOF</i>	USE:	6-DOF	<i>A-bomb</i>	USE:	Nuclear weapons
6-DOF	UF:	6 DOF	<i>A/D</i>	USE:	Analog-digital conversion
		6 degrees of freedom			
		Robot motion	<i>A/D conversion</i>		
		3-DOF			
		5-DOF			
		Motion analysis	<i>A/D converter</i>	USE:	Analog-digital conversion
6G mobile communication			<i>A2G</i>	USE:	Air to ground communication
	BT:	Mobile communication		USE:	Ambient assisted living
	RT:	5G mobile communication			
		Aerial computing			
		Cellular radio			
		Space-air-ground			
integrated networks			<i>AAL</i>		
<i>802.11</i>	USE:	IEEE 802.11 Standard	<i>AAV</i>	USE:	Autonomous aerial vehicles
<i>802.11ax</i>	USE:	IEEE 802.11ax Standard	<i>ABC algorithms</i>	USE:	Artificial bee colony algorithm
<i>802.11e</i>	USE:	IEEE 802.11e Standard	Abdomen	BT:	Body regions
<i>802.11g</i>	USE:	IEEE 802.11g Standard	<i>Abrasive water jet cutting</i>	USE:	Water jet cutting



JULY 2025 IEEE Thesaurus

Abrasives

BT: Production materials

Absorption

BT: Materials science and technology
RT: Semiconductor detectors

Abstract algebra

BT: Algebra
NT: Galois fields
Modules (abstract algebra)

Abstracts

BT: Writing
NT: Text summarization

AC generators

UF: Alternating current generators
BT: Generators
RT: Pulse width modulation
NT: Induction generators
Synchronous generators

AC light emitting diode lamps

USE: LED lamps

AC machines

UF: Alternating current machines
BT: Electric machines
RT: AC-AC converters
Pulse width modulation
Sensorless control
Windings
NT: AC motors
Induction machines
Synchronous machines

AC motors

UF: Alternating current motors
BT: AC machines
Motors
RT: Pulse width modulation
Pulse width modulation
inverters
modulation
NT: Hysteresis motors
Induction motors

AC power

USE: AC power transmission

AC power transmission

UF: AC power
Alternating current power transmission
BT: Power transmission
NT: Flexible AC transmission systems

AC-AC converters

UF: AC-AC convertors
AC-AC power conversion
BT: Converters
Power conversion
RT: AC machines

AC-AC convertors

USE: AC-AC converters

AC-AC power conversion

USE: AC-AC converters

AC-DC power converters

UF: AC-DC power converters
AC/DC power converters
Analog-to-digital converter
Analog-to-digital convertor
BT: Power conversion
RT: Machine vector control
Pulse width modulation
inverters
Voltage multipliers
Voltage-source converters
NT: Rectifying circuits

AC-DC power convertors

USE: AC-DC power converters

AC-LED lamps

USE: LED lamps

AC/DC power converters

USE: AC-DC power converters

Accelerated aging

BT: Aging
Materials testing

Accelerated computing

USE: Hardware acceleration

Accelerated testing

USE: Life estimation

Acceleration measurement

USE: Accelerometers



JULY 2025 IEEE Thesaurus

Accelerator architectures

BT: Computer architecture

Accelerator beams

USE: Particle beams

Accelerator magnets

BT: Magnetic devices
Particle accelerators

Accelerometers

UF: Acceleration measurement
BT: Measurement
RT: Fall detection

Access charges

BT: Economics
Multiaccess communication

Access control

BT: Security
RT: Biometric authentication
Biometrics
Building services
Capability-based security
Communication system

security

Computer security
Identification of persons
Smart cards
Trust management
Zero Trust
NT: Accesslists
Authorization
Blocklists
Multi-factor authentication
Non-repudiation
Passwords

Access lists

USE: Accesslists

Access point base station

USE: Femtocell networks

Access protocols

BT: Protocols
RT: CAPTCHAs
NT: Media Access Control
NOMA

Access rights

USE: Permission

Accesslists

UF: Access lists
Allow lists
BT: Access control
Information filters

Accident and emergency medicine

USE: Emergency medicine

Accident prevention

BT: Industry applications
RT: Explosion protection
Preventive maintenance
Risk analysis
Safety devices
NT: Accidents

Accidents

BT: Accident prevention
RT: Domestic safety
Electric shock
Emergency services
Explosions
Fires
Hazardous areas
Occupational health
Occupational safety
Oil pollution
Product safety
Risk analysis
NT: Aerospace accidents
Electrical accidents
Industrial accidents
Marine accidents
Railway accidents
Road accidents

Accreditation

BT: Educational programs
RT: Conformance testing
Training

Accuracy

BT: Mathematical analysis

Achilles tendon

BT: Tendons

Acidification

BT: Chemical processes
Pollution
NT: Ocean acidification

Acidosis

BT: Medical conditions



JULY 2025 IEEE Thesaurus

Acoustic applications

UF: Ultrasonic applications
 BT: Acoustics
 RT: Acoustic measurements
 Biomedical acoustics
 NT: Acoustic communication
 (telecommunication)
 Acoustic imaging
 Acoustic testing

Acoustic arrays

BT: Acoustic transducers
 RT: Acoustic signal processing
 Array signal processing
 Sonar

Acoustic beams

BT: Beams

Acoustic communication (telecommunication)

BT: Acoustic applications
 Telecommunication
 services
 RT: Mobile communication
 OFDM
 Wireless networks

Acoustic devices

UF: Ultrasonic devices
 BT: Acoustics
 RT: Piezoelectric devices
 NT: Acoustic waveguides
 Acousto-optical devices
 Acoustoelectric devices
 Bulk acoustic wave devices
 Film bulk acoustic
 resonators
 devices
 Surface acoustic wave

Acoustic diffraction

BT: Acoustic propagation

Acoustic distortion

BT: Distortion
 RT: Acoustic noise
 Acoustic signal processing
 Loudspeakers
 Nonlinear acoustics

Acoustic distortion measurement

USE: Distortion measurement

Acoustic emission

BT: Acoustics
 RT: Acoustic noise
 Acoustic testing
 Nondestructive testing

Acoustic field

BT: Acoustics

Acoustic imaging

BT: Acoustic applications
 RT: Acoustic testing
 Oceanographic techniques

Acoustic materials

UF: Acoustic metamaterials
 BT: Materials
 RT: Piezoelectric materials

Acoustic measurements

BT: Measurement
 RT: Acoustic applications
 Acoustic testing
 Anechoic chambers
 Biomedical acoustics
 Frequency measurement
 Phase measurement
 Seismic measurements
 Wavelength measurement

Acoustic metamaterials

USE: Acoustic materials AND
 Metamaterials

Acoustic noise

UF: Audible noise
 Audio restoration
 BT: Acoustics
 RT: Acoustic distortion
 Acoustic emission
 Acoustic signal detection
 Environmental factors
 Mechanical factors
 Vibrations
 NT: Background noise
 Noise cancellation
 Noise level
 Noise reduction
 Working environment noise

Acoustic phonetics

BT: Acoustics
 Phonetics



JULY 2025 IEEE Thesaurus

Acoustic propagation

BT: Acoustics
RT: Acoustic pulses
Waves
NT: Acoustic diffraction

Array signal processing
NT: Acoustic arrays

Acoustic wave attenuation

USE: Acoustic waves AND
Attenuation

Acoustic pulses

BT: Acoustics
RT: Acoustic propagation

Acoustic waveguides

BT: Acoustic devices

Acoustic reflection

BT: Reflection
RT: Acoustic scattering

Acoustic waves

UF: Acoustic wave attenuation
BT: Acoustics
RT: Seismic waves
NT: Acoustic refraction
Acoustoelectric effects
Surface acoustic waves

Acoustic refraction

BT: Acoustic waves

Acoustic scattering

BT: Scattering
RT: Acoustic reflection
Waves

Acoustical engineering

BT: Engineering - general

Acoustic sensors

BT: Sensors

Acoustical signal processing

USE: Acoustic signal processing

Acoustic signal detection

BT: Signal detection
RT: Acoustic noise
NT: Sonar detection

Acoustics

UF: Ultrasonics
BT: Music
Physics
RT: Acoustoelectric effects
Fourier transforms
Magnetoacoustic effects
Phonons
Resonators
Vibrations
NT: Acoustic applications
Acoustic devices
Acoustic emission
Acoustic field
Acoustic noise
Acoustic phonetics
Acoustic propagation
Acoustic pulses
Acoustic waves
Acoustooptic effects
Biomedical acoustics
Cepstral analysis
Nonlinear acoustics
Psychoacoustics
Reverberation
Spectral shape
Underwater acoustics

Acoustic signal processing

UF: Acoustical signal
processing
Audio enhancement
BT: Signal processing
RT: Acoustic arrays
Acoustic distortion
Acoustic transducers
NT: Active noise reduction
Speech processing

Acoustic surface waves

USE: Surface acoustic waves

Acoustic testing

BT: Acoustic applications
Materials testing
RT: Acoustic emission
Acoustic imaging
Acoustic measurements
Photoacoustic effects

Acoustic transducers

BT: Transducers
RT: Acoustic signal processing

Acousto-optic devices

USE: Acousto-optical devices



JULY 2025 IEEE Thesaurus

Acousto-optical devices

UF: Acousto-optic devices
Acoustooptic devices
BT: Acoustic devices
RT: Acoustooptic effects

Acoustoelectric devices

UF: Electroacoustic devices
BT: Acoustic devices
RT: Acoustoelectric effects
Piezoelectric devices
Pulsed electroacoustic

methods

Surface acoustic wave

devices

Acoustoelectric effects

UF: Electroacoustic effects
BT: Acoustic waves
Electric fields
RT: Acoustics
Acoustoelectric devices
Semiconductor materials
NT: Pulsed electroacoustic

methods

Acoustomagnetic effects

USE: Magnetoacoustic effects

Acoustooptic devices

USE: Acousto-optical devices

Acoustooptic effects

BT: Acoustics
RT: Acousto-optical devices
NT: Piezooptic effects

Acquired immune deficiency syndrome

UF: AIDS
Acquired immunodeficiency

syndrome

BT: Diseases
RT: Human immunodeficiency

virus

Acquired immunodeficiency syndrome

USE: Acquired immune
deficiency syndrome

Action potentials

UF: Bioelectric potentials
BT: Physiology
RT: Axons
Membrane potentials
Neurons

White matter

Activated sludge process

USE: Sludge treatment

Activation analysis

BT: Chemical analysis

Active appearance model

BT: Computer vision

Active circuits

BT: Circuits
NT: Active inductors
Gyrators
Operational amplifiers

Active contours

BT: Motion analysis

Active distribution networks

BT: Power distribution networks

Active disturbance rejection control

USE: Robust control

Active filters

BT: Filters
NT: Band-pass filters

Active inductors

BT: Active circuits
Inductors
RT: Gyrators
Integrated circuits
MOSFET circuits

Active learning

BT: Learning systems

Active matrix addressing

BT: Active matrix technology

Active matrix liquid crystal displays

UF: AMLCDs
Active-matrix liquid-crystal

displays

BT: Active matrix technology
Liquid crystal displays

Active matrix organic LEDs

USE: Active matrix organic light
emitting diodes



JULY 2025 IEEE Thesaurus

Active matrix organic light emitting diodes

UF: AMOLEDs
Active matrix organic LEDs
Active matrix organic light-emitting diodes
BT: Active matrix technology
Diodes
Organic light emitting diodes

Active matrix organic light-emitting diodes

USE: Active matrix organic light emitting diodes

Active matrix technology

UF: Active-matrix
BT: Displays
NT: Active matrix addressing
Active matrix liquid crystal displays
Active matrix organic light emitting diodes
Thin film transistors

Active networking

BT: Network architecture

Active noise reduction

BT: Acoustic signal processing
Noise reduction
NT: Echo cancellers

Active perception

BT: Psychology
RT: Cognition
Control systems
Sensor fusion

Active pixel sensors

BT: Image sensors

Active RFID tags

BT: RFID tags

Active shape model

BT: Image processing
Pattern recognition

Active-matrix

USE: Active matrix technology

Active-matrix liquid-crystal displays

USE: Active matrix liquid crystal displays

Activity recognition

BT: Cognition
Pattern recognition
Sensor systems
RT: Computer vision
NT: Human activity recognition

Actuators

UF: Dielectric electroactive polymer actuators
Electroactive polymer actuators
Electrostrictive polymer actuators
Ionomeric polymer-metal composite actuators
Nanoactuators
BT: Control equipment
RT: Control systems
Servomechanisms
Servosystems
Shape memory alloys
NT: Dielectric elastomer actuators
Electrostatic actuators
Electrothermal actuators
Hydraulic actuators
Intelligent actuators
Microactuators
Piezoelectric actuators
Pneumatic actuators

Acupuncture

BT: Medical treatment

Acute respiratory distress syndrome

UF: ARDS
BT: Medical conditions
RT: Lungs

Ad hoc networks

BT: Computer networks
RT: Cross layer design
Data communication
Land mobile radio
Mobile computing
Multicast communication
Protocols
Wireless LAN
Wireless sensor networks
NT: AODV
Mesh networks
Mobile ad hoc networks
Vehicular ad hoc networks



JULY 2025 IEEE Thesaurus

Ad hoc On Demand Distance Vector

USE: AODV

Ad hoc vehicle networks

USE: Vehicular ad hoc networks

Ad hoc vehicular networks

USE: Vehicular ad hoc networks

Adaptation models

BT: Adaptive algorithms

Adaptive algorithms

BT: Algorithms

NT: Adaptation models

Adaptive antenna arrays

USE: Adaptive arrays

Adaptive arrays

UF: Adaptive antenna arrays

BT: Antenna arrays

RT: Adaptive signal detection

Array signal processing

Radar countermeasures

Radio communication

countermeasures

Adaptive codes

USE: Adaptive coding

Adaptive coding

UF: Adaptive codes

BT: Data compression

Adaptive control

UF: Self-tuning regulators

BT: Adaptive systems

RT: Cognitive systems

Control systems

Disturbance observers

Iterative learning control

Adaptive equalisers

USE: Adaptive equalizers

Adaptive equalizers

UF: Adaptive equalisers

BT: Equalizers

Adaptive estimation

BT: Statistics

Adaptive filters

BT: Adaptive signal processing

Adaptive learning

BT: Education

RT: Distance learning

Human computer

interaction

User interfaces

Adaptive mesh refinement

BT: Numerical analysis

Adaptive optics

BT: Optics

Adaptive scheduling

BT: Scheduling

RT: Adaptive systems

Production control

Adaptive signal detection

BT: Adaptive signal processing

RT: Adaptive arrays

Blind source separation

Source separation

Adaptive signal processing

BT: Signal processing

NT: Adaptive filters

Adaptive signal detection

Adaptive systems

BT: Cybernetics

Systems engineering and

theory

RT: Adaptive scheduling

Extensibility

Learning systems

Neural networks

NT: Adaptive control

Cognitive radar

Line enhancers

Multi-agent systems

Variable structure systems

ADAS

USE: Advanced driver assistance

systems

Add-drop multiplexers

BT: Multiplexing equipment

NT: Optical add-drop

multiplexers

Added delay

BT: Delay systems



JULY 2025 IEEE Thesaurus

Adders

BT: Circuits
RT: Digital integrated circuits
Logic circuits

Addiction

UF: Substance abuse
BT: Medical conditions

Additive manufacturing

USE: Three-dimensional printing

Additive metric

USE: Maximum likelihood
detection

Additive noise

BT: Noise
NT: AWGN
Additive white noise

Additive white noise

BT: Additive noise
RT: Gaussian noise

Additives

UF: Fuel additives
BT: Materials
RT: Production materials

Adenoviridae

USE: Adenoviruses

Adenoviruses

UF: Adenoviridae
BT: Microorganisms

Adhesive bonding

USE: Adhesives

Adhesive strength

BT: Materials testing

Adhesives

UF: Adhesive bonding
BT: Bonding
NT: Conductive adhesives
Nonconductive adhesives

Adiabatic processes

BT: Thermodynamics

Adjacent channel interference

USE: Interchannel interference

Admission control

BT: Quality of service
RT: Bandwidth

Admittance

UF: Electric admittance
BT: Electric variables
RT: Admittance measurement
Impedance
NT: Admittance control

Admittance control

BT: Admittance
Control systems
RT: Human-robot interaction
Position control
Torque control

Admittance measurement

BT: Electric variables
measurement
RT: Admittance
Impedance measurement

Adrenal glands

BT: Glands

Adsorption

BT: Surface morphology
RT: Interface phenomena
Molecular sieves
Surfactants

Advanced driver assistance systems

UF: ADAS
BT: Traffic control
Vehicle safety
RT: Automotive electronics
Collision avoidance
Computer vision
Driver behavior
Intelligent transportation

systems

Intelligent vehicles
Mobile robots
Object detection
Steering systems
Vehicle-to-everything

Advanced renewable tariff

USE: Feed in tariff

Advanced Research Projects Agency Network

USE: ARPANET



JULY 2025 IEEE Thesaurus

Advanced TV

USE: HDTV

Advanced video coding

USE: Video coding

Adversarial learning

USE: Adversarial machine learning

Adversarial machine learning

UF: Adversarial learning
Adversarial metric learning
BT: Machine learning

Adversarial metric learning

USE: Adversarial machine learning

Advertising

BT: Marketing management

Aerial computing

BT: Computational modeling
RT: 5G mobile communication
6G mobile communication
Autonomous aerial vehicles
Data analysis
Edge computing
Internet of Things
Radio access networks

Aerial photography

USE: Satellite images

Aerial robots

USE: Autonomous aerial vehicles

Aero-engines

USE: Aircraft propulsion

Aerodynamics

BT: Dynamics
Mechanical factors
RT: Aerospace control
Flight dynamics
Shock waves
Wind tunnels

Aeroengines

USE: Aircraft propulsion

Aeroponics

BT: Agriculture

Aerosols

BT: Electrostatic processes
RT: Liquids
Particle production
Spraying

Aerospace accidents

BT: Accidents
RT: Aerospace safety
Space vehicles
NT: Air accidents

Aerospace and electronic systems

RT: Auditory displays
Digital signal processing
Programming
Systems engineering and theory

NT: Aerospace control
Aerospace engineering
Aerospace materials
Aircraft manufacture
Aircraft navigation
Aircraft propulsion
Command and control

systems

Electronic warfare
Military equipment
Sensor systems
Sonar
Telemetry

Aerospace biophysics

BT: Aerospace engineering
Biophysics
RT: Human factors

Aerospace components

BT: Aerospace materials

Aerospace control

UF: Aircraft control
Flight control
BT: Aerospace and electronic systems
RT: Aerodynamics
Aerospace simulation
Aircraft
Hardware-in-the-loop

simulation

Hypersonic vehicles
Military systems
Missiles
Motion control
Space vehicles



JULY 2025 IEEE Thesaurus

NT: Velocity control
Air traffic control
Attitude control
Ground support

Aerospace electronics

UF: Aerospace instrumentation
Aeronautical engineering
Aircraft electronics
Aircraft instrumentation
Avionics
Space vehicle electronics
Space vehicle

instrumentation

BT: Aerospace engineering
RT: Aircraft
Gamma-ray telescopes
Space vehicles
Total ionizing dose
X-ray telescopes

Aerospace engineering

BT: Aerospace and electronic
systems

RT: Aerospace industry
Aerospace materials
Lightweight structures
NT: Aerospace biophysics
Aerospace electronics
Aerospace safety
Aerospace simulation
Aerospace testing
Artificial satellites
Flight dynamics
Space technology

Aerospace ground equipment

USE: Ground support

Aerospace ground services

USE: Ground support

Aerospace industry

BT: Manufacturing industries
RT: Aerospace engineering
Aerospace materials
Aerospace safety
Aircraft manufacture
Lightweight structures

Aerospace instrumentation

USE: Aerospace electronics

Aerospace materials

UF: Aircraft materials

BT: Spacecraft materials
Aerospace and electronic
systems

RT: Production materials
Aerospace engineering
Aerospace industry
Aircraft manufacture
Lightweight structures
Space vehicles
NT: Aerospace components

Aerospace navigation

USE: Aircraft navigation

Aerospace propulsion

BT: Propulsion

Aerospace safety

BT: Aerospace engineering
Safety
RT: Aerospace accidents
Aerospace industry
Ion beam effects
Space shuttles
Space vehicles
NT: Air safety

Aerospace simulation

UF: Flight simulation
BT: Aerospace engineering
RT: Aerospace control
Aerospace testing
Wind tunnels

Aerospace testing

BT: Aerospace engineering
Testing
RT: Aerospace simulation
NT: Wind tunnels

Aeronautical engineering

USE: Aerospace electronics

Affective computing

BT: Artificial intelligence
Human computer
interaction
RT: Behavioral sciences
Cognitive systems
Emotion recognition
Human factors
Psychology
User experience



JULY 2025 IEEE Thesaurus

Affinity propagation

BT: Clustering algorithms

management

Software development

RT: Scrum (Software

development)

Affordances

BT: Object recognition
Optimization methods

RT: Interactive systems
User interfaces
Virtual reality

Agile software development

UF: Agile computing

BT: Software development
management

RT: Hackathon

NT: Scrum (Software
development)

Africa

BT: Continents

Afterburners

USE: Incineration

Aging

UF: Age factors

Aged

Ageing

BT: Materials science and
technology

RT: Alzheimer's disease
Ambient assisted living
Assisted living
Cataracts
Electric breakdown
Energy storage
Gerontology
Insulation life
Life estimation
Older adults
Reliability
Accelerated aging

Ag

USE: Silver

Age factors

USE: Aging

Age of information

USE: Information age

Aged

USE: Aging

Ageing

USE: Aging

Agent-based modeling

BT: Computational modeling

Software agents

RT: Multi-agent systems

Agri-IoT

USE: Agriculture Internet of

Things

Aggregates

BT: Materials

RT: Building materials

Agribusiness

UF: Agrobusiness

BT: Agriculture

Business

RT: Agricultural products

Crop yield

Forestry

Smart agriculture

AGI

USE: Artificial general intelligence

Agile computing

USE: Agile software development

Agrichemicals

USE: Agrochemicals

Agile manufacturing

BT: Manufacturing systems

RT: Computer integrated

manufacturing

Flexible manufacturing

systems

Agricultural engineering

BT: Engineering - general

RT: Agricultural machinery

Agricultural robots

Agriculture

Farming

NT: Deforestation

Agile project management

BT: Project management



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Agricultural machinery

UF: Combine harvesters
Tractors
BT: Machinery
RT: Agricultural engineering
Agriculture
Applicators
Blades
NT: Agricultural robots

Things

Agricultural products
Agriculture Internet of
Agrochemicals
Aquaculture
Greenhouses
Irrigation
Precision agriculture
Smart agriculture
Urban agriculture

Agricultural pollution

BT: Agriculture
Pollution
RT: Agrochemicals

Agriculture Internet of Things

UF: Agri-IoT
BT: Agriculture
Internet of Things

Agricultural products

BT: Agriculture
RT: Agribusiness
Agricultural robots
Farming
Food products
Food security
Irrigation
Pesticides
NT: Cotton
Crops
Dairy products
Sugar
Wool

Agrobusiness

USE: Agribusiness

Agrochemicals

UF: Agrichemicals
BT: Agriculture
Chemical products
RT: Agricultural pollution
NT: Fertilizers
Pesticides

AI

USE: Artificial intelligence

Agricultural robots

BT: Agricultural machinery
Robots
RT: Agricultural engineering
Agricultural products
Mobile robots

AI accelerators

UF: AI chips
Artificial intelligence chips
BT: Artificial intelligence
Microprocessor chips
RT: Application specific

integrated circuits

Coprocessors
Field programmable gate

arrays

Graphics processing units
Learning (artificial

intelligence)

Multiprocessing systems
Neural network hardware
Neural networks
Neuromorphic engineering
System-on-chip

Agriculture

BT: Industries
RT: Agricultural engineering
Agricultural machinery
Animals
Crop yield
Dairy products
Farming
Food waste
Genetic engineering
Livestock
Pest control
Seeds (agriculture)
Soil pollution
Vegetation mapping
NT: Aeroponics
Agribusiness
Agricultural pollution

AI chips

USE: AI accelerators

AI generated content

USE: Generative AI



JULY 2025 IEEE Thesaurus

AI technologies

USE: Artificial intelligence

AIDS

USE: Acquired immune deficiency syndrome

Aids for the handicapped

USE: Assistive technologies

AIEE Standards

BT: IEEE Standards

Air accidents

BT: Aerospace accidents
RT: Air safety
Air traffic control

Air bags

USE: Automotive components

Air cleaners

UF: Air filters
Air purifiers
BT: Machine components
RT: Air pollution
Cleaning
Purification

Air conditioning

BT: Cooling
RT: Building services
Buildings
Compressors
Ducts
Fans
HVAC
Ventilation
Vents
NT: Central air conditioning

Air filters

USE: Air cleaners

Air gaps

UF: Air-gap
Airgaps
BT: Electromagnetic analysis
RT: Electrodes
Spark gaps

Air interface

USE: Communication channels

Air pollutants

USE: Air pollution

Air pollution

UF: Air pollutants
BT: Air quality
Pollution
RT: Air cleaners
Ash
Atmospheric
measurements
Carbon footprint
Carbon sequestration
Exhaust gases
Flue gases
Fossil fuels
Global warming
Incineration
Industrial pollution
Meteorology
Natural gas
Thermal pollution
NT: Air pollution control

Air pollution control

BT: Air pollution
Atmospheric
measurements
RT: Carbon emissions

Air purifiers

USE: Air cleaners

Air quality

BT: Atmosphere
RT: Atmospheric
measurements
Environmental factors
NT: Air pollution
Indoor air quality

Air safety

BT: Aerospace safety
RT: Air accidents

Air to ground communication

UF: A2G
Air-ground communication
Air-to-ground
communication
BT: Communication systems
RT: Autonomous aerial vehicles
Global Positioning System
Military communication
Surveillance



JULY 2025 IEEE Thesaurus

Air traffic control

UF: Air traffic management
BT: Aerospace control
RT: Air accidents
Air transportation
Control systems
Radio navigation
Urban air mobility
Vertiports

Air traffic management

USE: Air traffic control

Air transportation

BT: Transportation
RT: Air traffic control
Airline industry
Global Positioning System
NT: Aircraft
Airports

Air-gap

USE: Air gaps

Air-ground communication

USE: Air to ground
communication

Air-to-ground communication

USE: Air to ground
communication

Airborne radar

BT: Radar
RT: Synthetic aperture radar

Aircraft

BT: Air transportation
RT: Aerospace control
Aerospace electronics
Aircraft manufacture
Aircraft navigation
Aircraft propulsion
Airline industry
Ground support
Military aircraft
Propellers
NT: Airplanes
Vertical takeoff and landing

aircraft

Aircraft control

USE: Aerospace control

Aircraft electronics

USE: Aerospace electronics

Aircraft engines

USE: Aircraft propulsion

Aircraft instrumentation

USE: Aerospace electronics

Aircraft manufacture

BT: Aerospace and electronic
systems
RT: Aerospace industry
Aerospace materials
Aircraft

Aircraft materials

USE: Aerospace materials

Aircraft navigation

UF: Aerospace navigation
Entry, descent and landing
BT: Aerospace and electronic
systems
RT: Navigation
Aircraft
Course correction
Vertiports
NT: Urban air mobility

Aircraft propulsion

UF: Aero-engines
Aeroengines
Aircraft engines
BT: Aerospace and electronic
systems
RT: Propulsion
Aircraft
Engines
Jet engines
Turbines
NT: Propellers

Airfields

USE: Airports

Airfoils

USE: Automotive components

Airgaps

USE: Air gaps

Airline industry

BT: Industries
RT: Air transportation



JULY 2025 IEEE Thesaurus

	Aircraft		RT:	Fish schools
	Airports		NT:	Algorithmic efficiency
Airplanes				Computational statistics
	BT:	Aircraft		Generative adversarial
			networks	
				Model compression
Airports				
	UF:	Airfields	Algorithm design and theory	
	BT:	Air transportation	BT:	Algorithms
	RT:	Airline industry	NT:	Backtracking
		Freeports		Consensus algorithm
	NT:	Vertiports		Flower pollination algorithm
<i>AI</i>			Algorithmic efficiency	
	USE:	Aluminum	BT:	Algorithm design and
			analysis	
<i>Al₂O₃</i>			RT:	Computational complexity
	USE:	Aluminum oxide		Software performance
				Software quality
Alarm systems			NT:	Metaheuristics
	UF:	Warning systems	Algorithms	
	BT:	Security	UF:	Subroutines
	RT:	Fall detection	BT:	Mathematics
		Monitoring	RT:	Biometrics
		Motion detection		Ciphers
		Safety		Cyclic redundancy check
		Safety devices		Huffman coding
	NT:	Smoke detectors		Linear programming
				Maximum likelihood
Alcoholic beverages				
	BT:	Ethanol	decoding	
	RT:	Fermentation		Model checking
Alcoholism				Numerical stability
	BT:	Diseases		Random processes
				Software
<i>Alexa</i>				Software libraries
	USE:	Virtual assistants	NT:	Stability analysis
				Adaptive algorithms
				Algorithm design and
Algae			analysis	
	BT:	Organisms		Algorithm design and
	RT:	Eutrophication	theory	
	NT:	Seaweed		Approximation algorithms
				Artificial bee colony
Algebra			algorithm	
	BT:	Mathematics		Backpropagation algorithms
	RT:	Lie groups		Basis algorithms
		Nonlinear equations		Bees algorithm
	NT:	Abstract algebra		Change detection
		Boolean algebra	algorithms	
		Linear algebra		Classification algorithms
		Set theory		Clustering algorithms
				Compression algorithms
Algorithm design and analysis				Density estimation robust
	BT:	Algorithms	algorithm	



JULY 2025 IEEE Thesaurus

optimization	Detection algorithms	Calcium
	Distributed algorithms	Cobalt
	Dynamic programming	Cobalt alloys
	Filtering algorithms	Copper alloys
	Genetic algorithms	Gallium alloys
	Glowworm swarm	Gallium compounds
		Germanium alloys
		Gold alloys
	Hash functions	Hafnium compounds
	Heuristic algorithms	Indium compounds
algorithms	Inference algorithms	Iron alloys
	Krill herd algorithm	Lithium
	MLFMA	Lithium compounds
	Machine learning	Neodymium alloys
detection	Matching pursuit algorithms	Nickel alloys
	Maximum likelihood	Niobium alloys
		Platinum alloys
		Silicon alloys
	Multicast algorithms	Strontium compounds
	Parallel algorithms	Tin alloys
	Partitioning algorithms	Titanium alloys
	Prediction algorithms	Yttrium compounds
	Procedural generation	NT: Intermetallic
	Projection algorithms	Shape memory alloys
algorithms	Pursuit algorithms	
	Signal processing	
		<i>Alloys</i>
	Software algorithms	USE: Metals
algorithms	Viterbi algorithm	
	Whale optimization	Alpha particles
		BT: Nuclear physics
		RT: Ions
<i>All optical networks</i>		
	USE: All-optical networks	<i>Alphavoltaic power sources</i>
All-optical networks		USE: Radioactive materials
	UF: All optical networks	
	BT: Optical fiber networks	<i>Alternating current generators</i>
Allergies		USE: AC generators
	BT: Diseases	
	Immune system	<i>Alternating current machines</i>
	RT: Medical conditions	USE: AC machines
<i>Allocation</i>		
	USE: Resource management	<i>Alternating current motors</i>
<i>Allow lists</i>		USE: AC motors
	USE: Accesslists	<i>Alternating current power transmission</i>
Alloying		USE: AC power transmission
	BT: Metals	<i>Alternative energy resources</i>
	RT: Aluminum alloys	USE: Renewable energy sources
	Aluminum compounds	
	Barium compounds	<i>Alternative energy sources</i>
	Bismuth compounds	USE: Renewable energy sources
		Alternators
		BT: Electric machines



JULY 2025 IEEE Thesaurus

RT: Synchronous generators

Altimetry

BT: Pressure measurement

RT: Atmospheric
measurements

Aluminium

USE: Aluminum

Aluminium alloys

USE: Aluminum alloys

Aluminium compounds

USE: Aluminum compounds

Aluminium industry

USE: Metals industry

Aluminium oxide

USE: Aluminum oxide

Aluminum

UF: Al
Aluminium

BT: Chemical elements
Metals

NT: Aluminum alloys
Aluminum compounds

Aluminum alloys

UF: Aluminium alloys

BT: Aluminum

RT: Alloying

Aluminum compounds

UF: Aluminium compounds

BT: Aluminum

RT: Alloying

NT: Aluminum gallium nitride
Aluminum nitride
Aluminum oxide

Aluminum gallium nitride

BT: Aluminum compounds
Gallium compounds

RT: III-V semiconductor
materials

Transistors

Aluminum industry

USE: Metals industry

Aluminum nitride

BT: Aluminum compounds

Aluminum oxide

UF: Al₂O₃

Aluminium oxide

BT: Aluminum compounds

RT: Ceramics

Alzheimer's disease

BT: Dementia

Diseases

RT: Aging

Gerontology

Hippocampus

Older adults

Ambient assisted living

UF: AAL

BT: Assisted living

Information and
communication technology

RT: Aging

Assistive devices

Ambient intelligence

BT: Consumer electronics

Telecommunications

RT: Intelligent systems

Internet of Things

Ubiquitous computing

User interfaces

Ambient networks

UF: AN Project

BT: Mobile communication

RT: 3G mobile communication

Ambisonics

BT: Audio systems

RT: 3D audio

Immersive audio

Spatial audio

Amblyopia

USE: Vision defects

Ambulatory surgery

BT: Surgery

American Express

USE: Credit cards

American National Institute of Standards

USE: ANSI



JULY 2025 IEEE Thesaurus

American Standard Code for Information Interchange

USE: ASCII

American Standards Association

USE: ASA

Americium

BT: Chemical elements

Amino acids

BT: Biochemistry

AML

learning

USE: Automated machine

AMLCDs

displays

USE: Active matrix liquid crystal

Ammeters

BT: Electric variables

measurement

RT: Current measurement

Ammonia

BT: Nitrogen compounds

Amniocentesis

BT: Medical tests

RT: Genetics

Ultrasonic imaging

NT: Amniotic fluid

Birth disorders

Amniotic fluid

BT: Amniocentesis
Fluids and secretions

AMOLEDs

USE: Active matrix organic light emitting diodes

Amorphous magnetic materials

BT: Magnetic materials

Amorphous materials

BT: Materials

NT: Diamond-like carbon

Glass

Amorphous semiconductors

BT: Semiconductor materials

RT: Silicon

Thin film devices

Amorphous silicon

BT: Silicon

Amperometric sensors

BT: Electrochemical devices

Gas detectors

Amphibious robots

BT: Marine vehicles

Robots

RT: Autonomous aerial vehicles

Mobile robots

Amplifiers

BT: Signal processing

RT: Frequency response

Klystrons

Optical fiber amplifiers

Rail to rail amplifiers

Rail to rail operation

NT: Broadband amplifiers

Differential amplifiers

Distributed amplifiers

Low-noise amplifiers

Operational amplifiers

Power amplifiers

Preamplifiers

Pulse amplifiers

Radiofrequency amplifiers

Resonators

Amplify-and-forward cooperative communication

USE: Cooperative communication

Amplitude estimation

BT: Parameter estimation

RT: Reflection coefficient

Amplitude modulation

BT: Modulation

RT: Demodulation

Intensity modulation

NT: Amplitude shift keying

Quadrature amplitude

modulation

Amplitude shift keying

UF: ASK

BT: Amplitude modulation

Amputation

BT: Injuries

Medical treatment



JULY 2025 IEEE Thesaurus

Amygdala

UF: Amygdalae
Corpus amygdaloideum
BT: Brain

Amygdalae

USE: Amygdala

AN Project

USE: Ambient networks

Anaemia

USE: Anemia

Anaerobic digestion

BT: Biological processes
Microorganisms
RT: Biodegradation
Biogas
Green energy
Methane
Renewable energy sources
Smart agriculture
Soil remediation
Sustainable development
Waste management

Anaesthesia

USE: Anesthesia

Analog circuits

BT: Circuits
RT: Microwave circuits
Millimeter wave circuits
Neuromorphics
Submillimeter wave circuits
Switched capacitor

networks

UHF circuits
VHF circuits
NT: Analog integrated circuits
Analog processing circuits

Analog CMOS integrated circuits

USE: CMOS analog integrated circuits

Analog computers

UF: Analogue computers
BT: Computers
RT: Summing circuits

Analog digital integrated circuits

USE: Analog-digital integrated circuits

Analog integrated circuits

UF: Analogue integrated circuits
Linear integrated circuits
BT: Analog circuits
Integrated circuits
RT: Analog processing circuits
MMICs
Microwave integrated

circuits

Millimeter wave integrated

circuits

Neural network hardware
Submillimeter wave

integrated circuits

UHF integrated circuits
CMOS analog integrated

circuits

Field programmable analog

arrays

Analog memory

BT: Memory
RT: Analog processing circuits

Analog processing circuits

BT: Analog circuits
RT: Analog integrated circuits
Analog memory
Application specific

integrated circuits

Mixed analog-digital

integrated circuits

Signal processing

Analog to digital conversion

USE: Analog-digital conversion

Analog to digital converter

USE: Analog-digital conversion

Analog TV

UF: Analogue TV
BT: TV

Analog-digital

USE: Analog-digital conversion

Analog-digital conversion

UF: A/D
A/D conversion
A/D converter
Analog to digital conversion
Analog to digital converter
Analog-digital
Analog-to-digital conversion



JULY 2025 IEEE Thesaurus

Analog-to-digital converter
 Analogue-digital conversion
 Analogue-digital converters
 BT: Data conversion
 RT: Data acquisition
 Quantization (signal)
 NT: Delta modulation
 Digital transformation
 Digitization

Analog-digital integrated circuits

UF: Analog digital integrated
 circuits
 Analogue digital integrated
 circuits
 Analogue-digital integrated
 circuits
 Minimum analog-digital
 integrated circuits
 BT: Integrated circuits
 NT: Mixed analog-digital
 integrated circuits

Analog-to-digital conversion

USE: Analog-digital conversion

Analog-to-digital converter

USE: AC-DC power converters

AND

Analog-digital conversion

Analog-to-digital convertor

USE: AC-DC power converters

Analogue CMOS integrated circuits

USE: CMOS analog integrated
 circuits

Analogue computers

USE: Analog computers

Analogue digital integrated circuits

USE: Analog-digital integrated
 circuits

Analogue integrated circuits

USE: Analog integrated circuits

Analogue TV

USE: Analog TV

Analogue-digital conversion

USE: Analog-digital conversion

Analogue-digital converters

USE: Analog-digital conversion

Analogue-digital integrated circuits

USE: Analog-digital integrated
 circuits

Analysis of variance

UF: ANOVA
 BT: Statistical analysis

Analytic hierarchy process

UF: Analytical hierarchy
 process
 BT: Decision making
 RT: Management
 Strategic planning

Analytical hierarchy process

USE: Analytic hierarchy process

Analytical models

BT: Modeling
 RT: Neuroinformatics
 NT: Common Information Model
 (computing)

Anatomical structure

BT: Medical diagnostic imaging

Anatomy

BT: Biological systems
 NT: Auditory system
 Biological tissues
 Body regions
 Cardiovascular system
 Circulatory system
 Digestive system
 Embryonic structures
 Endocrine system
 Fluids and secretions
 Human anatomy
 Immune system
 Integumentary system
 Lymphatic system
 Musculoskeletal system
 Nervous system
 Neuroanatomy
 Respiratory system
 Sense organs
 Stomatognathic system
 Urogenital system

Android (operating system)

USE: Operating systems



JULY 2025 IEEE Thesaurus

Androids

BT: Robots
RT: Human factors
Human-machine systems

Anechoic chambers

BT: Test facilities
RT: Acoustic measurements
Antenna measurements
Electromagnetic

measurements

Immunity testing
TEM cells

Anemia

UF: Anaemia
BT: Medical conditions
RT: Blood flow
Red blood cells

Anemometers

USE: Fluid flow measurement

Anesthesia

UF: Anaesthesia
BT: Medical treatment
NT: Anesthetic drugs

Anesthesiology

BT: Medical specialties

Anesthetic drugs

BT: Anesthesia

Aneurism

USE: Aneurysm

Aneurysm

UF: Aneurism
BT: Medical conditions

Angiocardiology

BT: Biomedical imaging
RT: Biomedical applications of
radiation

Angiography

UF: Arteriography
BT: Biomedical imaging

Angioplasty

BT: Medical treatment

Angiosperms

USE: Flowering plants

Angular velocity

BT: Mechanical variables
measurement
RT: Velocity control
Velocity measurement

Angular velocity control

BT: Velocity control

Animal behavior

BT: Behavioral sciences

Animal structures

BT: Animals
NT: Beak
Feathers
Tail

Animals

BT: Organisms
Zoology
RT: Agriculture
Biological systems
Life sciences
NT: Animal structures
Birds
Bovine
Cats
Dinosaurs
Dogs
Endangered species
Horses
Insects
Livestock
Marine animals
Mice
Rabbits
Rats
Rodents
Wildlife

Animation

UF: Computer animation
BT: Graphics
RT: Computer graphics
Motion capture
Text to video
Visual effects
Visualization
NT: Facial animation

Animatronics

BT: Robotics and automation



JULY 2025 IEEE Thesaurus

Anisotropic

BT: Filters

Anisotropic conductive films

BT: Conductive films

Anisotropic diffusion

USE: Anisotropic
magnetoresistance

Anisotropic effects

USE: Anisotropic
magnetoresistance

Anisotropic magnetoresistance

UF: Anisotropic diffusion
Anisotropic effects
Anisotropic
magnetoresistance sensors
Anisotropic material
Anisotropic processing
Anisotropically
Anisotropy
BT: Magnetoresistance

Anisotropic magnetoresistance sensors

USE: Anisotropic
magnetoresistance

Anisotropic material

USE: Anisotropic
magnetoresistance

Anisotropic processing

USE: Anisotropic
magnetoresistance

Anisotropically

USE: Anisotropic
magnetoresistance

Anisotropy

USE: Anisotropic
magnetoresistance

Ankle

BT: Joints
RT: Foot
Legs

Annealing

UF: Annealing temperature
BT: Heat treatment
Materials processing
RT: Quantum annealing

Simulated annealing

Softening

Thermal factors

NT: Rapid thermal annealing

Annealing temperature

USE: Annealing

Annotations

BT: Metadata
RT: Text analysis

Anodes

BT: Electrodes
RT: Electron tubes

Anomaly detection

UF: Novelty detection
Outlier detection
BT: Data mining

Anorexia

USE: Eating disorders

Anorexia nervosa

USE: Eating disorders

ANOVA

USE: Analysis of variance

ANPR

USE: License plate recognition

ANSI

UF: American National Institute
of Standards
BT: Standards organizations
RT: ASA

ANSI Standards

BT: Standards publications
RT: ASA Standards
IEEE Standards
ISO Standards
NT: National Electric Code

Answer set programming

BT: Programming
RT: Knowledge representation

Ant colony optimization

BT: Probability
RT: Graph theory
Metaheuristics



JULY 2025 IEEE Thesaurus

Antarctic Ocean

UF: Southern Ocean
BT: Oceans

Antarctica

BT: Geoscience
NT: South Pole

Antenna accessories

UF: Antenna components
BT: Antennas
NT: Radomes

Antenna arrays

UF: Distributed antennas
BT: Antennas
RT: Broadband antennas
SIMO
SISO
NT: Adaptive arrays
Butler matrices
Linear antenna arrays
Log periodic antennas
Microstrip antenna arrays
Microwave antenna arrays
Phased arrays
Planar arrays

Antenna components

USE: Antenna accessories

Antenna diversity

USE: Spatial diversity

Antenna feeds

BT: Feeds
RT: Antennas
Aperture coupled antennas

Antenna measurements

BT: Measurement
RT: Anechoic chambers
Antennas
Electromagnetic

measurements

Antenna phased arrays

USE: Phased arrays

Antenna radiation patterns

UF: Radiation pattern
BT: Antennas
RT: Antenna theory
NT: Near-field radiation pattern

Antenna theory

BT: Antennas
RT: Antenna radiation patterns
Current distribution
Mode matching methods
NT: Frequency selective

surfaces

Antenna-in-package

BT: Antennas
Electronics packaging
System-in-package

Antennas

BT: Antennas and propagation
RT: Antenna feeds
Antenna measurements
Beam steering
Butler matrices
Fractals
IEEE 802.11n Standard
Microstrip antenna arrays
Radio communication

equipment

NT: Spatial diversity
Waveguide theory
Antenna accessories
Antenna arrays
Antenna radiation patterns
Antenna theory
Antenna-in-package
Apertures
Broadband antennas
Dielectric resonator

antennas

Dipole antennas
Directional antennas
Directive antennas
Feeds
Fractal antennas
Helical antennas
Horn antennas
Leaky wave antennas
Loaded antennas
Log-periodic dipole

antennas

Loop antennas
Microstrip antennas
Microwave antennas
Mobile antennas
Multifrequency antennas
Omnidirectional antennas
Optical antennas
Patch antennas
Radar antennas



JULY 2025 IEEE Thesaurus

Receiving antennas
Rectennas
Reflector antennas
Satellite antennas
Slot antennas
Steerable antennas
Textile antennas
Transmission line antennas
Transmitting antennas
UHF antennas
Wearable antennas
Yagi-Uda antennas

Antennas and propagation

RT: Communication systems
Communications
technology
NT: Signal processing
Antennas
Electromagnetic
propagation
Radio astronomy

Anthropology

BT: Social sciences
RT: Behavioral sciences
Cultural differences
Humanities
Linguistics
NT: Ethnicity

Anthropometry

BT: Measurement
RT: Biomechanics
Biomedical measurement
Ergonomics
Human factors

Anthropomorphism

BT: Human factors

Anti freeze

USE: Anti-freeze

Anti virus software

USE: Anti-virus software

Anti-bacterial

USE: Antibacterial activity

Anti-biotics

USE: Antibiotics

Anti-freeze

UF: Anti freeze

Antifreeze
BT: Chemical compounds
RT: Methanol

Anti-fungal

UF: Antifungal
BT: Antibiotics

Anti-parasitical

UF: Antiparasitical
BT: Antibiotics

Anti-reflective coatings

USE: Antireflection coatings

Anti-virus software

UF: Anti virus software
BT: Software
RT: Computer viruses
Malware
Security

Antibacterial

USE: Antibacterial activity

Antibacterial activity

UF: Anti-bacterial
Antibacterial
BT: Antibiotics
RT: Bacteria

Antibiotics

UF: Anti-biotics
BT: Drugs
NT: Anti-fungal
Anti-parasitical
Antibacterial activity

Antibodies

UF: Immunoglobulin
BT: Immune system
RT: Microorganisms
NT: Monoclonal antibodies

Antidepressants

BT: Drugs

Antiderivatives

USE: Integral equations

Antiferroelectric materials

USE: Dielectric materials

Antiferromagnetic materials

BT: Magnetic materials



JULY 2025 IEEE Thesaurus

RT: Antiferromagnetic
resonance

Antiferromagnetic resonance

BT: Magnetic resonance
RT: Antiferromagnetic materials

Antifreeze
USE: Anti-freeze

Antifreeze materials
USE: Coolants

Antifungal
USE: Anti-fungal

Antigens

BT: Immunology
RT: Immune response
Immunofluorescence

Antimony

BT: Chemical elements

Antioxidants

BT: Chemical products
RT: Oxidation

Antiparasitical
USE: Anti-parasitical

Antireflection coatings

UF: Anti-reflective coatings
Antireflective coatings
BT: Coatings
RT: Optical reflection

Antireflective coatings
USE: Antireflection coatings

Anxiety disorders

BT: Mental disorders
RT: Emotion recognition
Medical conditions
Mental health
Sentiment analysis

AODV

UF: Ad hoc On Demand
Distance Vector
BT: Ad hoc networks
Wireless networks

AOI

USE: Information age

Aortic semilunar valves
USE: Heart valves

Apache hadoop
USE: Cluster computing

Apache spark
USE: Cluster computing

APCVD
USE: Atmospheric pressure
chemical vapor deposition

APDs
USE: Avalanche photodiodes

Aperture antennas

BT: Apertures
RT: Aperture coupled antennas
Reflector antennas

Aperture coupled antennas

BT: Apertures
RT: Antenna feeds
Aperture antennas
Microstrip antenna arrays
Microstrip antennas

Apertures

BT: Antennas
RT: Couplers
NT: Aperture antennas
Aperture coupled antennas

Aphasia

BT: Medical conditions
RT: Brain injuries
Patient rehabilitation
Speech
Stroke (medical condition)

API

USE: Application programming
interfaces

Apicology

UF: Melittology
BT: Entomology
RT: Insects

Appearance matching
USE: Image matching



JULY 2025 IEEE Thesaurus

Apple watch

USE: Wearable Health Monitoring
Systems

Appliances

USE: Home appliances

Application programming interfaces

UF: API
Mobile application

development

BT: Computer interfaces
RT: Software defined

networking

NT: Restful API
WebRTC

Application security

BT: Computer security

Application software

BT: Software
NT: Decentralized applications

Application specific integrated circuits

UF: ASIC
Custom integrated circuits
Semicustom integrated

circuits

BT: Circuits
Integrated circuits
RT: AI accelerators
Analog processing circuits
CMOS logic circuits
Field programmable analog

arrays

NT: System-on-chip

Application specific processors

BT: Program processors

Application virtualization

UF: Cross platform virtualization
Cross-platform virtualization
BT: Computer applications
RT: Emulation
Network function

virtualization

Simulation
NT: Edge computing

Applicators

BT: Production equipment
RT: Agricultural machinery
Labeling

Appraisal

BT: Human resource
management
RT: Incentive schemes
Personnel

Appropriate technology

BT: Technology
RT: Microhydro power
Picohydro power

Approximate computing

BT: Computers and information
processing

Approximation algorithms

BT: Algorithms

Approximation error

BT: Approximation methods

Approximation methods

UF: Approximation theory
BT: Numerical analysis
RT: Least squares
approximations
Minimization methods
Signal representation
NT: Approximation error
Chebyshev approximation
Curve fitting
Extrapolation
Function approximation
Interpolation
Linear approximation
Mean square error methods
Perturbation methods

Approximation theory

USE: Approximation methods

APS

USE: Automated parking

Aquaculture

BT: Agriculture
RT: Marine animals
NT: Coral reef
Eutrophication
Fisheries

Aquatic ecosystems

UF: Hydrosphere
BT: Ecosystems
RT: Lakes



JULY 2025 IEEE Thesaurus

		Ocean dynamics		<i>Architectural description languages</i>	
		Ocean salinity		USE:	Architecture description
		Oceans		languages	
		Rivers			
		Sea floor		Architecture	
		Wetlands		BT:	Industries
NT:		Marine ecosystems		RT:	Building information
				management	
Aquatic robots					Buildings
UF:		Swimming robots			Structural engineering
BT:		Robots			
<i>Aquatic vehicles</i>				<i>Architecture (computer)</i>	
USE:		Underwater vehicles		USE:	Computer architecture
Aquifers				Architecture description languages	
BT:		Hydrology		UF:	Architectural description
		Water resources		languages	
RT:		Rocks		BT:	Computer languages
		Water storage			
<i>Ar</i>				Arctic	
USE:		Argon		BT:	Geoscience
				NT:	North Pole
Arc discharges				Arctic Ocean	
UF:		Arc flash		BT:	Oceans
		Arc-flash			
BT:		Dielectric breakdown		<i>ARDS</i>	
RT:		Electrostatic discharges		USE:	Acute respiratory distress
		High intensity discharge		syndrome	
lamps				Area measurement	
		Light sources		BT:	Measurement
		Plasmas		RT:	Size measurement
<i>Arc flash</i>				Argon	
USE:		Arc discharges		UF:	Ar
				BT:	Gases
<i>Arc lamps</i>				<i>Artificial intelligence chips</i>	
USE:		Lighting		USE:	AI accelerators
<i>Arc-flash</i>					
USE:		Arc discharges		Arithmetic	
				BT:	Mathematics
Archaea				NT:	Digital arithmetic
BT:		Organisms			Fixed-point arithmetic
					Floating-point arithmetic
<i>Archaeology</i>				Armature	
USE:		Archeology		BT:	Electromechanical devices
Archeology				<i>Armpit</i>	
UF:		Archaeology		USE:	Axilla
BT:		Humanities			



JULY 2025 IEEE Thesaurus

Arms

BT: Limbs
NT: Wrist

ARPANET

UF: Advanced Research
Projects Agency Network
DARPANET
BT: Communication systems
RT: Internet
Packet switching

ARQ

USE: Automatic repeat request

Array

USE: Arrays

Array processing

USE: Arrays AND
Parallel processing

Array signal processing

UF: Beamforming
BT: Signal processing
RT: Acoustic arrays
Acoustic transducers
Adaptive arrays
Blind source separation
Direction-of-arrival

estimation

Semidefinite programming
Signal resolution
Source separation
Time of arrival estimation

Arrayed waveguide gratings

UF: AWG device
BT: Optical waveguides
RT: Demultiplexing
Integrated optics
Multiplexing

Arrays

UF: Array
Array processing
BT: Data structures
NT: Sensor arrays

Arresters

BT: Surge protection
RT: Power system protection
Power system transients
Varistors

Arrhythmia

BT: Medical conditions
RT: Cardiology
Heart beat

Arsenic

BT: Chemical elements
NT: Arsenic compounds

Arsenic compounds

UF: Arsenite
Arsine
BT: Arsenic

Arsenite

USE: Arsenic compounds

Arsine

USE: Arsenic compounds

Art

BT: Humanities
RT: Computer graphics
Graphics
Layout
Museums
Photorealism
NT: Digital art
Fractal art

Arterial blood circulation

BT: Arteries

Arterial blood pressure

BT: Arteries

Arterial occlusion

BT: Arteries

Arterial pressure

USE: Blood pressure

Arterial wall structures

USE: Arteries

Arterial walls

USE: Arteries

Arteries

UF: Arterial wall structures
Arterial walls
Artery
BT: Blood vessels
NT: Arterial blood circulation
Arterial blood pressure



JULY 2025 IEEE Thesaurus

	Arterial occlusion		BT:	Computational and artificial
	Carotid arteries		intelligence	
<i>Arteriography</i>			RT:	Autonomous vehicles
USE:	Angiography			Computational intelligence
Arteriosclerosis				Data mining
BT:	Diseases			Digital economy
NT:	Atherosclerosis			Digital humans
	Coronary arteriosclerosis	networks		Digital twins
<i>Artery</i>				Feedforward neural
USE:	Arteries	networks		Few shot learning
Arthritis		analysis		Generative adversarial
BT:	Diseases			Independent component
Artificial bee colony algorithm				Machine ethics
UF:	ABC algorithms			Minimax techniques
BT:	Algorithms			Model compression
RT:	Cooperative systems			Natural languages
	Optimization			Neural networks
	Particle swarm optimization			Neurocontrollers
	Search problems			Pervasive computing
Artificial biological organs		networks		Posthuman
UF:	Artificial organs			Prediction theory
BT:	Prosthetics			Radial basis function
RT:	Biological systems			Reinforcement learning
	Bioprinting			Robot learning
NT:	Artificial heart			Semantic Web
	Artificial limbs			Semisupervised learning
	Artificial muscles			Software agents
<i>Artificial fibers</i>			NT:	Support vector machines
USE:	Synthetic fibers			Synapses
<i>Artificial fibres</i>				Text summarization
USE:	Synthetic fibers			AI accelerators
Artificial general intelligence				Affective computing
UF:	AGI			Artificial general intelligence
BT:	Artificial intelligence			Autonomous robots
RT:	Intelligent systems			Bio-inspired computing
		intelligence		Cognitive systems
Artificial heart				Commonsense reasoning
BT:	Artificial biological organs			Context awareness
Artificial immune systems				Context management
BT:	Immune system			Conversational artificial
Artificial intelligence				Cooperative systems
UF:	AI			Edge AI
	AI technologies			Explainable AI
	Open AI			Foundation models
				Generative AI
				Intelligent systems
				Knowledge based systems
				Knowledge engineering
				Large language models



JULY 2025 IEEE Thesaurus

intelligence)	Learning (artificial			Low earth orbit satellites	
	Learning systems			Military satellites	
	Machine learning			Space stations	
	Machine listening	ASA			
	Prediction methods		UF:	American Standards	
generation	Retrieval augmented	Association			
			BT:	Standards organizations	
	Text to image		RT:	ANSI	
	Text to video				
	Virtual artifact	ASA Standards			
Artificial light			BT:	Standards publications	
			RT:	ANSI Standards	
	UF:	Light pollution			
Artificial limbs	BT:	Lighting	ASCII		
			UF:	American Standard Code	
				for Information Interchange	
Artificial muscles	BT:	Artificial biological organs	BT:	Encoding	
		Prosthetics			
	RT:	Limbs	Ash		
Artificial neural networks			BT:	Industrial waste	
			RT:	Air pollution	
	UF:	Muscle-like actuators		Exhaust gases	
	BT:	Artificial biological organs		Incineration	
				Volcanic ash	
networks			NT:	Fly ash	
	UF:	Deep neural networks			
	BT:	Neural networks	Asia		
	RT:	Fish schools		BT:	Continents
		Large language models			
		Mathematical models	ASIC		
		Neural machine translation		USE:	Application specific
		Neuromorphic engineering	integrated circuits		
		Synapses			
	NT:	Autoencoders	ASK		
		Convolutional neural		USE:	Amplitude shift keying
	maps				
		Hebbian theory	Asphalt		
Long short term memory			UF:	Bitumen	
Neural architecture search			BT:	Building materials	
Residual neural networks		Aspheric lenses			
Artificial organs	Self-organizing feature		USE:	Aspherical optics	
	Spiking neural networks	Aspheric mirrors			
			USE:	Aspherical optics	
Artificial satellites	USE:	Artificial biological organs	Aspheric optics		
			USE:	Aspherical optics	
	BT:	Aerospace engineering			
	RT:	Satellite communications	Aspherical lenses		
		Satellites		USE:	Aspherical optics
		Space technology			
		Space vehicles	Aspherical mirrors		
	NT:	Earth Observing System		USE:	Aspherical optics



JULY 2025 IEEE Thesaurus

Aspherical optics

UF: Aspheric lenses
Aspheric mirrors
Aspheric optics
Aspherical lenses
Aspherical mirrors
BT: Optics

Asphyxia

BT: Death

Aspirin

BT: Drugs

ASR

USE: Automatic speech recognition

Assemblers (program)

USE: Program processors

Assembly

BT: Manufacturing
RT: Assembly systems
Manipulators
Manufacturing automation
NT: Fitting
Microassembly
Preforms
Soldering

Assembly robots

USE: Robotic assembly

Assembly systems

BT: Industrial electronics
Manufacturing
Production systems
RT: Assembly
Fitting
Industrial control
Manipulators
Manufacturing automation
Mobile robots
Robots
NT: Flexible electronics
Robotic assembly

Asset management

UF: Asset-management
BT: Management
NT: Public infrastructure

Asset-management

USE: Asset management

Assisted living

BT: Medical services
RT: Aging
Assistive robots
Fall detection
Geriatrics
Older adults
NT: Ambient assisted living

Assistive devices

BT: Assistive technologies
RT: Ambient assisted living

Assistive robots

UF: Rehabilitation robotics
Rehabilitation robots
BT: Assistive technologies
Medical robotics
Service robots
RT: Assisted living
Exoskeletons
Field robots
Geriatrics
Older adults
Patient monitoring
Patient rehabilitation
Social robots
Soft robotics

Assistive technologies

UF: Aids for the handicapped
Handicapped aids
BT: Biomedical equipment
RT: Braille
Communication aids
Gaze tracking
Gerontechnology
Medical control systems
Orthotics
People with disabilities
Prosthetics
Sensory aids
Sign language
Social robots
Wearable robots
NT: Assistive devices
Assistive robots
Closed captioning
Video description
Wheelchairs

Association rule learning

UF: Association rules
BT: Data mining
Machine learning



JULY 2025 IEEE Thesaurus

Association rules

USE: Association rule learning

Associative memory

UF: Content addressable

memory

BT: Memory

RT: Neural networks

Associative processing

BT: Data processing

RT: Computers and information

processing

Asteroids

BT: Planets

NT: Meteoroids

Asteroseismology

BT: Astrophysics

NT: Helioseismology

Asthma

BT: Pulmonary diseases

RT: Chronic obstructive

pulmonary disease

Emphysema

Pneumonia

Astrochemistry

UF: Planetary chemistry

BT: Chemistry

Astronomy

BT: Science - general

RT: Extraterrestrial

measurements

Gamma-ray detectors

Telescopes

NT: Astrophysics

Extrasolar planets

Gravitational waves

Observatories

Radio astronomy

Solar system

Stars

X-ray astronomy

Astrophysics

BT: Astronomy

Physics

RT: Gravity measurement

NT: Asteroseismology

Dark matter

Orbits

Stellar dynamics

Asymptotic stability

BT: System analysis and design

RT: Discrete-time systems

Eigenvalues and

eigenfunctions

Stability

Asynchronous circuits

BT: Circuits

Asynchronous communication

BT: Data communication

RT: Web services

Asynchronous machines

USE: Induction motors

Asynchronous transfer mode

UF: ATM

BT: Data communication

Protocols

RT: B-ISDN

Broadband communication

ISDN

Multiprotocol label

switching

SONET

Atherosclerosis

BT: Arteriosclerosis

Atlantic Ocean

BT: Oceans

ATM

USE: Asynchronous transfer

mode AND

Automated teller machine

Atmosphere

BT: Geoscience

RT: Atmospheric

measurements

Atmospheric science

Meteorology

NT: Air quality

Atmospheric modeling

Atmospheric waves

Atmospheric measurements

BT: Measurement

RT: Air pollution

Air quality



JULY 2025 IEEE Thesaurus

Atopic dermatitis

USE: Eczema

ATPG

USE: Automatic test pattern generation

Atrial fibrillation

BT: Fibrillation

Atrioventricular valves

USE: Heart valves

Atrophy

BT: Medical conditions

Attention mechanisms

BT: Machine learning

RT: Deep learning

Attenuation

UF: Acoustic wave attenuation
Electromagnetic wave attenuation

BT: Light attenuation

BT: Propagation

RT: Attenuation measurement

Attenuators

Diagnostic radiography

Insertion loss

Attenuation measurement

BT: Electric variables measurement

RT: Attenuation
Loss measurement

Attenuators

BT: Signal processing

RT: Attenuation

NT: Optical attenuators

Attitude control

BT: Aerospace control

RT: Position control

Attitude determination

USE: Position measurement

ATV

USE: HDTV

Au

USE: Gold

Audible noise

USE: Acoustic noise

Audio coding

BT: Encoding

Information theory

RT: MPEG 7 Standard

Rate distortion theory

Speech coding

Audio compression

BT: Data compression

RT: HDMI

Audio databases

BT: Database systems

RT: File systems

Multimedia databases

Audio enhancement

USE: Acoustic signal processing

AND

Noise reduction

Audio recording

BT: Recording

Audio restoration

USE: Acoustic noise

Audio signal processing

USE: Machine listening

Audio systems

UF: Phonographs

Sound systems

Stereophonic systems

BT: Consumer electronics

RT: Digital audio broadcasting

Music

NT: 3D audio

Ambisonics

Audio tapes

Audio-visual systems

Auditory displays

Headphones

Immersive audio

Loudspeakers

Microphones

Pitch control (audio)

Portable media players

Sonification

Spatial audio

Video description



JULY 2025 IEEE Thesaurus

Audio tapes

BT: Audio systems

Hearing aids

Psychoacoustics

NT: Psychoacoustic models

Audio user interfaces

UF: Auditory icons

BT: User interfaces

RT: Multimedia computing

Augmented reality

BT: Programming

Virtual reality

RT: Digital representation

Digital transformation

Digital twins

Extended reality

Metaverse

Mixed reality

Network slicing

Spatial computing

Virtual museums

NT: 3D audio

Human augmentation

Immersive audio

Immersive experience

Spatial augmented reality

Audio video

USE: Audio-visual systems

Audio visual systems

USE: Audio-visual systems

Audio watermarking

USE: Watermarking

Audio-visual instructional aids

USE: Educational technology

Audio-visual systems

UF: Audio video

Audio visual systems

Audiovisual systems

BT: Audio systems

RT: Educational technology

Text to speech

NT: HDMI

Augmented virtuality

BT: Virtual reality

Austenite

UF: Gamma phase iron

BT: Iron alloys

RT: Materials science and

technology

Smart materials

Audiovisual systems

USE: Audio-visual systems

Auditory displays

BT: Audio systems

Communication equipment

RT: Aerospace and electronic

systems

Communication aids

Australia

BT: Continents

Authentication

BT: Computer security

Blockchains

CAPTCHAs

Federated identity

Image processing

Interactive systems

Passwords

Video signal processing

Zero Trust

NT: Multi-factor authentication

Nonfungible tokens

Auditory icons

USE: Audio user interfaces

Auditory implants

UF: Auditory midbrain implants

BT: Implants

Auditory midbrain implants

USE: Auditory implants

Auditory system

UF: Hearing

BT: Anatomy

RT: Biomedical acoustics

Chatbots

Head

Authoring systems

UF: Authoring tools

BT: Software tools

RT: Computer aided instruction

Courseware

Multimedia systems

Web design



JULY 2025 IEEE Thesaurus

Authoring tools

USE: Authoring systems

Authorisation

USE: Authorization

Authorization

UF: Authorisation
BT: Access control
RT: Privacy

Autism

BT: Medical conditions

Auto correlation

USE: Autocorrelation

Auto-pilot

USE: Autopilot

Autobiographies

UF: Memoirs
BT: Biographies

Autocorrelation

UF: Auto correlation
BT: Correlation
RT: Signal analysis
Time series analysis

Autoencoders

BT: Artificial neural networks
RT: Decoding
Encoding
Unsupervised learning

Autoimmune diseases

UF: Autoimmune disorders
BT: Diseases

Autoimmune disorders

USE: Autoimmune diseases

Automata

UF: Finite state machines
BT: Robots
RT: Cognitive systems
Cybernetics
Intelligent systems
NT: Turing machines

Automated automobile parking

USE: Automated parking

Automated car parking

USE: Automated parking

Automated guided vehicles

USE: Remotely guided vehicles

Automated highways

BT: Automation
Intelligent transportation
systems
RT: Road safety
Smart transportation

Automated indexing

USE: Machine assisted indexing

Automated machine learning

UF: AML
AutoML
Automated ML
BT: Automation
Machine learning
RT: Neural architecture search

Automated meter reading

USE: Automatic meter reading

Automated ML

USE: Automated machine
learning

Automated parking

UF: APS
Automated automobile
parking
Automated car parking
Smart automobile parking
Smart car parking
Smart parking
BT: Automation
Car parking
Mechanical systems
RT: Smart transportation

Automated storage and retrieval systems

USE: Storage automation

Automated teller machine

UF: ATM
BT: Banking
Financial services
RT: Transaction databases



JULY 2025 IEEE Thesaurus

Automatic control

BT: Control systems
NT: Power generation control

Automatic frequency control

BT: Frequency control

Automatic gain control

USE: Gain control

Automatic generation control

BT: Automation
Control systems
Power generation

Automatic indexing

USE: Machine assisted indexing

Automatic logic units

BT: Microprocessors

Automatic meter reading

UF: Automated meter reading
BT: Meter reading
RT: Flowmeters
Smart meters

Automatic number plate recognition

USE: License plate recognition

Automatic optical inspection

BT: Inspection
RT: Machine vision
Manufacturing automation
Pattern recognition

Automatic pilot

USE: Autopilot

Automatic programming

UF: Program generators
BT: Programming

Automatic protection switching

USE: Protection switching

Automatic question generation

USE: Question generation

Automatic repeat request

UF: ARQ
BT: Feedback communications

Automatic speech recognition

UF: ASR

BT: Speech recognition
RT: Speech to text

Automatic summarization

USE: Text summarization

Automatic test equipment

BT: Test equipment
RT: Automatic testing

Automatic Test Markup Language

USE: XML

Automatic test pattern generation

UF: ATPG
BT: Automatic testing
RT: Design automation
NT: Test pattern generators

Automatic testing

UF: Self testing
BT: Automation
Testing
RT: Automatic test equipment
Maintenance engineering
NT: Automatic test pattern
generation
Ring generators

Automatic voltage control

UF: AVC
BT: Voltage control
RT: Voltage
Voltage measurement

Automatic-number plate recognition

USE: License plate recognition

Automation

BT: Robotics and automation
RT: Bagging
Biometrics
Flash memories
Home automation
Information technology
Substation automation
Zigbee
NT: Automated highways
Automated machine
learning
Automated parking
Automatic generation
control
Automatic testing
Autonomous networks



JULY 2025 IEEE Thesaurus

		Building automation		Airfoils
		Fifth Industrial Revolution		Automobile parts
		Fourth Industrial Revolution		Radiators (automotive)
		Intelligent automation		Starter motors (automotive)
		Manufacturing automation		Windscreen wipers
		Office automation		Windscreens
		Storage automation		Windshield wipers
		Vehicular automation		Windshields
<i>AutoML</i>			BT:	Mechanical products
learning	USE:	Automated machine	RT:	Automobile manufacture
				Automobiles
<i>Automobile engineering</i>				Automotive control
	USE:	Automotive engineering		Automotive engineering
				Axles
Automobile manufacture				Belts
	BT:	Manufacturing systems		Brakes
	RT:	Automobiles		Camshafts
		Automotive components		Gears
		Automotive engineering	engines	Hoses
		Automotive materials		Internal combustion
		Die casting		Shock absorbers
		Engines		Steering systems
		Tires	systems)	Suspensions (mechanical
		Wheels		Tires
<i>Automobile materials</i>				Torque converters
	USE:	Automotive materials		Water pumps
				Wheels
<i>Automobile parts</i>			Automotive control	
	USE:	Automotive components	BT:	Automotive engineering
				Control systems
<i>Automobile safety</i>			RT:	Automobiles
	USE:	Vehicle safety		Automotive components
				Automotive electronics
Automobiles				Intelligent transportation
	UF:	Cars	systems	
		Motor vehicles		Road traffic control
	BT:	Road vehicles		Road vehicles
	RT:	Automobile manufacture		
		Automotive components	Automotive electronics	
		Automotive control	BT:	Automotive engineering
		Automotive engineering	RT:	Advanced driver assistance
		Automotive materials	systems	
	NT:	Car parking		Automotive control
<i>Automotive</i>			Automotive engineering	
	USE:	Automotive engineering	UF:	Automobile engineering
				Automotive
Automotive applications			BT:	Vehicular and wireless
	BT:	Automotive engineering	technologies	
			RT:	Automobile manufacture
Automotive components				Automobiles
	UF:	Air bags		Automotive components



JULY 2025 IEEE Thesaurus

NT: Diesel engines
Road safety
Wheels
Automotive applications
Automotive control
Automotive electronics
Power steering
Vehicle crash testing
Vehicle detection
Vehicle driving
Vehicle dynamics
Vehicle safety

Automotive materials

UF: Automobile materials
BT: Production materials
RT: Automobile manufacture
Automobiles

Automotive safety

USE: Vehicle safety

Autonomic computing

USE: Distributed computing

Autonomic nervous system

BT: Nervous system
NT: Parasympathetic nervous
system
Sympathetic nervous
system

Autonomic systems

BT: Network operating systems

Autonomous aerial vehicles

UF: AAV
Aerial robots
Micro air vehicles
UAV
Uncrewed aerial systems
Uncrewed aircraft
Unmanned aerial vehicles
Unmanned air vehicles
Unmanned airborne

vehicles

Unpiloted aerial vehicles
Unpiloted air vehicles
BT: Autonomous vehicles
RT: Aerial computing
Air to ground

communication

Amphibious robots
Drones
Military robotics

Military systems
Quadrotors
Urban air mobility

Autonomous agents

BT: Software agents

Autonomous automobiles

UF: Autonomous cars
Driver free automobiles
Driver free cars
Driver-free car
Driverless automobiles
Driverless cars
Robot automobiles
Robot cars
Self-driving automobiles
Self-driving car
Unmanned automobiles
Unmanned autonomous

cars

BT: Autonomous vehicles

Autonomous cars

USE: Autonomous automobiles

Autonomous driving

BT: Autonomous vehicles
Vehicle driving
RT: Scenario generation

Autonomous machines

USE: Autonomous systems

Autonomous mental development

BT: Computational and artificial
intelligence

Autonomous navigation

USE: Autonomous robots

Autonomous networks

UF: Zero touch networks
Zero-touch networks
BT: Automation
Autonomous systems
Network systems

Autonomous robots

UF: Autonomous navigation
BT: Artificial intelligence
Autonomous systems
Robots
RT: Cognitive robotics
Field robots



JULY 2025 IEEE Thesaurus

Intelligent robots

Autonomous systems

UF: Autonomous machines
Self managing systems
Self-managing systems
Unmanned systems
BT: Intelligent systems
Robotics and automation
RT: Border Gateway Protocol
NT: Autonomous networks
Autonomous robots
Autonomous vehicles

Autonomous trucks

USE: Autonomous vehicles

Autonomous underwater vehicles

UF: Underwater autonomous vehicles
Underwater drones
Underwater exploration robots
Underwater robots
Unmanned underwater vehicles
BT: Autonomous vehicles
Underwater vehicles
RT: Marine robots
Military robotics

Autonomous vehicles

UF: Autonomous trucks
Uncrewed
Unmanned autonomous vehicles
Unmanned surface vehicles
Unmanned vehicles
BT: Autonomous systems
Intelligent vehicles
RT: Artificial intelligence
Mechatronics
Multi-agent systems
Vehicular automation
NT: Autonomous aerial vehicles
Autonomous automobiles
Autonomous driving
Autonomous underwater vehicles

Autopilot

UF: Auto-pilot
Automatic pilot
BT: Control systems

Autopsy

BT: Medical diagnosis
RT: Pathology

Autoregressive moving average models

USE: Autoregressive processes

Autoregressive processes

UF: Autoregressive moving average models
Box Jenkins models
BT: Statistics
RT: Noise
Time series analysis

Auxetic materials

UF: Auxetics
BT: Materials

Auxetics

USE: Auxetic materials

Auxiliary transmitters

BT: Transmitters

Availability

BT: Reliability
RT: Maintenance engineering

Avalanche breakdown

BT: Electric breakdown

Avalanche photodiodes

UF: APDs
BT: Photodiodes
RT: Optical fiber communication
Photomultipliers
NT: Single-photon avalanche diodes

Avatars

BT: Graphical user interfaces
Virtual reality
RT: Metaverse
NT: Digital humans

AVC

USE: Automatic voltage control

Avionics

USE: Aerospace electronics

Awards

BT: IEEE indexing
RT: IEEE Awards activities



JULY 2025 IEEE Thesaurus

NT: Nobel Prize
AWG device
 USE: Arrayed waveguide gratings

AWGN
 BT: Additive noise
 Gaussian noise
 White noise

AWGN channels
 BT: Gaussian channels
 RT: Intersymbol interference
 White noise

Axilla
 UF: Armpit
 Underarm
 BT: Shoulder

Axles
 BT: Mechanical products
 RT: Automotive components
 Wheels

Axons
 BT: Nerve fibers
 RT: Action potentials
 Myelin
 White matter

Azimuth
 BT: Mathematics
 NT: Azimuthal angle
 Azimuthal component
 Azimuthal current
 Azimuthal harmonics
 Azimuthal plane

Azimuthal angle
 BT: Azimuth

Azimuthal component
 BT: Azimuth

Azimuthal current
 BT: Azimuth

Azimuthal harmonics
 BT: Azimuth

Azimuthal plane
 BT: Azimuth

Azobenzene
 BT: Polymers
 RT: Smart materials

B-cells
 USE: Lymphocytes

B-ISDN
 UF: Broadband ISDN
 BT: Broadband communication
 ISDN
 RT: Asynchronous transfer
 mode
 Data communication
 Frame relay
 Image communication
 Multimedia communication

B-Spline
 USE: Splines (mathematics)

Ba
 USE: Barium

Babies
 USE: Pediatrics

Baby
 USE: Pediatrics

Back
 BT: Body regions

Back propagation
 USE: Backpropagation

Back propagation through time
 USE: Backpropagation through
 time

Background noise
 BT: Acoustic noise

Backhaul networks
 BT: Telecommunication
 network topology

Backpacks
 BT: Consumer products

Backplanes
 BT: Data buses

Backpropagation
 UF: Back propagation



JULY 2025 IEEE Thesaurus

errors
 BT: Learning systems
 RT: Backpropagation algorithms
 Neural networks

Backpropagation algorithms

BT: Algorithms
 RT: Backpropagation
 NT: Backpropagation through

time

Backpropagation through time

UF: BPTT
 Back propagation through

time

BT: Backpropagation algorithms
 RT: Recurrent neural networks

Backscatter

BT: Reflection
 RT: Meteorological radar
 NT: Electron backscatter

diffraction

Backscattering

USE: Scattering

Backsheets

BT: Solar panels

Backstepping

BT: Control nonlinearities

Backtracking

BT: Algorithm design and

theory

Backward propagation

USE: Backpropagation

Backwards propagation of errors

USE: Backpropagation

Bacteria

BT: Microorganisms
 RT: Antibacterial activity
 Bacterial infections
 Bacteriophages
 NT: Cyanobacteria
 Escherichia coli
 Salmonella

Bacterial infections

BT: Diseases
 RT: Bacteria
 Escherichia coli

Bacteriophages

UF: Phages
 BT: Viruses (medical)
 RT: Bacteria

Bag of words model

UF: Bag-of-words model
 BT: Natural language

processing

Bag-of-words model

USE: Bag of words model

Bagging

BT: Packaging
 RT: Automation
 Packaging machines
 Plastic packaging

Baidu

USE: Web and internet services

Ball bearings

BT: Machinery
 RT: Mechanical bearings
 Metal products
 Rolling bearings

Ball grid arrays

BT: Electronics packaging
 Surface mount technology

Ball milling

BT: Production
 RT: Milling machines

Ball screws

USE: Mechanical products

Ballasts

USE: Electronic ballasts

Ballistic transport

BT: Electron emission
 NT: Electronic ballasts

Baluns

BT: Electromagnetic devices
 Impedance matching
 Microwave technology



JULY 2025 IEEE Thesaurus

	Transformers	<i>Bandwidth efficiency</i>	
RT:	Transmission lines	USE:	Spectral efficiency
Bamboo		<i>Bang bang control</i>	
BT:	Flowering plants	USE:	Bang-bang control
<i>Band gap</i>		Bang-bang control	
USE:	Photonic band gap	UF:	Bang bang control
<i>Band pass filters</i>		BT:	Optimal control
USE:	Band-pass filters	RT:	Time factors
Band structures		Banking	
BT:	Energy states	BT:	Financial industry
<i>Band-gap</i>		RT:	Finance
USE:	Photonic band gap	NT:	Automated teller machine
			Online banking
			Open banking
Band-pass filters		Bankruptcy	
UF:	BPF	BT:	Finance
	Band pass filters	RT:	Business
	Bandpass filters		Commercial law
BT:	Active filters		Economics
RT:	Frequency	Bar codes	
	Signal processing	BT:	Optical detectors
NT:	Filter banks		Product codes
<i>Band-stop filters</i>		RT:	Internet of Things
USE:	Notch filters		Inventory management
<i>Bandgap</i>		NT:	QR codes
USE:	Photonic band gap	<i>Barges</i>	
<i>Bandpass filters</i>		USE:	Boats
USE:	Band-pass filters	Barium	
Bandwidth		UF:	Ba
BT:	Frequency	BT:	Metals
RT:	Admission control	NT:	Barium compounds
	Coherence time	Barium compounds	
	Computer network	BT:	Barium
management	Direct sequence spread	RT:	Alloying
spectrum communication			Yttrium barium copper
	Information theory	oxide	
	Radio communication	Barometers	
	Signal processing	BT:	Instruments
	Spectral efficiency	RT:	Atmospheric
	Spectroscopy	measurements	
NT:	Narrowband		Meteorology
	Wideband	<i>Baroreceptor reflex</i>	
<i>Bandwidth allocation</i>		USE:	Baroreflex
USE:	Channel allocation		



JULY 2025 IEEE Thesaurus

Baroreflex	UF: Baroreceptor reflex BT: Cardiovascular system		Secondary cells Storage batteries Storage battery
Bars	BT: Structural shapes NT: Billets	BT: Electrochemical devices Energy conversion Energy storage Battery charge	
Basal cell carcinoma	BT: Skin cancer	measurement	Battery chargers Emergency power supplies Lithium Lithium compounds Power generation Uninterruptible power
Basal ganglia	BT: Brain		
Base stations	BT: Radio communication equipment RT: Device-to-device communication NT: Femtocell networks Femtocells	systems	NT: Lead acid batteries Lithium batteries Lithium-ion batteries Lithium-sulfur batteries Nickel cadmium batteries Solid state batteries
Baseball	USE: Sports	Battery charge measurement	BT: Charge measurement RT: Batteries Battery chargers Battery powered vehicles
Baseband	BT: Digital communication Radio communication RT: Passband	Battery chargers	UF: Charging devices Device chargers BT: Power supplies RT: Batteries Battery charge
Basis algorithms	BT: Algorithms	measurement	NT: Charging stations Electric vehicle charging State of charge
Batch manufacturing	USE: Batch production systems	Battery energy storage system	BT: Energy storage
Batch normalization	BT: Deep learning	Battery management systems	BT: Electrochemical devices
Batch processing	USE: Batch production systems	Battery powered vehicles	BT: Electric vehicles RT: Battery charge measurement Charging stations Energy storage Hybrid electric vehicles Solar powered vehicles Traction motors Vehicle-to-grid
Batch production systems	UF: Batch manufacturing Batch processing BT: Manufacturing systems		
Bathymetry	BT: Measurement Sea floor RT: Hydrography Side-scan sonar		
Batteries	UF: Flow batteries		



JULY 2025 IEEE Thesaurus

Battery storage plants

BT: Electricity supply industry
Energy storage

Bayes methods

UF: Bayesian approach
Bayesian belief networks
Bayesian estimation
Bayesian inference
Bayesian learning
Bayesian methods
Bayesian networks
BT: Probability
RT: Belief propagation
Posterior probability
Reinforcement learning
Relevance vector machines
Semisupervised learning
NT: Naive Bayes methods
Recursive estimation

Bayesian approach

USE: Bayes methods

Bayesian belief networks

USE: Bayes methods

Bayesian estimation

USE: Bayes methods

Bayesian inference

USE: Bayes methods

Bayesian learning

USE: Bayes methods

Bayesian methods

USE: Bayes methods

Bayesian networks

USE: Bayes methods

BCI

USE: Brain-computer interfaces

Beak

BT: Animal structures
RT: Birds

Beam bunches

USE: Particle beam bunching

Beam steering

BT: Microwave technology
RT: Antennas

NT: Steerable antennas

Beamforming

USE: Array signal processing

Beams

UF: Electromagnetic beams
BT: Physics
NT: Acoustic beams
Laser beams
Molecular beams
Optical beams
Particle beams

Bean model

UF: Pry and Bean model
BT: Superconductivity

Bearing estimation

USE: Direction-of-arrival
estimation

Bees algorithm

BT: Algorithms
Optimization

Behavior recognition

BT: Behavioral sciences
RT: Deep learning
Machine learning
Pattern recognition

Behavioral economics

UF: Behavioural economics
BT: Behavioral sciences
RT: Psychology

Behavioral sciences

BT: Social sciences
Systems, man, and
cybernetics
RT: Affective computing
Anthropology
Bio-inspired computing
Cultural competence
Cyberbullying
Cyberethics
Digital intelligence
Emotion recognition
Ergonomics
Fish schools
Human factors
Intent recognition
Medical services
Mental health



JULY 2025 IEEE Thesaurus

	Persuasive systems	<i>Benchmark tasks</i>	
	Social Internet of Things	USE:	Benchmark testing
	Social computing		
	System dynamics	Benchmark testing	
NT:	Animal behavior	UF:	Benchmark problems
	Behavior recognition		Benchmark tasks
	Behavioral economics		Benchmarking
	Cognition	BT:	Testing
	Consumer behavior	RT:	NSL-KDD
	Psychiatry		Performance evaluation
	Psychology		
	Social intelligence	<i>Benchmarking</i>	
	User preference	USE:	Benchmark testing
<i>Behavioural economics</i>			
USE:	Behavioral economics	Bending	
		BT:	Mechanical factors
<i>Belief functions</i>		<i>Benign masses</i>	
USE:	Evidence theory	USE:	Benign tumors
Belief propagation		Benign tumors	
UF:	Sum product message	UF:	Benign masses
passing		BT:	Tumors
BT:	Inference mechanisms		
RT:	Bayes methods	<i>BER</i>	
	Evidence theory	USE:	Bit error rate
	Graph theory	<i>BER analysis</i>	
	Iterative methods	USE:	Bit error rate
	Markov processes	<i>BER performance</i>	
	Message passing	USE:	Bit error rate
	Probability		
Bellows		Berry phase	
BT:	Mechanical products	BT:	Waves
RT:	Pistons		
	Pneumatic systems	<i>BERT</i>	
	Pumps	USE:	Bit error rate
	Vacuum systems		
Belts		Beryllium	
UF:	Cambelts	BT:	Chemical elements
	Seat belts		
BT:	Machine components	<i>Bespoke production</i>	
	Machinery	USE:	Job production systems
RT:	Automotive components	Best practices	
	Camshafts	BT:	Management
	Fasteners		Quality assurance
<i>Bench to bedside</i>		RT:	Business communication
USE:	Translational research		Enterprise architecture
<i>Benchmark problems</i>		management	
USE:	Benchmark testing	Beta rays	
		BT:	Nuclear physics
		RT:	Electrons



JULY 2025 IEEE Thesaurus

Betavoltaic power sources

USE: Radioactive materials

Bevel gears

USE: Gears

Beverage industry

BT: Industries

RT: Bottling

Food industry

Beyond CMOS

BT: Integrated circuit technology

BGP

USE: Border Gateway Protocol

BI

USE: Business intelligence

Bi

USE: Bismuth

Bi-directional long short term memory

USE: Bidirectional long short term memory

Bi-directional LSTM

USE: Bidirectional long short term memory

Bi-directional power flow

USE: Bidirectional power flow

Bi-stable circuits

USE: Bistable circuits

Bibliographies

BT: Writing

RT: Publishing

Bibliometrics

BT: Publishing

NT: Citation analysis

BiCMOS integrated circuits

UF: BiMOS integrated circuits

BT: Bipolar transistor circuits

Bicuspid valves

USE: Heart valves

Bicycle sharing

USE: Shared transport

Bicycles

BT: Land vehicles
Vehicles

RT: Micromobility
Sports equipment

Bidirectional communication

USE: Bidirectional control

Bidirectional control

UF: Bidirectional communication

Bidirectional reflectance

BT: Control systems

RT: Bidirectional long short term memory

Bidirectional long short term memory

UF: Bi-directional LSTM
Bi-directional long short term memory

BiLSTM

Bidirectional LSTM

BT: Long short term memory

Recurrent neural networks

RT: Bidirectional control

Natural language

processing

Bidirectional LSTM

USE: Bidirectional long short term memory

Bidirectional power flow

UF: Bi-directional power flow

BT: Power system control

Bidirectional reflectance

USE: Bidirectional control

Bifurcation

BT: Nonlinear equations

RT: Chaos

Big Data

BT: Data collection

RT: Buffer storage

Data handling

Data lakes

Data mining

Information management

Information processing

Information retrieval

Linked data

Neuroinformatics



JULY 2025 IEEE Thesaurus

NT: NoSQL databases
Big Data applications

Big Data applications
BT: Big Data
Computer applications
RT: Cloud computing
Data analysis
Data systems
Information analysis
Information systems

Bike sharing
USE: Shared transport

Bilinear systems
USE: Nonlinear systems

Billets
BT: Bars

Bills of materials
BT: Inventory management
Materials requirements
planning

BiLSTM
USE: Bidirectional long short term
memory

BIM
USE: Building information
management

BiMOS integrated circuits
USE: BiCMOS integrated circuits

Binary codes
BT: Codes
NT: Reflective binary codes
Webassembly

Binary decision diagrams
BT: Data structures

Binary phase shift keying
UF: BPSK
Binary phase-shift keying
BT: Phase shift keying

Binary phase-shift keying
USE: Binary phase shift keying

Binary search trees
BT: Binary trees

Binary sequences
UF: Bit streams
Bitstreams
BT: Sequences

Binary trees
BT: Tree data structures
NT: Binary search trees

Binge eating
USE: Eating disorders

Bio inspired materials
USE: Bio-inspired materials

Bio-agents
USE: Biological weapons

Bio-computing
USE: Bio-inspired computing

Bio-inspired computing
UF: Bio-computing
Biocomputing
Bioinspired computing
Biologically inspired
computing
BT: Artificial intelligence
Bio-inspired engineering
RT: Behavioral sciences
Bio-inspired materials
Biology
Machine learning
Mathematics
Neural networks
Social factors

Bio-inspired control
UF: Biologically inspired control
BT: Bio-inspired engineering

Bio-inspired engineering
UF: Biologically inspired
engineering
BT: Engineering - general
RT: Biology
Biomimetics
Complex systems
NT: Bio-inspired computing
Bio-inspired control
Bio-inspired robotics

Bio-inspired materials
UF: Bio inspired materials
Bioinspired materials



JULY 2025 IEEE Thesaurus

	BT: Materials		BT: Metabolic networks
	RT: Bio-inspired computing		BT: Biology
	Biomimetics		Chemistry
	Nanotechnology		RT: Biogeochemistry
	Organic inorganic hybrid		Biological cells
materials			Bioreactors
	NT: Self-assembly		Cell motility
			Cell signaling
			Chemical reaction network
Bio-inspired robotics		theory	
UF: Biologically inspired robots			Computational biochemistry
Biologically-inspired robots			Drugs
bioinspired robotics			Entomology
BT: Bio-inspired engineering			Hydrolysis
Robots			Molecular biophysics
			Pharmaceutical technology
<i>Bio-MEMs</i>			Pharmaceuticals
USE: Biomedical			Pharmacodynamics
microelectromechanical systems			Pharmacokinetics
			Pharmacology
<i>Bio-nanotechnology</i>			NT: Amino acids
USE: Bionanotechnology			Biochemical analysis
			Biochemical oxygen
<i>Bio-sensors</i>			
USE: Biosensors		demand	
			Metabolism
<i>Bio-weapons</i>			Peptides
USE: Biological weapons			Proteins
			Receptor (biochemistry)
<i>Bioacoustics</i>			
USE: Biomedical acoustics		Biochips	
		BT: Molecular biology	
<i>Bioagents</i>		RT: Biochemical analysis	
USE: Biological weapons		Microfluidics	
		NT: Digital microfluidic biochips	
Bioceramics			
BT: Biological materials		Biocompatibility	
Biomedical materials		BT: Material properties	
Ceramics		RT: Medical devices	
RT: Ceramics industry			
Prosthetics		<i>Biocomputing</i>	
		USE: Bio-inspired computing	
Biochemical analysis			
BT: Biochemistry		<i>Biocontrol</i>	
RT: Biochips		USE: Biological control systems	
Biochemical oxygen demand		<i>Biocybernetics</i>	
UF: BOD		USE: Cybernetics	
BT: Biochemistry			
Microorganisms		Biodegradable materials	
RT: Biodegradation		BT: Biodegradation	
Composting		RT: Cellulose	
NT: BOD5			
		Biodegradation	
Biochemistry		BT: Environmental	
UF: Hormones		management	



JULY 2025 IEEE Thesaurus

RT: Anaerobic digestion
Biochemical oxygen
demand
Waste management
Weathering
NT: Biodegradable materials
Composting

Biodiversity

BT: Biology
RT: Circular economy
NT: Biogeography
Endangered species

Bioelectric phenomena

UF: Bioelectronics
Electrobiology
BT: Biology
RT: Brain
Electrical accidents
Electroencephalography
Electromyography
Electrooculography
Nervous system
NT: Electric shock

Bioelectric potentials

USE: Action potentials

Bioelectronics

USE: Bioelectric phenomena

Bioengineering

USE: Biomedical engineering

Biofeedback

USE: Biological control systems

Biofilms

BT: Biological materials
Microorganisms

Biofuels

BT: Fuels
RT: Food waste
NT: Biogas

Biogas

BT: Biofuels
RT: Anaerobic digestion

Biogeochemistry

BT: Chemistry
Geology
RT: Biochemistry

Biogeography

BT: Biodiversity
NT: Biomes

Biographies

BT: Writing
RT: Engineering profession
NT: Autobiographies

Biohazards

UF: Germ warfare
BT: Hazards
RT: Chemical hazards
Green products
Medical treatment
Terrorism
NT: Biological weapons

Bioimaging

USE: Biomedical imaging

Bioimpedance

BT: Biomedical engineering
Current
RT: Blood flow

Bioinformatics

UF: Biomedical informatics
Health informatics
BT: Biomedical computing
Informatics
RT: Biology
Computational biochemistry
Computational biology
Computational biophysics
NT: Neuroinformatics

Bioinspired computing

USE: Bio-inspired computing

Bioinspired materials

USE: Bio-inspired materials

bioinspired robotics

USE: Bio-inspired robotics

Biological agent

USE: Biological weapons

Biological cells

UF: Cell biology
Chromosomes
BT: Biology
RT: Biochemistry
Biological materials



JULY 2025 IEEE Thesaurus

	Biomembranes	<i>Biological macromolecules</i>	
	DNA	USE:	Molecular biophysics
	Microorganisms		
	Self-assembly	<i>Biological markers</i>	
NT:	Cell signaling	USE:	Biomarkers
	Cells (biology)		
	Chromosome mapping	Biological materials	
	Endothelial cells	UF:	Biomaterials
	Fibroblasts	BT:	Materials
	RNA	RT:	Biological cells
	Stem cells		Biomedical materials
			Fats
<i>Biological clocks</i>			Tissue engineering
USE:	Chronobiology	NT:	Bioceramics
			Biofilms
Biological control systems			
UF:	Biocontrol		
	Biofeedback		
BT:	Systems, man, and		
cybernetics			
RT:	Immune system		
	Legged locomotion		
	Prosthetics		
NT:	Biomarkers		
<i>Biological effects of protons</i>			
USE:	Proton effects		
Biological effects of radiation			
UF:	Biological radiation effects		
BT:	Radiation effects		
RT:	Biomedical applications of		
radiation			
	Neutron capture therapy		
	Occupational health		
	Proton therapy		
	Radiation protection		
<i>Biological EPR</i>			
USE:	Electron paramagnetic		
resonance			
<i>Biological imaging</i>			
USE:	Biomedical imaging		
Biological information theory			
BT:	Biology		
	Information theory		
RT:	DNA		
	Genetic communication		
Biological interactions			
BT:	Biological processes		



JULY 2025 IEEE Thesaurus

Biological systematics

USE: Systematics

BT: Germ warfare
Biohazards
Weapons
RT: Chemical weapons
National security
Nuclear weapons
US Department of

Biological systems

UF: Biological organs
Organs (biological)
BT: Biology
RT: Animals
Artificial biological organs
Biomedical engineering
Organoids
NT: Anatomy
Molecular communication
Organisms

Homeland Security
Weapons of mass
destruction

Biologically inspired computing

USE: Bio-inspired computing

Biologically inspired control

USE: Bio-inspired control

Biologically inspired engineering

USE: Bio-inspired engineering

Biologically inspired robots

USE: Bio-inspired robotics

Biologically-inspired robots

USE: Bio-inspired robotics

Biological therapy

USE: Immunotherapy

Biological threat agents

USE: Biological weapons

Biological tissue

USE: Biological tissues

Biological tissues

UF: Biological tissue
Tissues
BT: Anatomy
RT: Electrosurgery
NT: Bone tissue
Breast tissue
Cardiac tissue
Connective tissue
Glands
Neoplasms

Biology

BT: Engineering in medicine
and biology

RT: Science - general
Bio-inspired computing
Bio-inspired engineering
Bioinformatics
Computational biology
Environmental science
Immune system
Life sciences
Paleontology
Pharmacology

NT: Biochemistry
Biodiversity
Bioelectric phenomena
Biological cells
Biological information

Biological warfare

USE: Biological weapons

Biological warfare agents

USE: Biological weapons

theory

Biological weapons

UF: Bio-agents
Bio-weapons
Bioagents
Biological agent
Biological threat agents
Biological warfare
Biological warfare agents
Bioweapons

Biological processes
Biological system modeling
Biological systems
Biology computing
Biophotonics
Biophysics
Biostatistics
Botany
Cryobiology
Embryology



JULY 2025 IEEE Thesaurus

- Evolution (biology)
- Genetics
- Homeostasis
- Mechanobiology
- Microbiology
- Microinjection
- Nanobioscience
- Phenology
- Physiology
- Predator prey systems
- Synthetic biology
- Systematics
- Systems biology
- Vegetation
- Zoology

RT:	Anthropometry
	Cell motility
	Cell signaling
	Entomology
	Human activity recognition
	Mechanobiology
	Motion capture
	Wearable robots
NT:	Fall detection

Biology computing

BT: Biology
RT: Biomedical computing
Computers and information

processing

Bioluminescence

BT: Chemiluminescence

Biomagnetism

UF:	Biomagnetism
BT:	Biophysics
	Magnetics
RT:	Biomedical engineering
	Magnetic fields
	Magnetic materials
	Magnetic particles
NT:	Magnetoencephalography

Biomagnetism

USE: Biomagnetics

Biomarkers

UF:	Biological markers
	Human disease markers
BT:	Biological control systems
	Biomedical measurement
NT:	Molecular biomarkers

Biomass

BT: Renewable energy sources
RT: Renewable Portfolio

Standard

Biomaterials

USE: Biological materials

Biomechanics

BT: Mechanical factors

Biomechatronics

BT: Mechatronics

Biomedical acoustics

UF:	Bioacoustics
	Biomedical ultrasonics
BT:	Acoustics
RT:	Acoustic applications
	Acoustic measurements
	Auditory system

Biomedical applications of electromagnetic radiation

USE: Biomedical applications of

Biomedical applications of radiation

UF: Biomedical applications of electromagnetic radiation

BT: Biomedical engineering
Nuclear and plasma

sciences

RT: Angiocardiography
 Biological effects of

radiation

Biomedical imaging
Cancer
Collimators
Computed tomography
Gamma-ray detectors
Medical treatment
Positron emission

tomography

- Radiation effects
- Radiography
- Synchrotron radiation
- Radiation therapy

NT:

Biomedical communication

BT: Communication systems
Engineering in medicine

and biology

- RT: Fall detection
- Medical devices
- Nanocommunication



JULY 2025 IEEE Thesaurus

communication systems	Picture archiving and		Biomedical electronics
	Point of care	processing	Biomedical signal
NT:	Biomedical telemetry		Bioprinting
	Telemedicine		Biotechnology
Biomedical computing			Cloning
UF:	Medical computing		Drug delivery
BT:	Engineering in medicine		Neural engineering
and biology			Protein engineering
RT:	Biology computing		Tissue engineering
	Biomedical signal		Translational research
processing		Biomedical engineering education	
	Computer applications	BT:	Engineering education
communication systems	Picture archiving and	RT:	Biomedical engineering
	Signal processing	Biomedical equipment	
NT:	Bioinformatics	UF:	Clinical equipment
	Medical expert systems		Medical equipment
	Medical information	BT:	Engineering in medicine
systems		and biology	
		RT:	Biological techniques
Biomedical electrodes			Biomedical electronics
BT:	Biomedical equipment		Biomedical measurement
RT:	Biomedical engineering		Biomedical
	Biomedical measurement	microelectromechanical systems	
	Dry electrodes		Collimators
	Electrophysiology		Electrocardiography
	Wet electrodes		Electroencephalography
			Endomicroscopy
Biomedical electronics			Insulin pumps
BT:	Biomedical engineering		Medical control systems
RT:	Biomedical equipment		Medical robotics
			Molecular biophysics
Biomedical engineering			Nanosensors
UF:	Bioengineering		Needles
BT:	Engineering in medicine		Orthotics
and biology			Prosthetics
RT:	Biological systems		Sensory aids
	Biomagnetics		Speech synthesis
	Biomedical electrodes		Surgery
	Biomedical engineering		Zigbee
education		NT:	Assistive technologies
	Biomedical monitoring		Biomedical electrodes
	Biomedical optical imaging		Biomedical telemetry
	Colloidal lithography		Biomedical transducers
	Genetic communication		Catheters
	Genetic engineering		Endoscopes
	Hospitals		Gerontechnology
	Microfluidics		Hypodermic needles
	Orthotics		Implants
NT:	Bioimpedance		Intracranial pressure
	Biological techniques	sensors	
	Biomedical applications of		Lithotriptors
radiation			Medical devices



JULY 2025 IEEE Thesaurus

Medical instruments
Pacemakers
Petri dishes
Pulse oximeter
Stethoscope
Surgical instruments
Ventilators

Cardiography
Contrast agents
DICOM
Elastography
Encephalography
Mammography
Medical diagnostic imaging
Molecular imaging
Phantoms
Photoacoustic imaging

Biomedical image processing

UF:	Medical image processing
BT:	Biomedical signal
RT:	Biomedical imaging
	Biomedical optical imaging
	Functional magnetic

resonance imaging	Magnetoencephalography
	Medical robotics
	Subtraction techniques
NT:	Imaging phantoms
	Motion artifacts
	Neuroimaging
enhancement	Radiographic image
	Radiology
	Radiomics
	Ultrasonography
	Whole body imaging

Biomedical imaging

UF:	Bioimaging
	Biological imaging
	Biomedical X-ray imaging
	Medical imaging
	Tomosynthesis
BT:	Engineering in medicine

and biology	Engineering in medicine
RT:	Imaging
radiation	Biomedical applications of

Biomedical image
processing
Data visualization
Isosurfaces
Medical diagnosis
Molecular biophysics
Nanobiophotonics
Picture archiving and
communication systems

NT:	Radiation imaging
	Tomography
	Ultrasonic imaging
	Angiocardiography
	Angiography
	Biomedical optical imaging

Biomedical informatics

USE: Bioinformatics

Biomedical infrared imaging

USE: Biomedical optical imaging

Biomedical instruments

USE: Biomedical measurement

Biomedical materials

BT:	Materials
RT:	Biological materials
	Diamond-like carbon
	Molecular biophysics
NT:	Bioceramics
	Biomembranes

Biomedical measurement

UF: Biomedical instruments
 Biomedical measurements

BT: Measurement
RT: Anthropometry
Biomedical electrodes
Biomedical equipment
Biosensors
Pulse oximetry

NT: Biomarkers
Biomedical monitoring
Body mass index
Electroencephalography
Electromyography
Electrooculography
Electrophysiology
Photoplethysmography
Plethysmography
Pulse oximeter
Sensitivity and specificity
Spirometry

Biomedical measurements

USE: Biomedical measurement

Biomedical microelectromechanical systems

UF: Bio-MEMs



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity. **Page**

JULY 2025 IEEE Thesaurus

BT:	Micromechanical devices	Biomembranes	UF:	Biological membranes
RT:	Biomedical equipment			Membranes
Biomedical monitoring			BT:	Biomedical materials
BT:	Biomedical measurement		RT:	Biological cells
RT:	Biomedical engineering	Biomes		
	Epidemiology	BT:		Biogeography
	Internet of Medical Things	Biometric authentication		
	Phonocardiography	BT:		Biometrics
NT:	Continuous glucose	RT:		Access control
monitoring	Nanomedicine			Security
<i>Biomedical MRI</i>		Biometric identification		
USE:	Magnetic resonance	BT:		Biometrics
imaging				Identification of persons
Biomedical optical imaging		Biometric systems		
UF:	Biomedical infrared imaging	USE:		Biometrics
BT:	Biomedical imaging	Biometrics		
RT:	Biomedical engineering	UF:		Biometric systems
	Biomedical image	BT:		Identification of persons
processing	Endomicroscopy	RT:		Access control
	Endoscopes			Algorithms
	Infrared imaging			Automation
	Optical communication			Handwriting recognition
equipment	Optical devices			Information technology
				Security
Biomedical signal processing				Speaker recognition
BT:	Biomedical engineering	NT:		Biometric authentication
RT:	Biomedical computing			Biometric identification
	Fall detection			Face recognition
	Neurophysiology			Fingerprint recognition
	Time-frequency analysis			Gait recognition
NT:	Biomedical image			Iris recognition
processing				Keystroke dynamics
				Palmprint recognition
Biomedical telemetry		<i>Biometry</i>		
UF:	Biotelemetry	USE:		Biostatistics
BT:	Biomedical communication	<i>Biomimetic</i>		
	Biomedical equipment	USE:		Biomimetics
	Telemetry	Biomimetic materials		
Biomedical transducers		BT:		Biomimetics
BT:	Biomedical equipment			Smart materials
	Transducers	<i>Biomimetic microelectronics</i>		
<i>Biomedical ultrasonics</i>		USE:		Biomimetics
USE:	Biomedical acoustics	Biomimetics		
<i>Biomedical X-ray imaging</i>		UF:		Biomimetic
USE:	Biomedical imaging			



JULY 2025 IEEE Thesaurus

Biomimetic microelectronics
 Biomimicry
 Bionics
 BT: Microprocessors
 RT: Bio-inspired engineering
 Bio-inspired materials
 Intelligent materials
 Soft robotics
 Whale optimization

algorithms
 NT: Biomimetic materials

Biomimicry
 USE: Biomimetics

Biomolecular electronics
 USE: Molecular electronics

Biomolecules
 USE: Molecular biophysics

Bionanotechnology
 UF: Bio-nanotechnology
 BT: Engineering in medicine
 and biology
 Nanotechnology

Bionics
 USE: Biomimetics

Biophotonics
 BT: Biology
 Photonics

Biophysics
 BT: Biology
 Physics
 RT: Computational biophysics
 NT: Aerospace biophysics
 Biomagnetics
 Cellular biophysics
 Molecular biophysics

Biopolymers
 BT: Polymers

Bioprinting
 BT: Biomedical engineering
 Three-dimensional printing
 RT: Artificial biological organs
 Tissue engineering

Biopsies
 USE: Biopsy

Biopsy
 UF: Biopsies
 BT: Medical tests

Bioreactors
 BT: Chemical reactions
 RT: Biochemistry

Biorthogonal modulation
 BT: Wavelet transforms

Biosensors
 UF: Bio-sensors
 Biological sensors
 BT: Chemical and biological
 sensors
 RT: Biomedical measurement
 Nanobiophotonics
 Wearable sensors

Biosphere
 BT: Environmental factors
 Geoscience
 RT: Carbon cycle

Biostatistics
 UF: Biometry
 BT: Biology
 Statistics

Biotechnology
 BT: Biomedical engineering
 RT: Genetic engineering
 Hydrolysis

Biotelemetry
 USE: Biomedical telemetry

Bioterrorism
 BT: Engineering in medicine
 and biology
 Terrorism

Bioweapons
 USE: Biological weapons

Bipartite graph
 BT: Graph theory

Biped locomotion
 USE: Legged locomotion

Bipolar integrated circuits
 BT: Bipolar transistor circuits
 RT: Bipolar transistors



JULY 2025 IEEE Thesaurus

Bipolar transistor circuits

BT: Circuits
RT: Parameter extraction
NT: BiCMOS integrated circuits
Bipolar integrated circuits

Bipolar transistors

BT: Power semiconductor switches
RT: Bipolar integrated circuits
Proton radiation effects
Semiconductor epitaxial layers
NT: Transistors
Insulated gate bipolar transistors
Kirk field collapse effect

Birds

BT: Animals
RT: Beak

Birefringence

BT: Optics
RT: Photorefractive effect
Photorefractive materials
Refractive index
Thermooptic effects

Birth disorders

BT: Amniocentesis

Bismuth

UF: Bi
BT: Metals
RT: Bismuth compounds

Bismuth compounds

UF: BSCCO
BT: Compounds
RT: Alloying
Bismuth

BIST

USE: Built-in self-test

Bistability (optical)

USE: Optical bistability

Bistable circuits

UF: Bi-stable circuits
BT: Circuits
NT: Latches

Bistable multivibrator

USE: Pulse circuits

Bistatic radar

BT: Radar

Bit allocation

USE: Bit rate

Bit error rate

UF: BER
BER analysis
BER performance
BERT
Bit error rate test
BT: Error analysis

Bit error rate test

USE: Bit error rate

Bit interleaved coded

USE: Interleaved codes

Bit rate

UF: Bit allocation
Bitrate
BT: Timing
RT: Communication system

signaling

Computer networks
Signal processing

Bit streams

USE: Binary sequences

Bit-interleaved coded

USE: Interleaved codes

Bitcoin

BT: Cryptocurrency
RT: Blockchains
Cryptography
Finance
Nonfungible tokens
Online banking

Bitrate

USE: Bit rate

Bitstreams

USE: Binary sequences

Bitumen

USE: Asphalt



JULY 2025 IEEE Thesaurus

<i>Bixby</i>	USE:	Virtual assistants	Blind equalizers	UF:	Blind channel estimation Blind equalisers Source signal equalizers
<i>Black box</i>	USE:	Flight recording		BT:	Equalizers
<i>Blackberry</i>	USE:	Personal digital devices	<i>Blind signal separation</i>	USE:	Blind source separation
<i>Blackbox</i>	USE:	Closed box	Blind source separation	UF:	Blind signal separation Mixed source separation
Bladder	BT:	Urogenital system		BT:	Source separation
				RT:	Adaptive signal detection Array signal processing Independent component
Blades	UF:	Vanes	analysis		Signal analysis Signal detection
	BT:	Mechanical products			
	RT:	Agricultural machinery Cutting tools Fans Impellers Propellers Turbomachinery	Blindness	BT:	Medical conditions
				RT:	Braille Visual impairment Visual prosthesis
Blanking	BT:	Manufacturing systems	Blob detection	BT:	Computer vision Image processing
	RT:	Metal products Metals Sheet metal processing		RT:	Feature extraction
Blast furnaces	BT:	Furnaces	<i>Block chain</i>	USE:	Blockchains
	RT:	Smelting	Block codes	UF:	Block coding
Bleaching	BT:	Materials processing		BT:	Channel coding
	RT:	Manufacturing systems Paper making Process control Textile technology		RT:	Mobile communication
				NT:	Linear codes Polar codes
<i>Bleeding</i>	USE:	Hemorrhaging	<i>Block coding</i>	USE:	Block codes
<i>Blended learning</i>	USE:	Hybrid learning	<i>Block listing</i>	USE:	Blocklists
<i>Blind channel estimation</i>	USE:	Blind equalizers	<i>Block lists</i>	USE:	Blocklists
<i>Blind equalisers</i>	USE:	Blind equalizers	<i>Block signaling</i>	USE:	Block signalling
			Block signalling	UF:	Block signaling



JULY 2025 IEEE Thesaurus

	Signaling block systems	Blood	
	Signalling block systems	BT:	Blood vessels
BT:	Control systems	RT:	Leukemia
	Railway communication	NT:	Blood platelets
RT:	Collision avoidance		Coagulation
	Rail transportation		Red blood cells
			White blood cells
Blockchains			
UF:	Block chain	<i>Blood clots</i>	
	Chain codes	USE:	Coagulation
	Ethereum		
	Permissioned blackchains	Blood flow	
	Private blockchains	BT:	Blood pressure
BT:	Public blockchains	RT:	Anemia
	Cryptography		Bioimpedance
	Digital economy		Hematology
	Distributed databases		Hemorrhaging
RT:	Authentication	NT:	Hemodynamics
	Bitcoin		
	Computer security	Blood platelets	
	Content management	BT:	Blood
	Cryptocurrency	RT:	Coagulation
	Data collection		Hematology
	Decentralized autonomous		
organization		Blood pressure	
	Decentralized identity	UF:	Arterial pressure
	Directed acyclic graph	BT:	Blood vessels
	Distributed ledger	NT:	Blood flow
	Federated identity		Blood pressure
	Metaverse	measurement	
	Micropayments		Blood pressure variability
	Proof of Work		Hypertension
	Trustless services		Hypotension
NT:	Consensus protocol	Blood pressure measurement	
	Nonfungible tokens	BT:	Blood pressure
	Proof of stake		
Blocklists		Blood pressure variability	
UF:	Block listing	BT:	Blood pressure
	Block lists		
	Deny lists	Blood vessels	
BT:	Access control	BT:	Cardiovascular system
	Information filters	RT:	Endothelial cells
			Hematology
<i>Blogging</i>		NT:	Arteries
USE:	Blogs		Blood
			Blood pressure
Blogs			Veins
UF:	Blogging	Bluetooth	
	Twitter	BT:	Personal area networks
	Weibo		Radio communication
BT:	Information retrieval	RT:	Cellular radio
RT:	Electronic mail		Communication equipment
	Internet		Digital communication
	Social networking (online)		



JULY 2025 IEEE Thesaurus

IEEE 802.11 Standard
IEEE 802.11g Standard
IEEE 802.11n Standard
IEEE 802.15 Standard
Land mobile radio
Protocols
Spread spectrum

communication

Wireless LAN
Wireless communication
Zigbee
NT: Bluetooth Low Energy

Bluetooth Low Energy

BT: Bluetooth

BMI

USE: Body mass index

BNCT

USE: Neutron capture therapy

BNSC

UF: British National Space

Centre

BT: Organizations

Boat building industry

USE: Shipbuilding industry

Boats

UF: Barges
Yachts
BT: Marine vehicles
RT: Marine robots

BOD

USE: Biochemical oxygen
demand

BOD5

UF: 5-day BOD
5-day biochemical oxygen

demand

BT: Biochemical oxygen

demand

Body area networking

USE: Body area networks

Body area networks

UF: Body area networking
BT: Personal area networks
RT: Human activity recognition
Wearable antennas

Body borne computers

USE: Wearable devices

Body mass index

UF: BMI
BT: Biomedical measurement

Body regions

BT: Anatomy
NT: Abdomen
Back
Breast
Extremities
Head
Neck
Pelvis
Perineum
Thorax
Torso
Viscera

Body sensor networks

BT: Personal area networks
Wireless sensor networks
RT: Fall detection
Human activity recognition
Wearable sensors

Boilers

BT: Heating systems
RT: Heat recovery
Steam engines
Turbines
Waste heat

Bolometers

BT: Radiation detectors
RT: Infrared detectors
Temperature measurement

Bolts

USE: Fasteners

Boltzmann distribution

BT: Statistics
NT: Lattice Boltzmann methods

Boltzmann equation

UF: Boltzmann transport
equation

BT: Equations

Boltzmann transport equation

USE: Boltzmann equation



JULY 2025 IEEE Thesaurus

<i>Bomb</i>		RT:	Logic
USE:	Weapons		Logic gates
			Set theory
Bonding		NT:	Boolean functions
BT:	Bonding processes		
RT:	Manufacturing	Boolean functions	
	Materials processing	BT:	Boolean algebra
NT:	Adhesives	RT:	Fault trees
		NT:	Logic functions
Bonding forces			
BT:	Materials testing	Boosting	
		BT:	Machine learning
Bonding processes			Supervised learning
BT:	Fabrication		
	Joining processes	Booting	
RT:	Soldering	BT:	Operating systems
	Welding		
NT:	Bonding	Border Gateway Protocol	
	Diffusion bonding	UF:	BGP
	Wafer bonding	BT:	Protocols
		RT:	Autonomous systems
Bone density			Information exchange
UF:	Bone mineral density		Peer-to-peer computing
BT:	Bones		Routing protocols
RT:	Density measurement		Telecommunication
		network management	
Bone diseases			Telecommunication traffic
BT:	Diseases		
NT:	Osteoarthritis	Boring	
	Osteoporosis	BT:	Machining
		RT:	Drilling
<i>Bone mineral density</i>			Milling
USE:	Bone density		Turning
Bone tissue		Boron	
BT:	Biological tissues	BT:	Chemical elements
RT:	Bones		Metals
NT:	Cancellous bone	RT:	Fertilizers
	Cortical bone	NT:	Boron alloys
Bones		Boron alloys	
BT:	Skeleton	BT:	Boron
RT:	Bone tissue	RT:	Magnetic materials
	Skull		
NT:	Bone density	<i>Boron neutron capture therapy</i>	
	Pelvic bones	USE:	Neutron capture therapy
<i>Bonuses</i>		<i>Bot</i>	
USE:	Incentive schemes	USE:	Chatbots
Book reviews		Bot (Internet)	
BT:	IEEE indexing	UF:	WWW robot
			Web robot
Boolean algebra		BT:	Computer applications
BT:	Algebra		Internet



JULY 2025 IEEE Thesaurus

	World Wide Web	<i>BPR</i>	
RT:	Crawlers	USE:	Business process re-engineering
Botany			
BT:	Biology	<i>BPSK</i>	
RT:	Seeds (agriculture)	USE:	Binary phase shift keying
Botnet		<i>BPTT</i>	
BT:	Interconnected systems	USE:	Backpropagation through time
	Internet		
	Software agents	<i>Brachial</i>	
RT:	Computer crime	USE:	Brachytherapy
	Distributed denial-of-service		
attack			
	Robots	Brachytherapy	
		UF:	Brachial
Bottling		BT:	Medical treatment
BT:	Packaging	RT:	Radiation effects
RT:	Beverage industry		
	Glass products	Bradycardia	
	Packaging machines	BT:	Heart rate
	Plastic products	RT:	Tachycardia
Boundary conditions		Bragg gratings	
BT:	Boundary value problems	UF:	Fiber Bragg gratings
NT:	Lower bound		Fiber-Bragg gratings
	Upper bound	BT:	Filters
			Optical devices
<i>Boundary element methods</i>		RT:	Diffraction
USE:	Boundary-element methods		Diffraction gratings
			Laser beams
Boundary value problems			Optical beams
BT:	Mathematics		Optical transmitters
RT:	Partial differential equations		Temperature sensors
NT:	Boundary conditions		Wavelength division
Boundary-element methods		multiplexing	
UF:	Boundary element methods	NT:	Fiber gratings
BT:	Partial differential equations		
RT:	Integral equations	Braille	
	Method of moments	BT:	Writing
		RT:	Assistive technologies
Bovine			Blindness
BT:	Animals		Haptic interfaces
NT:	Cows		Tactile sensors
<i>Box Jenkins models</i>		Brain	
USE:	Autoregressive processes	BT:	Nervous system
		RT:	Bioelectric phenomena
			Cerebrospinal fluid
<i>BPEL</i>			Cognition
USE:	Business Process		Cognitive informatics
Execution Language			Cognitive science
			Diffusion tensor imaging
<i>BPF</i>			Electroencephalography
USE:	Band-pass filters		Encephalography



JULY 2025 IEEE Thesaurus

sensors	Head	<i>Brain implants</i>	
	Intracranial pressure	USE:	Neural implants
NT:	Magnetoencephalography	Brain injuries	
	Soma	BT:	Brain
	Synapses		Injuries
	White matter	RT:	Aphasia
	Amygdala		Cerebral palsy
	Basal ganglia		Spasticity
	Brain cells	<i>Brain interfaces</i>	
	Brain injuries	USE:	Brain-computer interfaces
	Brain modeling	<i>Brain machine interfaces</i>	
	Brain tumors	USE:	Brain-computer interfaces
	Brain ventricles	Brain mapping	
	Brainstem	BT:	Nervous system
	Cerebellum	NT:	Neuroimaging
	Cerebral cortex	Brain modeling	
	Cerebrum	UF:	Brain modelling
	Corpus callosum	BT:	Brain
	Forebrain		Modeling
	Frontal lobe	<i>Brain modelling</i>	
	Hindbrain	USE:	Brain modeling
	Hydrocephalus	<i>Brain plasticity</i>	
	Hypothalamus	USE:	Neuroplasticity
	Limbic system	<i>Brain stem</i>	
	Midbrain	USE:	Brainstem
	Neural activity	<i>Brain stem implants</i>	
	Neural implants	USE:	Brainstem implants
	Neurodynamics	Brain stimulation	
	Neurophysiology	BT:	Medical treatment
	Neuroprostheses	NT:	Deep brain stimulation
	Neuropsychology	Brain tumors	
	Neurotechnology	BT:	Brain
	Occipital Lobe		Tumors
	Parietal lobe	NT:	Brain cancer
	Primary motor cortex	Brain ventricles	
	Sleep	BT:	Brain
	Temporal lobe	<i>Brain-computer interaction</i>	
	Thalamus	USE:	Brain-computer interfaces
	Ventricle system	Brain-computer interfaces	
	Virtual artifact	UF:	BCI
			Brain computer interfaces
Brain cancer			
BT:	Brain tumors		
	Cancer		
Brain cells			
BT:	Brain		
<i>Brain computer interfaces</i>			
USE:	Brain-computer interfaces		
<i>Brain imaging</i>			
USE:	Neuroimaging		



JULY 2025 IEEE Thesaurus

	Brain interfaces		<i>Breakdown</i>	
	Brain machine interfaces		USE:	Electric breakdown
	Brain-computer interaction			
	Brain-computer-interfaces		Breakdown voltage	
	Brain-machine interfaces		BT:	Voltage
	Mind-machine interfaces		RT:	Current
BT:	User interfaces			Diodes
RT:	Fifth Industrial Revolution			Insulators
	Neural engineering			
	Neuroprostheses		Breast	
			BT:	Body regions
			NT:	Breast biopsy
				Breast cancer
				Breast tissue
				Breast tumors
<i>Brain-computer-interfaces</i>				
USE:	Brain-computer interfaces			
<i>Brain-machine interfaces</i>				
USE:	Brain-computer interfaces			
<i>BrainLobe</i>				
USE:	Frontal lobe			
Brainstem				
UF:	Brain stem			
BT:	Brain			
Brainstem implants				
UF:	Brain stem implants			
BT:	Implants			
Brakes				
BT:	Control systems			
	Mechanical products			
RT:	Automotive components			
Branching factor				
BT:	Game theory			
	Tree data structures			
Brand management				
UF:	Branding			
BT:	Marketing management			
RT:	Market research			
	Product development			
<i>Branding</i>				
USE:	Brand management			
Brazing				
BT:	Soldering			
RT:	Welding			
Breadboard				
UF:	Plugboard			
	Solderless breadboard			
BT:	Electronic circuits			
	Prototypes			
			<i>Breast cancer</i>	
			USE:	Breast cancer



JULY 2025 IEEE Thesaurus

Bremsstrahlung

BT: Electromagnetic radiation

BT: Communication systems

RT: Asynchronous transfer

mode

Bridge circuits

BT: Circuits

RT: Rectifiers

Cable TV

Frequency division

multiaccess

Bridge converters

USE: Switched reluctance motors

IEEE 802.16 Standard

IPTV

Multimedia communication

Optical fiber communication

Ultra wideband

Bridges

BT: Structural shapes

RT: Civil engineering

Structural engineering

Transportation

communication

NT:

Video on demand

B-ISDN

Broadband amplifiers

Brightness

BT: Optics

NT: Brightness temperature

Broadband ISDN

USE: B-ISDN

Brightness temperature

BT: Brightness

Broadband networks

USE: Broadband communication

Brillouin scattering

BT: Scattering

Broadcast technology

NT: Broadcasting

Bring your own device

UF: BYOD

BT: Information technology

RT: Mobile computing

Office automation

Personnel

Security

Smart phones

Broadcasting

UF: Broadcasts

BT: Broadcast technology

RT: Entertainment industry

Journalism

NT: Digital audio broadcasting

Digital multimedia

broadcasting

Digital video broadcasting

Motion pictures

NVIS

Radio broadcasting

Satellite broadcasting

Web TV

British National Space Centre

USE: BNSC

Broadband amplifiers

UF: Wideband amplifiers

BT: Amplifiers

Broadband communication

Broadcasts

USE: Broadcasting

Broadband antennas

UF: Wideband antennas

BT: Antennas

RT: Antenna arrays

Microstrip

Microwave propagation

UHF propagation

NT: Ultra wideband antennas

Vivaldi antennas

Bromine

BT: Chemical elements

NT: Bromine compounds

Bromine compounds

UF: Organobromine compounds

BT: Bromine

Chemical compounds

RT: Flame retardants

Broadband communication

UF: Broadband networks

Bronchi

USE: Respiratory system



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Bronchoscopy

BT: Medical diagnosis

Brownian motion

UF: Fractional brownian motion

BT: Random processes

RT: Diffusion processes

Browsers

UF: Google Chrome

Web browsers

BT: Computer interfaces

RT: User interfaces

Webassembly

Brushes

BT: Contacts

RT: Rotating machines

Brushless DC motors

UF: Brushless direct current
motors

BT: Brushless motors

DC motors

Brushless direct current motors

USE: Brushless DC motors

Brushless machines

BT: Electric machines

Brushless motors

BT: Motors

RT: Switched reluctance motors

NT: Brushless DC motors

Brute force attacks

UF: Brute-force attacks

BT: Cryptography

Brute-force attacks

USE: Brute force attacks

BSCCO

USE: Bismuth compounds

Buck converters

BT: DC-DC power converters

Buckyballs

USE: Fullerenes

Buckminsterfullerene

USE: Fullerenes

Buckyballs

USE: Fullerenes

Buckytubes

USE: Fullerenes

Buffer layers

BT: Thin films

RT: Diffusion processes

Semiconductor films

Semiconductor growth

Buffer overflows

BT: Computer crashes

Buffer storage

UF: Data storage systems

BT: Data systems

RT: Big Data

In-memory computing

Random access memory

Storage area networks

NT: Triples (Data structure)

Bugs

USE: Computer bugs

Building automation

BT: Automation

Building services

RT: Construction industry

Building information management

UF: BIM

Building information

modelling

BT: Buildings

Modeling

RT: Architecture

Building management

systems

Building services

Design engineering

Facilities management

Project management

Structural engineering

Building information modelling

USE: Building information

management

Building integrated photovoltaics

UF: Building-integrated

photovoltaics

Roof mounted photovoltaics



JULY 2025 IEEE Thesaurus

arrays		Roof mounted solar cell			Construction industry
	BT:	Photovoltaic systems			Elevators
	RT:	Building services			Escalators
		Solar power generation			Industrial power systems
Building management systems					Lighting
					Modular construction
					Prefabricated construction
	BT:	Buildings			Smart cities
management		Management			Space cooling
	RT:	Building information			Vents
			NT:		Building information
			management		
Building materials					Building management
	BT:	Buildings	systems		Building materials
		Materials			Building services
	RT:	Aggregates			Flexible structures
		Construction			Intelligent structures
		Construction industry			Smart buildings
		Prefabricated construction			Smart homes
		Solar panels			
		Structural beams			
	NT:	Asphalt	Built-in self-test		
		Concrete	UF:		BIST
Building services		Floors			Self-testing
		Mortar	BT:		Testing
		Tiles	RT:		Circuit testing
		Windows			Design for testability
			<i>Bulimia</i>		
	BT:	Buildings	USE:		Eating disorders
	RT:	Access control			
management		Air conditioning			
		Building information	<i>Bulimia nervosa</i>		
			USE:		Eating disorders
photovoltaics		Building integrated	Bulk acoustic wave devices		
			BT:		Acoustic devices
		Furnaces	RT:		Film bulk acoustic
		Lighting	resonators		
		Solar panels			
		Space heating	Bulk storage		
		Wiring	BT:		Material storage
	NT:	Building automation	RT:		Containers
		Elevators			
		Facilities management	Bundle adjustment		
			BT:		Three-dimensional displays
	<i>Building-integrated photovoltaics</i>				
photovoltaics	USE:	Building integrated	Buoyancy		
			BT:		Fluid dynamics
			RT:		Fluids
					Physics
Buildings			Buried object detection		
	UF:	Space habitats	UF:		Buried objects
	BT:	Construction			Underground object
	RT:	Air conditioning	detection		
		Architecture			
		Civil engineering			



JULY 2025 IEEE Thesaurus

	Underground objects	Franchising
BT:	Object detection	Industrial relations
RT:	Geophysical measurements	Management
	Ground penetrating radar	Operations research
NT:	Landmine detection	Organizations
<i>Buried objects</i>		
USE:	Buried object detection	Business communication
		BT: Organizational aspects
		RT: Best practices
<i>burn injuries</i>		
USE:	Skin burns	Business continuity
		BT: Management
<i>burn wounds</i>		RT: Security
USE:	Skin burns	System recovery
		Venture capital
Burnishing		
BT:	Surface finishing	
RT:	Machining	Business data processing
		BT: Business
Burst switching		Data processing
BT:	Packet switching	RT: Data governance
NT:	Optical burst switching	Information processing
<i>Bushings</i>		Business intelligence
USE:	Insulators	UF: BI
		BT: Business
Business		Data analysis
BT:	Engineering management	RT: Competitive intelligence
RT:	Bankruptcy	Data mining
	Business process	Strategic planning
integration		
	Business process	<i>Business organisation</i>
management		USE: Organizational aspects
	Commercial law	
	Consortia	<i>Business organization</i>
	Contracts	USE: Organizational aspects
	Digital economy	
	Digital transformation	Business Process Execution Language
	Employment	UF: BPEL
	Enterprise resource	WP-BPEL
planning		Web services business
	Finance	process execution language
	Industrial communication	BT: Computer languages
	Industries	Web services
	International trade	RT: Business process re-
	Leadership	engineering
	Manufacturing	Information processing
	Productivity	
	Service computing	Business process integration
NT:	Agribusiness	BT: Enterprise resource
	Business data processing	planning
	Business intelligence	
	Commerce and trade	RT: Process planning
	Disruptive innovation	Business
	Entrepreneurship	Resource management
		Supply chain management



JULY 2025 IEEE Thesaurus

theory	Systems engineering and	<i>C sharp languages</i>	USE: C# languages
Business process management		C# languages	
BT:	Management	UF:	C sharp languages
	Process planning	BT:	C languages
RT:	Business	RT:	Object oriented
	Resource management	programming	
	Supply chain management	C++ languages	
	Systems engineering and	BT:	C languages
theory		RT:	Webassembly
NT:	Task analysis		
Business process re-engineering		C-band	
UF:	BPR	UF:	C band
BT:	Management	BT:	Microwave bands
RT:	Business Process		
Execution Language		<i>Ca</i>	
	Corporate acquisitions	USE:	Calcium
	Organizational aspects		
	Total quality management	Cable insulation	
<i>Business writing</i>		BT:	Insulation
USE:	Writing	RT:	Cables
			Oil filled cables
		NT:	Power cable insulation
Butler matrices		Cable shielding	
UF:	Butler matrix	BT:	Electromagnetic shielding
BT:	Antenna arrays	RT:	Cables
RT:	Antennas		
	IEEE 802.11 Standard	<i>Cable splicing</i>	
	Phase shifters	USE:	Splicing
	Wireless LAN		
<i>Butler matrix</i>		Cable TV	
USE:	Butler matrices	UF:	Community antenna
<i>Butter</i>		television	
USE:	Dairy products	BT:	TV
		RT:	Broadband communication
Buttocks			Image communication
BT:	Extremities	NT:	Must-carry regulations
<i>BYOD</i>		Cables	
USE:	Bring your own device	BT:	Transmission lines
		RT:	Cable insulation
<i>C band</i>			Cable shielding
USE:	C-band		Conductors
			Fault location
C languages			Winches
BT:	Computer languages		Wiring
RT:	Object oriented	NT:	Coaxial cables
programming			Communication cables
NT:	C# languages		Mechanical cables
	C++ languages		Optical fiber cables
			Power cables
			Underwater cables



JULY 2025 IEEE Thesaurus

Cables (mechanical)

USE: Mechanical cables

BT: Metals
RT: Alloying
NT: Calcium compounds

Cache memory

BT: Memory
RT: In-memory computing
NT: Cache storage

Calcium carbonate

USE: Calcium compounds

Cache storage

BT: Cache memory

Calcium compounds

UF: Calcium carbonate
Calcium phosphate
BT: Calcium

CAD

USE: Design automation

Calcium phosphate

USE: Calcium compounds

Cadaver

UF: Corpse
BT: Pathological processes

Calculators

BT: Computers
RT: Digital arithmetic
NT: Difference engines

CADCAM

BT: Computer aided
manufacturing
Design automation
RT: Computer integrated
manufacturing
Integrated manufacturing
systems

Calculus

BT: Mathematics
NT: Differential equations
Integral equations
Level set

Cadmium

BT: Metals
NT: Cadmium compounds

Calibration

UF: Intercalibration
BT: Measurement techniques
RT: Odometry

Cadmium compounds

BT: Cadmium

Californium

BT: Chemical elements

CAE

USE: Computer aided
engineering

Call admission control

BT: Telecommunication
congestion control
RT: Internet telephony

Caesium

USE: Cesium

Call conference

BT: Collaborative tools

CAI

USE: Computer aided instruction

Callosal commissure

USE: Corpus callosum

Calamities

USE: Disasters

Calorimetry

BT: Measurement
RT: Energy measurement
Thermal variables
measurement

Calcination

BT: Heat treatment
RT: Kilns

CAM

USE: Computer aided
manufacturing

Calcium

UF: Ca



JULY 2025 IEEE Thesaurus

CAMAC

UF: Computer automated
measurement and control
BT: Control systems
RT: Data buses
Data communication
Data processing
Nuclear measurements

Cambelts

USE: Belts

Camcorders

USE: Video equipment

Cameras

BT: Imaging
RT: Digital photography
Image capture
Image sensors
Motion pictures
Photography
Photorealism
NT: Digital cameras
Smart cameras
Webcams

Cams

BT: Machine components
RT: Engines
Mechanical power

transmission

NT: Camshafts

Camshafts

BT: Cams
Shafts
RT: Automotive components
Belts
Engines

CAN

USE: Controller area networks

Canadian Standards Association

USE: CSA Group

Cancellous bone

BT: Bone tissue
RT: Osteoporosis

Cancer

UF: Malignancy
Malignant
BT: Diseases

RT: Biomedical applications of
radiation

Chemotherapy
Medical diagnostic imaging
Oncological surgery
Oncology
Single photon emission
computed tomography

NT:

Tumors
Brain cancer
Breast cancer
Cervical cancer
Colorectal cancer
Leukemia
Liver cancer
Lung cancer
Metastasis
Ovarian cancer
Pancreatic cancer
Prostate cancer
Skin cancer
Thyroid cancer

Cancer detection

BT: Medical tests

Cancer drugs

BT: Drugs

Cancer treatment

BT: Medical treatment
RT: Monoclonal antibodies
Radiation therapy
NT: Cell therapy
Microwave ablation

Canning

BT: Packaging
RT: Containers
Material storage
Materials handling
Materials processing

Cantilever beams

USE: Structural beams

Cap and trade

USE: Emissions trading

Cap-and-trade

USE: Emissions trading

Capability engineering

BT: Systems engineering and
theory



JULY 2025 IEEE Thesaurus

Capability maturity model

BT: Software engineering
RT: Software performance
Software reusability

Capability-based security

BT: Security
RT: Access control

Capacitance

BT: Electric variables
RT: Capacitance measurement
Capacitance-voltage

characteristics

Capacitive transducers
Capacitors
Supercapacitors
Transmission line theory
NT: Parasitic capacitance
Quantum capacitance

Capacitance measurement

BT: Electric variables
measurement
RT: Capacitance
Capacitors
Dielectric measurement
Supercapacitors

Capacitance-voltage characteristics

BT: Electric variables
RT: Capacitance
Voltage

Capacitive sensors

UF: Strain based sensors
Strain sensors
BT: Mechanical sensors

Capacitive transducers

BT: Transducers
RT: Capacitance
Position control
Sensors

Capacitor testing

USE: Capacitors

Capacitors

UF: Capacitor testing
Electric condensers
BT: Dielectric devices
Electronic components
Voltage multipliers
RT: Capacitance

Capacitance measurement

Dielectric constant
Electrets
MOS capacitors
Q-factor
Switched capacitor

networks

NT: Ceramic capacitors
Power capacitors
Varactors

Capacity factor

BT: Power system
measurements
RT: Power generation reliability

Capacity planning

BT: Production planning
RT: Supply chain management
NT: Storage management

Capital cost reduction

USE: Costing

CAPTCHAs

BT: Symbols
RT: Access protocols
Authentication

Car parking

BT: Automobiles
NT: Automated parking

Car plate recognition

USE: License plate recognition

Car pools

USE: Shared transport

Car sharing

USE: Shared transport

Car-sharing

USE: Shared transport

Carbinol

USE: Methanol

CarboFullerene

USE: Fullerenes

Carbon

BT: Chemical elements
RT: Carbon compounds
Low carbon economy



JULY 2025 IEEE Thesaurus

NT:	Organic compounds Carbon cycle Carbon nanotubes Diamond Fullerenes Graphene Graphite	Environmental factors Greenhouse effect
Carbon capture and storage		
BT:	Carbon dioxide	
NT:	Carbon sequestration	
Carbon compounds		
BT:	Organic compounds	
RT:	Carbon	
NT:	Carbon dioxide Carbon emissions Carbon monoxide	
Carbon cycle		
BT:	Carbon	
RT:	Biosphere	
Carbon dioxide		
BT:	Carbon compounds	
RT:	Carbon footprint Carbon tax GOSAT Greenhouse gases Net zero	
NT:	Carbon capture and storage Carbon neutral	
Carbon emissions		
BT:	Carbon compounds Gases	
RT:	Air pollution control Climate change Emissions trading Global warming Green communications Green hydrogen Greenhouse effect Methane Pollution control	
NT:	Carbon footprint Carbon neutral	
Carbon footprint		
BT:	Carbon emissions	
RT:	Air pollution Carbon dioxide Carbon neutral Climate change	
Carbon monoxide		
BT:	Carbon compounds	
<i>Carbon nanotube</i>		
USE:	Carbon nanotubes	
<i>Carbon nanotube FETs</i>		
USE:	CNTFETs	
<i>Carbon nanotube field effect transistors</i>		
USE:	CNTFETs	
<i>Carbon nanotube field-effect transistors</i>		
USE:	CNTFETs	
Carbon nanotubes		
UF:	Carbon nanotube Carbon-nanotube Single-wall carbon nanotubes	
BT:	Carbon Nanotubes	
RT:	CNTFETs	
Carbon neutral		
UF:	Carbon neutralization	
BT:	Carbon dioxide Carbon emissions	
RT:	Carbon footprint Climate change Electrification	
<i>Carbon neutralization</i>		
USE:	Carbon neutral	
Carbon sequestration		
BT:	Carbon capture and storage	
RT:	Air pollution Environmental factors Global warming Greenhouse effect	
Carbon tax		
BT:	Environmental economics	
RT:	Carbon dioxide	
<i>Carbon trading</i>		
USE:	Emissions trading	
<i>Carbon-nanotube</i>		
USE:	Carbon nanotubes	



JULY 2025 IEEE Thesaurus

Carbon-nanotube FETs

USE: CNTFETs

Carbon-nanotube field effect transistors

USE: CNTFETs

Carbon-nanotube field-effect transistors

USE: CNTFETs

Cardiac arrest

UF: Cardiopulmonary arrest
Heart arrest
Heart attack

BT: Cardiovascular diseases
RT: Cardiopulmonary

resuscitation

Cardiac cath

USE: Cardiac catheterization

Cardiac catheterization

UF: Cardiac cath
Heart cath

BT: Medical diagnosis
RT: Heart

Cardiac disease

BT: Cardiovascular diseases

Cardiac function

BT: Heart

Cardiac tissue

BT: Biological tissues
Cardiology

Cardiac transplants

USE: Heart transplantation

Cardiography

BT: Biomedical imaging
RT: Cardiology
Sputter etching
NT: Echocardiography
Electrocardiography
Phonocardiography

Cardiology

BT: Medical specialties
RT: Arrhythmia
Cardiography
Defibrillation
Heart
Pacemakers
Phonocardiography

NT: Cardiac tissue
Cardiopulmonary

resuscitation

Cardiopulmonary arrest

USE: Cardiac arrest

Cardiopulmonary resuscitation

UF: CPR
BT: Cardiology
RT: Cardiac arrest

Cardiovascular diseases

UF: Heart failure
BT: Diseases
NT: Cardiac arrest
Cardiac disease

Cardiovascular system

BT: Anatomy
NT: Baroreflex
Blood vessels
Heart

Career development

BT: Education
NT: Continuing education
Jobs listings
Mentoring

Careers

USE: Engineering profession

Cargo handling

USE: Freight handling

Carotid arteries

UF: Carotoid arteries
BT: Arteries

Carotoid arteries

USE: Carotid arteries

Carpal tunnel syndrome

BT: Medical conditions
RT: Wrist

Carpools

USE: Shared transport

Carrier confinement

BT: Charge carrier processes

Carrier density

USE: Charge carrier density



JULY 2025 IEEE Thesaurus

Carrier lifetime

USE: Charge carrier lifetime

Carrier processes

USE: Charge carrier processes

Carrier sense multiaccess

USE: Multiaccess communication

Cars

USE: Automobiles

Cartilage

BT: Musculoskeletal system

Cartography

BT: Geography

RT: Geographic information

systems

Cascade lasers

USE: Quantum cascade lasers

Cascading style sheets

BT: Style sheet languages

RT: Markup languages

Casimir effect

UF: Casimir energy

Casimir force

BT: Electric fields

Nanotechnology

RT: Atomic force microscopy

Elementary particle vacuum

Vacuum systems

Casimir energy

USE: Casimir effect

Casimir force

USE: Casimir effect

Cast iron

BT: Iron

RT: Casting

Production materials

Castellations

USE: Flip chip solder joints

Casting

BT: Materials processing

RT: Cast iron

Foundries

NT: Die casting

Tape casting

Catalysis

BT: Chemical reactions

RT: Hydrolysis

NT: Electrocatalysis

Photocatalysis

Catalysts

BT: Materials

NT: Electrocatalysts

Photocatalysts

Catalytic converters

USE: Exhaust systems

Catalytic convertors

USE: Exhaust systems

Cataracts

BT: Eyes

Medical conditions

RT: Aging

Visual impairment

Catheterization

BT: Medical services

RT: Catheters

Catheters

BT: Biomedical equipment

RT: Catheterization

Surgery

Cathode ray tubes

UF: CRT

BT: Displays

Electron devices

RT: Flyback transformers

Cathode-ray oscilloscopes

USE: Oscilloscopes

Cathodes

BT: Electrodes

RT: Electron emission

Electron tubes

NT: Photocathodes

Cats

UF: Felines

BT: Animals

Cattle

USE: Cows



JULY 2025 IEEE Thesaurus

Causality

USE: Cause effect analysis

Cause effect analysis

UF: Causality
Fishbone diagrams
Ishikawa diagrams
BT: Process planning
RT: Expert systems
Failure analysis
Fault diagnosis
Pareto analysis
Testing

Cavity perturbation methods

BT: Perturbation methods
RT: Cavity resonators

Cavity resonators

BT: Resonators
RT: Cavity perturbation

methods

Klystrons
Microcavities
Resonance
NT: Laser cavity resonators

CCD

USE: Charge coupled devices

CCD image sensors

BT: Image sensors
RT: Digital photography

CD recording

UF: Compact disk
BT: Optical recording
RT: Laser applications
NT: CD-ROMs

CD-ROM

USE: CD-ROMs

CD-ROMs

UF: CD-ROM
BT: CD recording
RT: Electronic publishing
Information systems

CDMA

USE: Multiaccess communication

Cell biology

USE: Biological cells

Cell biophysics

USE: Cellular biophysics

Cell clones

USE: Cloning

Cell motility

UF: Cellular motility
BT: Biological processes
RT: Biochemistry
Biomechanics

Cell phones

USE: Cellular phones

Cell signaling

UF: Cell signaling
BT: Biological cells
RT: Biochemistry
Biomechanics
Mechanobiology

Cell therapy

UF: Cell transplantation
Cellular therapy
Cytotherapy
BT: Cancer treatment
RT: Oncology

Cell transplantation

USE: Cell therapy

Cells (biology)

BT: Biological cells
NT: Cytometry
Extracellular
Ganglia
Glial cells
Membrane potentials
Mitochondria
Organoids
Progenitor cells
Vesicles

Cellular biophysics

UF: Cell biophysics
BT: Biophysics
RT: Molecular biophysics
Nanomedicine

Cellular land mobile radio

USE: Cellular radio

Cellular manufacturing

BT: Manufacturing systems



JULY 2025 IEEE Thesaurus

systems RT: Flexible manufacturing
Production control

Cellular motility

USE: Cell motility

Cellular networks

BT: Cellular radio
RT: Cellular technology
Cloud radio access

networks

communication

Device-to-device

Handover
Sidelink

NT: Femtocell networks
Macrocell networks
Microcell networks
Ultra-dense networks

Cellular neural networks

BT: Neural networks

Cellular phones

UF: Cell phones
BT: Telephone equipment

Cellular radio

UF: Cellular land mobile radio
Land mobile radio cellular

systems

systems

BT: Land mobile radio
RT: 3G mobile communication
4G mobile communication
5G mobile communication
6G mobile communication
Bluetooth
Channel estimation
Code division multiplexing
Cross layer design
Digital multimedia

broadcasting

Downlink
Film bulk acoustic

resonators

Inter-cell interference
Location awareness
Multiuser detection
NOMA
Network resource

management

networks Personal communication
Software radio
Time division synchronous
code division multiple access
NT: Cellular networks
Paging systems

Cellular technology

BT: Mobile communication
Radio communication
RT: Cellular networks
NT: 3G mobile communication
4G mobile communication
5G mobile communication
GSM
Land mobile radio networks
Multiaccess communication

Cellular therapy

USE: Cell therapy

Cellulose

BT: Polymers
RT: Biodegradable materials
Paper pulp
Polymer fibers

Cement industry

BT: Manufacturing industries

Censorship

BT: Law
RT: Consumer protection
Government policies
Law enforcement
Legal factors

Central air conditioning

UF: Central air-conditioning
BT: Air conditioning

Central air-conditioning

USE: Central air conditioning

Central heating

USE: District heating

Central nervous system

BT: Nervous system
RT: Hypothalamus
NT: Grey matter
Midbrain
White matter



JULY 2025 IEEE Thesaurus

Central office

BT: Communication networks

Glass products
Glazes
High-temperature

Central Processing Unit

UF: CPU
BT: Electronic circuits
RT: Hardware acceleration
NT: VLIW

superconductors

Magnesium oxide
Powders
Tape casting
Tiles
NT: Bioceramics
Porcelain

Centralized control

UF: Integrated control
BT: Control systems

Ceramics industry

BT: Manufacturing industries
RT: Bioceramics
Ceramics
Porcelain

Cepstral analysis

BT: Acoustics
RT: Music information retrieval
Speech analysis
Speech recognition
NT: Cepstrum
Mel frequency cepstral

coefficient

Cerebellum

BT: Brain

Cerebral cortex

BT: Brain

Cepstrum

BT: Cepstral analysis
RT: Fourier transforms

Cerebral palsy

BT: Medical conditions
RT: Brain injuries
Spasticity

Ceramic capacitors

BT: Capacitors
Ceramic products

Cerebrospinal fluid

BT: Fluids and secretions
Spinal cord
RT: Brain

Ceramic glazes

BT: Glazes

Ceramic products

BT: Manufactured products
RT: Ceramics
Glass products
Insulators
Porcelain
Tiles
NT: Ceramic capacitors

Cerebrum

BT: Brain

Cerenkov lasers

USE: Free electron lasers

Cerium

BT: Chemical elements

Ceramics

UF: Glass ceramics
BT: Insulation
Materials
RT: Aluminum oxide
Ceramic products
Ceramics industry
Cermets
Dielectric materials
Diffusion bonding
Electrets
Firing
Glass

Cermet

BT: Composite materials
RT: Ceramics
Metallic materials

Certification

BT: Training
RT: Conformance testing

Cervical cancer

BT: Cancer
RT: Cervix



JULY 2025 IEEE Thesaurus

Cervix	BT: Uterus RT: Cervical cancer	BT: Communication channels RT: Cellular radio Equalizers Land mobile radio Multipath channels Signal detection Spread spectrum
Cesium	UF: Caesium BT: Chemical elements	communication
<i>CFC</i>	USE: Chlorofluorocarbons	Channel hot electron injection
<i>CFD</i>	USE: Computational fluid dynamics	UF: Channel hot-electron injection BT: Hot carrier injection
<i>CGM</i>	USE: Computer generated music	<i>Channel hot-electron injection</i> USE: Channel hot electron injection
<i>Chain codes</i>	USE: Blockchains	Channel impulse response UF: CIR BT: Channel state information RT: Frequency response Impulse testing
Chalcogenides	BT: Chemical compounds	Channel models BT: Communication channels
Change detection algorithms	BT: Algorithms	Channel rate control BT: Rate distortion theory
Channel allocation	UF: Bandwidth allocation BT: Communication channels NT: Spectral efficiency	Channel spacing BT: Communication channels RT: Optical fiber applications Rate distortion theory
Channel bank filters	BT: Filters	<i>Channel state estimation</i> USE: Channel estimation
Channel capacity	BT: Communication channels RT: Quantum communication	Channel state information BT: Communication channels NT: Channel impulse response
Channel coding	BT: Encoding Information theory RT: Communication channels Convolutional codes Polar codes Rate distortion theory Space-time codes NT: Block codes Combined source-channel coding Turbo codes	<i>Channel-state estimation</i> USE: Channel estimation
Channel estimation	UF: Channel state estimation Channel-state estimation	Chaos BT: Nonlinear systems RT: Bifurcation Econophysics Fractals Nonlinear circuits Nonlinear dynamical systems Pattern formation Predator prey systems



JULY 2025 IEEE Thesaurus

NT: Random media
Chaotic communication
Complexity theory
Spatiotemporal phenomena

Electron mobility
Electron traps
Excitons
Space charge

Chaotic communication

BT: Chaos
RT: Cryptography
Synchronization
Time series analysis

Chaotic mapping

BT: Cryptography
RT: Encryption
Nonlinear equations
Random sequences

Character generation

BT: Graphics
RT: Computer graphics
Displays
Printing

Character recognition

UF: Print readers
BT: Pattern recognition
RT: License plate recognition
Text recognition

Characteristic mode analysis

BT: Electromagnetic analysis

Charge carrier density

UF: Carrier density
BT: Charge carriers

Charge carrier lifetime

UF: Carrier lifetime
BT: Charge carriers

Charge carrier mobility

BT: Charge carriers

Charge carrier processes

UF: Carrier processes
Charge carrier trapping
Electron carriers
Hole carriers
Semiconductor charge

carriers

BT: Charge carriers
RT: Diffusion processes
Semiconductor impurities
NT: Carrier confinement
Charge transfer

Charge carrier trapping

USE: Charge carrier processes

Charge carriers

BT: Elementary particles
RT: Conductivity
Impact ionization
Semiconductivity
Semiconductor materials
NT: Charge carrier density
Charge carrier lifetime
Charge carrier mobility
Charge carrier processes
Hot carriers

Charge coupled devices

UF: CCD
Charge injection devices
Charge transfer devices
Charge-injection devices
Charge-transfer devices
BT: MIS devices

Charge injection devices

USE: Charge coupled devices

Charge measurement

BT: Electrostatic measurements
RT: Pulsed electroacoustic
methods
NT: Battery charge
measurement

Charge pumps

UF: Charge-pumping
BT: Circuits
RT: Voltage multipliers

Charge transfer

BT: Charge carrier processes

Charge transfer devices

USE: Charge coupled devices

Charge-coupled image sensors

BT: Image sensors
Optoelectronic devices

Charge-injection devices

USE: Charge coupled devices



JULY 2025 IEEE Thesaurus

Charge-pumping

USE: Charge pumps

Charge-transfer devices

USE: Charge coupled devices

Charged device model

USE: Electrostatic discharges

Charging devices

USE: Battery chargers

Charging stations

BT: Power supplies
RT: Battery chargers
Battery powered vehicles
Electric vehicles
Hybrid electric vehicles
Plug-in hybrid electric

vehicles

NT: Docking stations
Fast charging

Chatbots

UF: Bot
ChatGPT
BT: Conversational artificial

intelligence

Human computer

interaction

Natural language

processing

RT: Speech synthesis
Auditory system
Digital humans
Foundation models
Generative Pre-trainer

transformer

Human factors
Prompt engineering
Question answering

(information retrieval)

Question generation

ChatGPT

USE: Chatbots

CHCP

USE: Trigeration

Chebyshev approximation

BT: Approximation methods
RT: Discrete cosine transforms

Checkpointing

BT: System recovery

Cheese

USE: Dairy products

Chemical analysis

BT: Chemistry
Materials science and

technology

RT: Chemical technology
Drugs
Fractionation
Activation analysis
Chemical processes
Chemicals
Electronic noses
pH measurement

Chemical and biological sensors

BT: Sensors
NT: Biosensors
Gas detectors

Chemical compounds

BT: Chemistry
NT: Anti-freeze
Bromine compounds
Chalcogenides
Chlorophyll
Ethanol
Methanol
Radiotracer

Chemical elements

BT: Materials, elements, and
compounds

NT: Aluminum
Americium
Antimony
Arsenic
Beryllium
Boron
Bromine
Californium
Carbon
Cerium
Cesium
Chlorine
Dysprosium
Europium
Fluorine
Gadolinium
Hafnium
Helium



JULY 2025 IEEE Thesaurus

Holmium	RT:	Biohazards
Hydrogen		Contamination
Iodine		Explosions
Iridium		Hazardous materials
Isotopes		Toxicology
Krypton	NT:	Chemical weapons
Lutetium		Toxic chemicals
Mercury (metals)		
Molybdenum		
Neon		
Neptunium		
Nitrogen		
Osmium		
Oxygen		
Phosphorus		
Plutonium		
Polonium		
Potassium		
Praseodymium		
Promethium		
Protactinium		
Radium		
Radon		
Rhenium		
Rhodium		
Roentgenium		
Rubidium		
Ruthenium		
Scandium		
Selenium		
Sodium		
Sulfur		
Tantalum		
Technetium		
Tellurium		
Terbium		
Thallium		
Thorium		
Thulium		
Titanium		
Uranium		
Vanadium		
Ytterbium		
Yttrium		
Zirconium		

Chemical industry

BT:	Industries
RT:	Chemical engineering
	Chemical reactions
	Chemical technology
	Electrochemical processes
	Pesticides
	Petrochemicals
	Petroleum industry
	Pipelines
	Plastic products
	Plastics industry
	Rubber industry

Chemical lasers

BT:	Lasers
RT:	Gas lasers

Chemical mechanical planarisation

USE:	Planarization
------	---------------

Chemical mechanical planarization

USE:	Planarization
------	---------------

Chemical processes

BT:	Chemical analysis
NT:	Acidification
	Fermentation
	Hydrophobicity
	Leaching
	Molecular sieves
	Osmosis
	Oxidation
	Reverse osmosis
	Solvents
	Thermolysis
	Water splitting

Chemical engineering

BT:	Engineering - general
RT:	Chemical industry
	Chemical products
	Chemical technology
	Process design

Chemical hazards

BT:	Hazards
-----	---------

Chemical products

BT:	Manufactured products
RT:	Chemical engineering
	Chemistry
	Glass products
	Pesticides
	Plastic products
	Production materials
NT:	Agrochemicals



JULY 2025 IEEE Thesaurus

Antioxidants

Fats

Inhibitors

Lacquers

Mortar

Paints

Petrochemicals

Petroleum

Pharmaceuticals

Phthalates

Plastics

Propellants

Chemical reaction network theory

BT: Mathematics

RT: Biochemistry

Chemical reactions

Chemical reactions

UF: CSTR

BT: Chemical technology

RT: Chemical industry

Chemical reaction network

theory

Crystallizers

Process control

Water splitting

NT: Bioreactors

Catalysis

Chemical reduction

Chemiluminescence

Continuous-stirred tank

reactor

Hydrolysis

Ignition

Solvation

Chemical reduction

BT: Chemical reactions

NT: Redox

Chemical sensors

BT: Chemical technology

RT: Detectors

Chemical technology

BT: Industry applications

RT: Chemical analysis

Chemical engineering

Chemical industry

Chemistry

Decontamination

Refining

NT: Chemical reactions

Chemical sensors

Crystallizers

Distillation equipment

Fluidization

Pharmaceutical technology

Vitrification

Chemical transducers

BT: Transducers

RT: Gas detectors

Chemical vapor deposition

UF: CVD

Chemical vapour deposition

BT: Plasma materials

processing

RT: Coatings

Epitaxial layers

Films

NT: Atmospheric pressure

chemical vapor deposition

Atomic layer deposition

MOCVD

Pulsed laser deposition

Chemical vapour deposition

USE: Chemical vapor deposition

Chemical warfare

USE: Chemical weapons

Chemical weapons

UF: Chemical warfare

BT: Chemical hazards

Weapons

RT: Biological weapons

National security

Nuclear weapons

Terrorism

US Department of

Homeland Security

Weapons of mass

destruction

Chemicals

BT: Chemical analysis

RT: Plastics

Chemiluminescence

UF: Chemoluminescence

BT: Chemical reactions

Luminescence

RT: Electroluminescence

Photoluminescence

Thermoluminescence

NT: Bioluminescence



JULY 2025 IEEE Thesaurus

Chemistry

BT: Science - general
 RT: Chemical products
 Chemical technology
 Drugs
 Petrochemicals
 Pharmaceutical technology
 Pharmaceuticals
 Pickling
 Plastic products
 NT: Astrochemistry
 Biochemistry
 Biogeochemistry
 Chemical analysis
 Chemical compounds
 Computational chemistry
 Electrochemistry
 Geochemistry
 Inorganic chemicals
 Interstellar chemistry
 Organic chemicals
 Photochemistry
 Physical chemistry
 Quantum chemistry

Chemoluminescence

USE: Chemiluminescence

Chemotherapy

BT: Medical treatment
 RT: Cancer
 Drugs
 Medical services
 Oncology
 Patient monitoring

Chest medicine

USE: Pulmonology

Child

USE: Pediatrics

Children

USE: Pediatrics

Chip design

USE: Chip scale packaging

Chip development

USE: Chip scale packaging

Chip fabrication

USE: Chip scale packaging

Chip scale packaging

UF: CSP
 Chip design
 Chip development
 Chip fabrication
 Chip-making process
 BT: Electronics packaging
 RT: Integrated circuit packaging
 NT: System-in-package

Chip-making process

USE: Chip scale packaging

Chipless RFID

BT: RFID tags

Chipselets

BT: Integrated circuits

Chirp

BT: Signal processing

Chirp modulation

UF: Linear frequency
 modulation

BT: Modulation
 RT: Sonar
 Spread spectrum

communication

Spread spectrum radar

Chlorine

BT: Chemical elements
 NT: Chlorine compounds

Chlorine compounds

UF: Chlorine dioxide
 Chloroform
 Hydrogen chloride
 Sodium chloride
 BT: Chlorine
 NT: Salt

Chlorine dioxide

USE: Chlorine compounds

Chlorofluorocarbons

UF: CFC
 BT: Fluorine compounds
 RT: Greenhouse gases

Chloroform

USE: Chlorine compounds



JULY 2025 IEEE Thesaurus

Chlorophyll

BT: Chemical compounds
Plants (biology)
RT: Photosynthesis

Chokes

USE: Inductors

Cholera

BT: Diseases

Choppers (circuits)

BT: Switching circuits
RT: Power conversion

CHP

USE: Cogeneration

Chromatic dispersion

BT: Dispersion

Chrome plating

BT: Plating
RT: Coatings

Chromium

UF: Cr
BT: Metals
NT: Chromium alloys

Chromium alloys

BT: Chromium

Chromosome mapping

BT: Biological cells

Chromosomes

USE: Biological cells

Chronic kidney disease

UF: CKD
BT: Kidney
Medical conditions

Chronic obstructive pulmonary disease

UF: COPD
BT: Pulmonary diseases
RT: Asthma
Emphysema
Pneumonia

Chronobiology

UF: Biological clocks
BT: Biological processes
RT: Phenology

Churn

BT: Customer satisfaction

CIM

USE: Common Information Model
(computing) AND
Common Information Model
(electricity) AND
Computer integrated
manufacturing AND
In-memory computing

Cinema

USE: Motion pictures

Cinematography

BT: Photography
RT: Motion pictures
Object tracking

Ciphers

UF: Cryptograph
Cyphers
BT: Cryptography
RT: Algorithms
Codes
Encryption
S Box

CIR

USE: Channel impulse response

Circadian rhythm

UF: Circadian rhythms
BT: Biological processes

Circadian rhythms

USE: Circadian rhythm

Circuit analysis

BT: Circuits
RT: Frequency-domain analysis
SPICE
Sensitivity
Tolerance analysis
Yield estimation
NT: Circuit analysis computing
Coupled mode analysis
Nonlinear network analysis

Circuit analysis computing

BT: Circuit analysis

Circuit boards

USE: Printed circuits



JULY 2025 IEEE Thesaurus

Circuit breakers

BT: Switchgear
RT: Interrupters
Power system protection
Protection
Switching circuits
NT: Molded case circuit

breakers

Circuit CAD

USE: Design automation

Circuit complexity

USE: Complexity theory

Circuit design

USE: Circuit synthesis

Circuit design (CAD)

USE: Design automation

Circuit design (logic)

USE: Logic design

Circuit faults

BT: Circuits
NT: Electrical fault detection

Circuit feedback

USE: Feedback circuits

Circuit layout CAD

USE: Design automation

Circuit noise

BT: Circuits
RT: Transmission lines
NT: Thermal noise

Circuit optimisation

USE: Circuit optimization

Circuit optimization

UF: Circuit optimisation
Circuit performance
Circuit tuning
BT: Optimization methods
RT: Tolerance analysis

Circuit performance

USE: Circuit optimization

Circuit reliability

BT: Circuits

Circuit simulation

BT: Circuits
RT: Design automation
Semiconductor process

modeling

Circuit stability

BT: Stability
RT: Grounding
Jitter

Circuit subsystems

BT: Solid state circuits
RT: Circuits and systems

Circuit synthesis

UF: Circuit design
BT: Circuits
RT: Control system synthesis
Logic design
Solid state circuit design
NT: High level synthesis
Integrated circuit synthesis
Register transfer level

Circuit testing

BT: Testing
RT: Built-in self-test
NT: Integrated circuit

measurements

Circuit theory

BT: Solid state circuits
NT: Inductive coupling

Circuit tolerance analysis

USE: Tolerance analysis

Circuit topology

BT: Digital circuits
RT: Graph theory
Tree graphs
NT: Current mirrors

Circuit tuning

USE: Circuit optimization

Circuits

BT: Circuits and systems
RT: Flow graphs
Impedance matching
Oscillators
Phase transformers
Poles and zeros
Scattering parameters



[illegible]

JULY 2025 IEEE Thesaurus

Circular polarization

USE: Polarization

Circular waveguides

BT: Electromagnetic waveguides

Circulators

BT: Ferrite devices
Microwave technology
RT: Electromagnetic coupling
Waveguide components

Circulatory system

UF: Vascular system
BT: Anatomy

Citation analysis

UF: Citation identification
Citation studies
BT: Bibliometrics

Citation identification

USE: Citation analysis

Citation studies

USE: Citation analysis

Cities and towns

USE: Urban areas

City

USE: Urban areas

City planning

USE: Urban planning

Civil engineering

BT: Engineering - general
RT: Bridges
Buildings
Construction
Energy resources
Environmental factors
Power systems
Road transportation
Roads
Transmission lines
NT: Geotechnical engineering
Geotechnical structures
Railway engineering
Structural engineering

CKD

USE: Chronic kidney disease

Cladding techniques

BT: Coating techniques
RT: Claddings

Claddings

BT: Coatings
Optical fiber cables
RT: Cladding techniques
NT: Laser cladding

Cladistics

USE: Phylogeny

Clamping

USE: Clamps

Clamps

UF: Clamping
BT: Production equipment
RT: Machine tools
Machining

Classification algorithms

BT: Algorithms
NT: Multi label classification
Relevance vector machines

Classification tree analysis

BT: Decision trees
RT: Formal concept analysis

Clean energy

USE: Green energy AND
Renewable energy sources

Cleaning

BT: Materials handling
RT: Air cleaners
Refining
NT: Purification
Surface cleaning

Client server model

USE: Client-server systems

Client server systems

USE: Client-server systems

Client-server model

USE: Client-server systems

Client-server systems

UF: Client server model
Client server systems
Client-server model



JULY 2025 IEEE Thesaurus

	Clientserver systems	Climatology	
BT:	Distributed computing	UF:	Climate science
	Software architecture	BT:	Atmospheric science
RT:	Dew computing	RT:	Meteorology
	Unified modeling language		
NT:	Middleware	Climbing robots	
	Servers	BT:	Mobile robots
<i>Clientserver systems</i>		<i>Clinical analysis</i>	
USE:	Client-server systems	USE:	Clinical diagnosis AND Clinical trials
<i>Climate</i>		Clinical diagnosis	
USE:	Meteorology	UF:	Clinical analysis Clinical engineering Clinical information
Climate change		BT:	Medical services
UF:	Climate fluctuations Climate mitigation Climate warming Climatic change	RT:	Point of care
BT:	Environmental factors	NT:	Clinical neuroscience
RT:	Carbon emissions Carbon footprint Carbon neutral Climate variability Emissions trading Phenology	<i>Clinical engineering</i>	
NT:	Global warming	USE:	Clinical diagnosis
<i>Climate fluctuations</i>		<i>Clinical equipment</i>	
USE:	Climate change	USE:	Biomedical equipment
<i>Climate mitigation</i>		<i>Clinical information</i>	
USE:	Climate change	USE:	Clinical diagnosis
<i>Climate science</i>		Clinical neuroscience	
USE:	Climatology	BT:	Clinical diagnosis Neuroscience
Climate variability		Clinical trials	
UF:	Climate variations	UF:	Clinical analysis
BT:	Meteorology	BT:	Medical treatment
RT:	Climate change Weather modification	<i>Clock synchronization</i>	
NT:	El Nino El Nino-Southern	USE:	Synchronization
Oscillation		Clocks	
<i>Climate variations</i>		BT:	Time measurement
USE:	Climate variability	RT:	Timing
<i>Climate warming</i>		NT:	Atomic clocks Watches
USE:	Climate change	<i>Clone</i>	
<i>Climatic change</i>		USE:	Cloning
USE:	Climate change	<i>Clones</i>	
		USE:	Cloning
		Cloning	
		UF:	Cell clones Clone



JULY 2025 IEEE Thesaurus

	Clones	NT:	Footwear
	Human cloning		Protective clothing
	Molecular clones		
	Reproductive cloning	Clothing industry	
BT:	Biomedical engineering	UF:	Fashion industry
RT:	DNA		Garment industry
	Stem cells	BT:	Manufacturing industries
		RT:	Clothing
Closed box			Footwear
UF:	Blackbox		Footwear industry
	Closed-box		Protective clothing
BT:	Software		Textile industry
	System analysis and design		
RT:	Software testing	<i>Clotting</i>	
	System testing	USE:	Coagulation
Closed captioning		Cloud computing	
UF:	Vision captioning	BT:	Internet
	Visual captioning	RT:	Big Data applications
BT:	Assistive technologies		Dew computing
	Communication aids		Distributed computing
RT:	Media		Edge computing
	TV		Grid computing
<i>Closed form solution</i>			Internet of Things
USE:	Closed-form solutions		Network function
Closed loop systems		virtualization	
UF:	Closed-loop systems		Service computing
BT:	Control systems		Software as a service
RT:	H infinity control	networking	Software defined
<i>Closed-box</i>			Virtual power plants
USE:	Closed box	NT:	Web services
<i>Closed-form expression</i>			Cloud computing security
USE:	Closed-form solutions		Cloud gaming
Closed-form solutions			Cloud robotics
UF:	Closed form solution		Elastic computing
	Closed-form expression		Platform as a service
BT:	Mathematics		Serverless computing
<i>Closed-loop systems</i>		Cloud computing security	
USE:	Closed loop systems	UF:	Cloud security
<i>Cloth face masks</i>		BT:	Cloud computing
USE:	Face masks		Computer security
Clothing		Cloud gaming	
UF:	Garments	UF:	Gaming on demand
BT:	Consumer products	BT:	Cloud computing
RT:	Clothing industry		Games
	Fabrics	RT:	Online services
	Wool	Cloud radio access networks	
		BT:	Network function
		virtualization	
			Radio access networks
		RT:	Cellular networks



JULY 2025 IEEE Thesaurus

Cloud robotics

UF: Cloud robots
BT: Cloud computing
Robotics and automation

Cloud robots

USE: Cloud robotics

Cloud security

USE: Cloud computing security

Cloud-dew architecture

USE: Dew computing

Cloud-dew computing

USE: Dew computing

Clouds

BT: Terrestrial atmosphere

Cluster computing

UF: Apache hadoop
Apache spark
Network of workstations
Workstation clusters
BT: Distributed computing
RT: Distributed processing
Message systems
Parallel processing
Peer-to-peer computing
Resource management
Workstations

Clustered regularly interspaced short palindromic repeats

USE: CRISPR

Clustering algorithms

BT: Algorithms
NT: Affinity propagation

Clustering methods

BT: Pattern recognition
RT: Extreme learning machines
Fish schools
NT: Pattern clustering

Clutter

BT: Interference
RT: Echo interference

CMM

USE: Coordinate measuring machines

CMOS analog integrated circuits

UF: Analog CMOS integrated circuits
Analogue CMOS integrated circuits
CMOS analogue integrated circuits
BT: Analog integrated circuits
CMOS integrated circuits

CMOS analogue integrated circuits

USE: CMOS analog integrated circuits

CMOS digital integrated circuits

BT: CMOS integrated circuits
NT: CMOS logic circuits

CMOS image sensors

BT: Image sensors

CMOS integrated circuits

BT: Integrated circuits
RT: CMOSFETs
Neuromorphic engineering
NT: CMOS analog integrated circuits
CMOS digital integrated circuits
CMOS logic circuits
CMOS memory circuits
Transconductors

CMOS logic circuits

BT: CMOS digital integrated circuits
CMOS integrated circuits
RT: Application specific integrated circuits
Power dissipation

CMOS memory circuits

UF: CMOS memory integrated circuits
BT: CMOS integrated circuits
RT: Memory
SRAM chips

CMOS memory integrated circuits

USE: CMOS memory circuits

CMOS process

BT: CMOS technology



JULY 2025 IEEE Thesaurus

CMOS technology

BT: Integrated circuit
technology
RT: MOSFET
Microcontrollers
Microprocessors
Transistors
NT: CMOS process
Silicon on sapphire

CMOSFET circuits

BT: MOSFET circuits
RT: Rail to rail operation

CMOSFET logic devices

BT: CMOSFETs
RT: MISFETs
MOSFET
P-i-n diodes

CMOSFETs

BT: MOSFET
RT: CMOS integrated circuits
Semiconductor-insulator
interfaces
NT: CMOSFET logic devices

CNC

USE: Computer numerical control

CNFETs

USE: CNTFETs

CNN

USE: Convolutional neural
networks

CNTFETs

UF: CNFETs
Carbon nanotube FETs
Carbon nanotube field
effect transistors
Carbon nanotube field-
effect transistors
Carbon-nanotube FETs
Carbon-nanotube field
effect transistors
Carbon-nanotube field-
effect transistors
BT: Field effect transistors
RT: Carbon nanotubes
Quantum capacitance

Co-channel interference

USE: Interchannel interference

Coagulate

USE: Coagulation

Coagulation

UF: Blood clots
Clotting
Coagulate
BT: Biological processes
Blood
RT: Blood platelets
Hematology

Coal

BT: Fuels
RT: Coal gas
Coal mining

Coal ash

USE: Fly ash

Coal gas

UF: Coal gasification
Illumination gas
Town gas
BT: Gases
RT: Coal
Fuels

Coal gasification

USE: Coal gas

Coal industry

BT: Industries
RT: Coal mining

Coal mining

BT: Mining industry
RT: Coal
Coal industry

Coal tar

USE: Fuel processing industries

Coastlines

BT: Water

Coating techniques

BT: Coatings
NT: Cladding techniques

Coatings

BT: Materials processing
RT: Chemical vapor deposition
Chrome plating
Corrosion



JULY 2025 IEEE Thesaurus

		Films			Code division multiplexing	
		Magnetic multilayers			UF:	Code division multiplexed
		Painting				OCDM
		Spraying				Optical code division
		Sputtering			multiplexing	
		Vapor deposition			BT:	Communication switching
	NT:	Antireflection coatings				Multiplexing
		Claddings			RT:	Cellular radio
		Coating techniques				Codes
		Dip coating				Multicarrier code division
		Epitaxial layers			multiple access	
		Glazes				Optical fiber applications
		Lacquers				Software radio
		Paints				Spread spectrum
		Powders			communication	
Coaxial cables					Code refracting	
	BT:	Cables			UF:	Refracting
	RT:	Electromagnetic			BT:	Encoding
waveguides					RT:	Information theory
		Transmission lines				Software engineering
	NT:	Coaxial components				
		Hybrid fiber coaxial cables			<i>Code-division multiple access</i>	
					USE:	Multiaccess communication
Coaxial components					<i>Code-division multiple-access</i>	
	BT:	Coaxial cables			USE:	Multiaccess communication
Cobalt					Codecs	
	BT:	Metals			UF:	Coder-decoders
	RT:	Alloying			BT:	Communication equipment
		Magnets			RT:	Decoding
	NT:	Cobalt alloys				Encoding
Cobalt alloys					NT:	Speech codecs
	BT:	Cobalt				Video codecs
	RT:	Alloying				
<i>Cobots</i>					<i>Coder-decoders</i>	
	USE:	Collaborative robots			USE:	Codecs
<i>Cochannel interference</i>					Codes	
	USE:	Interchannel interference			UF:	Parity check
Cochlear implants					BT:	Information theory
	BT:	Implants			RT:	Ciphers
	RT:	Ear				Code division multiplexing
<i>Code division multiaccess</i>						Cryptography
	USE:	Multiaccess communication				Decoding
<i>Code division multiple access</i>						Encoding
	USE:	Multiaccess communication				Error correction
<i>Code division multiplexed</i>						Redundancy
	USE:	Code division multiplexing				Sequences
						Vector quantization
					NT:	Binary codes
						Convolutional codes
						Cyclic redundancy check
					codes	



JULY 2025 IEEE Thesaurus

	Error correction codes		Self-aware
	Parity check codes		
	Product codes	<i>Cognitive computing</i>	
	Space-time codes	USE:	Cognitive systems
	Zero correlation zone		
<i>Coding</i>		Cognitive informatics	
USE:	Encoding	BT:	Cybernetics
			Informatics
<i>Coding theory</i>		RT:	Brain
USE:	Information theory		
Codons		Cognitive load	
BT:	Genomics	BT:	Cognition
RT:	DNA	RT:	Cognitive processes
	RNA		Memory
Coercive force		Cognitive neuroscience	
UF:	Coercivity	BT:	Cognition
BT:	Magnetic forces		Neuroscience
<i>Coercivity</i>		Cognitive processes	
USE:	Coercive force	BT:	Cognition
		RT:	Cognitive load
<i>Cogen</i>		Cognitive radar	
USE:	Cogeneration	BT:	Adaptive systems
			Radar
Cogeneration		Cognitive radio	
UF:	CHP	UF:	Cognitive radio network
	Cogen	BT:	Wireless communication
	Combined heat and power		
BT:	Heating systems	<i>Cognitive radio network</i>	
	Power generation	USE:	Cognitive radio
RT:	Industrial power systems		
	Trigeneration	Cognitive robotics	
	Waste heat	UF:	Cognitive robots
<i>Cogging</i>		BT:	Robots
USE:	Forging	RT:	Autonomous robots
		<i>Cognitive robots</i>	
Cognition		USE:	Cognitive robotics
UF:	Reasoning		
BT:	Behavioral sciences	Cognitive science	
RT:	Active perception	UF:	Mental models
	Brain	BT:	Cybernetics
	Cognitive systems	RT:	Brain
	Cultural competence		Computational and artificial
	Digital intelligence	intelligence	
	Psychology		Human factors
NT:	Activity recognition		Inference mechanisms
	Cognitive load		Logic
	Cognitive neuroscience		Psychology
	Cognitive processes		Uncertainty
	Commonsense reasoning	NT:	Human intelligence
	Metacognition		Problem-solving



JULY 2025 IEEE Thesaurus

Cognitive systems

UF: Cognitive computing
Reasoning
BT: Artificial intelligence
Learning systems
RT: Adaptive control
Affective computing
Automata
Cognition
Cybernetics
Fuzzy cognitive maps
Machine learning

Coherence

UF: Coherent detection
BT: Electromagnetic scattering
RT: Interference
Quantum decoherence
NT: Coherence time

Coherence time

BT: Coherence
Quantum mechanics
RT: Bandwidth
Electromagnetic scattering
Quantum computing
Qubit

Coherent detection

USE: Coherence

Coilguns

BT: Electromagnetic launching

Coils

UF: Electric coils
BT: Electronic components
RT: Electromagnets
Generators
Inductance
Inductors
Magnetic circuits
Motors
Rotating machines
Transformers
Windings
NT: Superconducting coils

Cold chain

UF: Cold chain supply
Cold chain transportation
BT: Supply chains

Cold chain supply

USE: Cold chain

Cold chain transportation

USE: Cold chain

Cold plates

BT: Cooling

Collaboration

BT: Professional communication
RT: Collective intelligence
Cyber-physical systems
Information sharing
Interoperability
Social Internet of Things
NT: Collaborative robots
Collaborative tools
Discussion forums
Hackathon
Teamwork
Virtual groups

Collaborative filtering

BT: Filtering theory
RT: Recommender systems

Collaborative intelligence

BT: Federated learning
Multi-agent systems
RT: Distributed management
Intelligent systems

Collaborative learning

USE: Federated learning

Collaborative networking

USE: Federated learning

Collaborative problem solving

USE: Federated learning

Collaborative robots

UF: Cobots
BT: Collaboration
Robots
RT: Field robots

Collaborative software

UF: Groupware
BT: Collaborative tools
RT: Communication system
software
Federated learning

Collaborative tools

BT: Collaboration



JULY 2025 IEEE Thesaurus

NT:	Call conference Collaborative software Videoconferences				Obstacle avoidance Sense and avoid Motion control Advanced driver assistance
<i>Collaborative work</i>			systems		
USE:	Federated learning				Block signalling Lane departure warning
<i>Collective bargaining</i>			systems		
USE:	Industrial relations				Lane detection Vehicle crash testing
Collective intelligence					
BT:	Decision making Intelligent systems			<i>Collision detection</i>	
RT:	Collaboration Crowdsensing Crowdsourcing Sociology			USE:	Collision avoidance
NT:	Fish schools			Collision mitigation	
				BT:	Motion control
				<i>Collision theory</i>	
				USE:	Kinetic theory
Collective learning				Colloidal crystals	
BT:	Learning systems			BT:	Crystals
<i>Colleges</i>				RT:	Crystallizers
USE:	Educational institutions			NT:	Ice clouds
Colliding beam accelerators				Colloidal lithography	
BT:	Colliding beam devices Particle accelerators			BT:	Lithography Nanopatterning
RT:	Klystrons Particle beams Synchrotrons			RT:	Biomedical engineering Nanobioscience Nanotopography Polymers Surface treatment Tissue engineering
Colliding beam devices				Colloidal nanocrystals	
BT:	Nuclear and plasma			BT:	Nanocrystals Optical materials
sciences					
RT:	Particle accelerators			Colon	
NT:	Colliding beam accelerators Muon colliders			BT:	Digestive system
				NT:	Colonic polyps Colorectal cancer
Collimators				<i>Colon cancer</i>	
UF:	Multileaf collimators			USE:	Colorectal cancer
BT:	Optical devices			Colonic polyps	
RT:	Biomedical applications of			BT:	Colon Tumors
radiation				RT:	Colorectal cancer
	Biomedical equipment Dosimetry Gamma-rays Linear accelerators Single photon emission			Colonography	
computed tomography				BT:	Medical diagnosis
	X-ray applications X-rays				
Collision avoidance					
UF:	Collision detection				



JULY 2025 IEEE Thesaurus

Colonoscopy

BT: Medical tests
NT: Virtual colonoscopy

Color

BT: Optics
RT: Electrochromism
Imaging
Photochromism
NT: Color gamut
Color temperature
Pigmentation

Color blindness

USE: Vision defects

Color center lasers

USE: Solid lasers

Color gamut

UF: Colour gamut
BT: Color
RT: Image color analysis
Light sources
Printing

Color temperature

UF: Colour temperature
BT: Color
Temperature

Color TV

BT: TV

Colorectal cancer

UF: Colon cancer
BT: Cancer
Colon
RT: Colonic polyps

Colored noise

UF: Coloured noise
BT: Noise

Colossal magnetoresistance

BT: Magnetoresistance

Colour gamut

USE: Color gamut

Colour temperature

USE: Color temperature

Coloured noise

USE: Colored noise

Comb filters

BT: Filters

Combinational circuits

UF: Combinational logic circuits
BT: Logic circuits

Combinational logic circuits

USE: Combinational circuits

Combinatorial mathematics

BT: Mathematics
NT: Graph theory
Steiner trees

Combinatorial software testing

USE: Combinatorial testing

Combinatorial testing

UF: Combinatorial software testing
BT: Software testing
RT: Design for testability

Combine harvesters

USE: Agricultural machinery

Combined heat and power

USE: Cogeneration

Combined heat, cooling and power

USE: Trigeneration

Combined heat, cooling, and power

USE: Trigeneration

Combined source channel coding

USE: Combined source-channel coding

Combined source-channel coding

UF: Combined source channel coding
BT: Channel coding

Combustion

BT: Oxidation
RT: Exhaust gases
NT: Plasma-assisted combustion

Comets

BT: Planets
RT: Meteors
NT: Meteoroids



JULY 2025 IEEE Thesaurus

Command and control systems

control
systems
UF: Military command and
BT: Aerospace and electronic
RT: Military communication
Military systems

Command languages

BT: Computer languages

Commerce and trade

BT: Business
NT: Free economic zones
Product delivery

Commercial law

BT: Law
RT: Bankruptcy
Business
Consumer products
Consumer protection
Economics

Commercial power systems

USE: Industrial power systems

Commercialization

BT: Engineering management

Common Information Model (computing)

UF: CIM
BT: Analytical models
Information management
RT: Information exchange

Common Information Model (electricity)

UF: CIM
BT: Information management
Power transmission
RT: IEC Standards
Information exchange
Interoperability
Open systems
Unified modeling language

common sense knowledge

USE: Commonsense reasoning

common sense reasoning

USE: Commonsense reasoning

common-sense knowledge

USE: Commonsense reasoning

common-sense reasoning

USE: Commonsense reasoning

commonsense knowledge

USE: Commonsense reasoning

Commonsense reasoning

UF: common sense knowledge
common sense reasoning
common-sense knowledge
common-sense reasoning
commonsense knowledge
reasoning about programs
BT: Artificial intelligence
Cognition

Communicable disease

USE: Infectious diseases

Communication aids

BT: Professional
communication
RT: Assistive technologies
Auditory displays
NT: Closed captioning

Communication cables

UF: Underground
communication cables
BT: Cables
RT: Fault location
Wire

Communication cables (optical)

USE: Optical fiber cables

Communication channels

UF: Air interface
Telecom channels
Telecommunication
channels
BT: Information theory
RT: Channel coding
Communication systems
IEEE 802.11e Standard
IEEE 802.11n Standard
Multicarrier code division
multiple access
OFDM
Synapses
NT: Channel allocation
Channel capacity
Channel estimation
Channel models
Channel spacing



JULY 2025 IEEE Thesaurus

Channel state information		Communication networks	
Gaussian channels		UF:	PSTN
Multipath channels			Public switched telephone
Multiuser channels		network	
Partial response channels		BT:	Communication systems
Quantum channels		RT:	Network security
Throughput		NT:	Central office
Time-varying channels			Cyberspace
			Industrial communication
			Maritime communications
			Radio access technologies
			Relay networks
			Telecommunication
<i>Communication complexity</i>		network performance	
USE:	Complexity theory		Virtual links
Communication effectiveness		<i>Communication protocols</i>	
BT:	Professional	USE:	Protocols
communication		<i>Communication satellites</i>	
RT:	Cooperative communication	USE:	Satellite communications
	Federated learning	Communication standards	
Communication engineering education		UF:	Telecommunication
BT:	Engineering education	standards	
Communication equipment		BT:	Standards categories
BT:	Communications	RT:	Communication systems
technology			FDDI
RT:	Bluetooth		IEC
	Communication systems		ISO
	Multiplexing equipment		ISO Standards
	Satellite ground stations		Radio spectrum
NT:	Auditory displays	management	
	Codecs	NT:	Data over cable service
	Modems	interface specification	
	On board unit		Long Term Evolution
equipment	Optical communication		Near field communication
			SONET
equipment	Radio communication		Synchronous digital
	Receivers	hierarchy	
	Repeaters		Universal Serial Bus
	Speech codecs	Communication switching	
	TV equipment	BT:	Communications
	Telephone equipment	technology	
	Transceivers	RT:	IEEE 802.3 Standard
	Transmitters		Switching systems
	Transponders	NT:	Code division multiplexing
	Video codecs		Electronic switching
	Video equipment	systems	
	Vocoders		Frame relay
Communication industry			Handover
BT:	Industries		Multiprotocol label
RT:	Communication systems	switching	
<i>Communication network reliability</i>			Packet switching
USE:	Telecommunication		
network reliability			



JULY 2025 IEEE Thesaurus

Communication symbols

BT: Professional
communication
Symbols
RT: Pragmatics
Syntactics
NT: Semiotics

Communication system control

BT: Communication systems
RT: Control systems
NT: Telecommunication control

Communication system operations and management

BT: Management
RT: Communication system
signaling
Communication systems

Communication system privacy

USE: Communication system
security

Communication system security

UF: Communication system
privacy
Telecommunication security
Wireless security
BT: Communication systems
RT: Access control
Cryptography
Data security
Electronic warfare
Hardware security
Privacy
NT: Denial-of-service attack
Impersonation attacks
Quantum key distribution
Radio communication
countermeasures

Communication system signaling

UF: Signaling systems
Telecom signaling
Telecom system signaling
Telecommunication
signalling
BT: Communication systems
RT: Bit rate
Communication system
operations and management
Handover
NT: Received signal strength
indicator

Communication system software

BT: Communication systems
RT: Collaborative software
NT: Streaming media

Communication system traffic

UF: Mice flows
BT: Communication systems
RT: Telecommunication traffic

Communication system traffic control

BT: Communication systems

Communication systems

BT: Communications
technology
RT: Antennas and propagation
Communication channels
Communication equipment
Communication industry
Communication standards
Communication system
operations and management
Digital systems
Huffman coding
Information theory
Office automation
Telecontrol equipment
Traffic control
NT: ARPANET
Air to ground
communication
Biomedical communication
Broadband communication
Communication networks
Communication system
control
Communication system
security
Communication system
signaling
Communication system
software
Communication system
traffic
Communication system
traffic control
Computer networks
Cross layer design
Data buses
Data communication
Device-to-device
communication
Digital communication



JULY 2025 IEEE Thesaurus

systems	Duplex communication	Token networks
	FDDI	UHF communication
communication	Facsimile	Underwater communication
	IP networks	Vehicle-to-everything
communications	ISDN	Video conferencing
	Indoor communication	Videophone systems
communication	Integrated sensing and	Videotex
	Internet	Visual communication
communications	Local area networks	Wide area networks
	Low latency communication	Wideband
communications	Machine-to-machine	Wireless communication
	Magnetic communication	Wireless mesh networks
networks	Metropolitan area networks	Wireless sensor networks
	Microwave communication	
networks	Military communication	<i>Communications computing</i>
	Mobile communication	USE: Telecommunication
networks	Molecular communication	computing
	Multiaccess communication	Communications technology
networks	Multicast communication	RT: Antennas and propagation
	Multimedia communication	NT: Communication equipment
networks	NOMA	Communication switching
	Nanocommunication	Communication systems
networks	Narrowband	Couplers
	Optical fiber communication	Green communications
networks	Personal communication	High-speed electronics
	Protocols	Image communication
networks	Quality of experience	Information and
	Quality of service	communication technology
networks	Quantum communication	MIMO
	Radio communication	MISO
networks	Regional area networks	Message systems
	Routing	Modulation
networks	SIMO	Multiplexing
	Satellite communications	Network topology
networks	Satellite ground stations	Presence network agents
	Semantic communication	SISO
networks	Spatial diversity	TV
	Submillimeter wave	UHF technology
communication	Subscriber loops	Ultra wideband technology
	Switching systems	VHF devices
communication	Synchronous digital	<i>Community antenna television</i>
	Telecommunications	USE: Cable TV
hierarchy	Teleconferencing	Community networks
	Telegraphy	BT: Social networking (online)
hierarchy	Telephony	RT: Social computing
	Teleprinting	Commutation
hierarchy	Teletext	BT: Motors
	Terahertz communications	Commutators
hierarchy	Terrestrial communications	BT: DC motors



JULY 2025 IEEE Thesaurus

Compact disk

USE: CD recording

Compaction

BT: Waste reduction
RT: Materials handling

Companies

BT: Organizations

Compass

UF: Compasses
BT: Instruments
RT: Magnetic fields
Navigation

Compasses

USE: Compass

Competitive intelligence

BT: Information management
RT: Business intelligence
Decision support systems
Digital intelligence
Knowledge management
Market research

Competitive learning

BT: Unsupervised learning

Compilers (program)

USE: Program processors

Complex networks

BT: Network topology
RT: Social network theory
Social sciences
System dynamics
System of systems

Complex systems

theory
BT: Systems engineering and
RT: Bio-inspired engineering
Configuration management
Large-scale systems

Complexity

USE: Complexity theory

Complexity constrained detection

USE: Maximum likelihood
detection

Complexity theory

UF: Circuit complexity
Communication complexity
Complexity
BT: Chaos
RT: Computation theory
Econophysics
NT: Computational complexity
NP-complete problem
NP-hard problem

Compliance testing

USE: Conformance testing

Compliant mechanisms

USE: Manufacturing processes

Component architectures

UF: Component-based systems
BT: Components, packaging,
and manufacturing technology

Component-based systems

USE: Component architectures

Components, packaging, and manufacturing technology

NT: Component architectures
Electronic components
Electronic equipment

manufacture

Electronics packaging
Environmentally friendly

manufacturing techniques

Integrated circuit

manufacture

Integrated circuit packaging
Semiconductor device

packaging

Thermal management of

electronics

Composite materials

BT: Materials
RT: Intelligent materials
NT: Cermet

Composite media

USE: Nonhomogeneous media

Composite systems

USE: Interconnected systems



JULY 2025 IEEE Thesaurus

Composting

BT: Biodegradation
Recycling
RT: Biochemical oxygen
demand
Fertilizers
Waste management

Compounds

BT: Materials, elements, and
compounds
NT: Bismuth compounds
Gallium compounds
Indium compounds
Inorganic compounds
Lead compounds
Organic compounds
Silicon compounds

Compressed sensing

UF: Compressive sensing
BT: Sampling methods

Compression algorithms

BT: Algorithms

Compression molding

UF: Compression moulding
BT: Production
RT: Injection molding

Compression moulding

USE: Compression molding

Compressive sensing

USE: Compressed sensing

Compressive stress

BT: Stress

Compressors

BT: Electric machines
RT: Air conditioning
Pumps
Turbines
Turbomachinery

Computation complexity

USE: Computational complexity

Computation theory

BT: Computational intelligence
RT: Complexity theory
NT: Computational chemistry
Computational complexity

Computational statistics
Concurrent computing
Greedy algorithms
Reservoir computing
Support vector machines
Turing completeness

Computational and artificial intelligence

RT: Cognitive science
Digital systems
NT: Artificial intelligence
Autonomous mental
development
Computational intelligence
Logic
Machine intelligence
Neural networks

Computational auditory scene analysis

USE: Machine listening

Computational biochemistry

BT: Computational biology
RT: Biochemistry
Bioinformatics

Computational biology

BT: Engineering in medicine
and biology
RT: Bioinformatics
Biology
Computational
neuroscience
Synthetic biology
NT: Computational biochemistry
Computational biophysics
Computational systems
biology

Computational biophysics

BT: Computational biology
RT: Bioinformatics
Biophysics

Computational chemistry

BT: Chemistry
Computation theory

Computational complexity

UF: Computation complexity
BT: Complexity theory
Computation theory
RT: Algorithmic efficiency
Graph drawing
Semidefinite programming



JULY 2025 IEEE Thesaurus

NT: Time complexity	Synapses
<i>Computational cultural dynamics</i>	NT: Computation theory
USE: Computational cultural modeling	Computational cybernetics
	Evolutionary computation
	Fuzzy systems
	Genetic algorithms
Computational cultural modeling	
UF: Computational cultural dynamics	<i>Computational life sciences</i>
Computational social and behavioral modeling	USE: Computational modeling
BT: Computational modeling	AND Life sciences
Computational cybernetics	Computational linguistics
BT: Computational intelligence	BT: Systems, man, and cybernetics
Cybernetics	RT: Context modeling
	Natural language generation
Computational efficiency	NT: Machine translation
BT: Mathematics	Sentiment analysis
<i>Computational electrodynamics</i>	
USE: Computational electromagnetics	Computational materials science
	BT: Computational modeling
Computational electromagnetics	Materials science and technology
UF: Computational electrodynamics	RT: Informatics
BT: Electromagnetic analysis	Computational modeling
RT: Computer applications	UF: Computational life sciences
Electromagnetic field theory	Life sciences computing
Electromagnetic fields	ZINDO
Finite difference methods	BT: Modeling
Monte Carlo methods	RT: Fish schools
Stochastic processes	Neuroinformatics
	Opinion dynamics
<i>Computational ethics</i>	Time complexity
USE: Machine ethics	NT: Aerial computing
	Agent-based modeling
Computational fluid dynamics	Computational cultural modeling
UF: CFD	Computational materials science
BT: Fluid dynamics	Evolutionary dynamics
RT: Isosurfaces	Multiphysics
	Reversible computing
Computational geometry	<i>Computational morality</i>
BT: Geometry	USE: Machine ethics
RT: Computer graphics	
Layered manufacturing	Computational neuroscience
Surface fitting	UF: Theoretical neuroscience
NT: Fractals	BT: Computer science
Geometric modeling	Neuroscience
	RT: Computational biology
Computational intelligence	Nervous system
BT: Computational and artificial intelligence	
RT: Artificial intelligence	



JULY 2025 IEEE Thesaurus

Computational science

USE: Scientific computing

Computational social and behavioral modeling

USE: Computational cultural modeling

Computational statistics

UF: Statistical computing

BT: Algorithm design and

analysis

Computation theory
Statistics

Computational systems biology

BT: Computational biology

Compute-in-memory

USE: In-memory computing

Computed microtomography

USE: Computed tomography

Computed tomography

UF: CT scan
Computed

microtomography

Computerised axial

tomography

Computerised tomography
Computerized axial

tomography

Computerized tomography

BT: Tomography

RT: Biomedical applications of

radiation

NT: Single photon emission

computed tomography

Computer aided analysis

BT: Computer applications

RT: Digital simulation

Geophysics computing

Independent component

analysis

Simulation

Computer aided design

USE: Design automation

Computer aided diagnosis

UF: Computer assisted

diagnosis

Computer-aided diagnosis

Computer-assisted

diagnosis

BT: Medical diagnosis

Computer aided engineering

UF: CAE

BT: Computer applications

Computer aided instruction

UF: CAI

Computer aided learning

Computer-aided instruction

Computer-aided learning

Teaching machines

BT: Computer applications

Educational technology

RT: Authoring systems

Continuing education

Courseware

Educational courses

Electronic learning

MATLAB

Technology acceptance

model

NT: Hybrid learning

Learning management

systems

Computer aided learning

USE: Computer aided instruction

Computer aided manufacturing

UF: CAM

BT: Industrial electronics

Manufacturing automation

RT: Computer integrated

manufacturing

Integrated manufacturing

systems

NT: CAD/CAM

Silicon compiler

Computer aided software engineering

BT: Software engineering

RT: Programming environments

Software tools

Computer animation

USE: Animation

Computer applications

UF: Volunteer computing

BT: Computers and information

processing

RT: Biomedical computing



JULY 2025 IEEE Thesaurus

electromagnetics	Computational	BT:	Computers and information processing
	Computerized monitoring	RT:	Microprogramming
	Edge computing	NT:	Accelerator architectures
	Electrical engineering		Data structures
computing			Dynamic voltage scaling
	Flexible manufacturing		Memory architecture
systems			Memory management
	Humanities		Multiprocessor
	Information technology	interconnection	Parallel architectures
systems	Learning management		Reconfigurable
	Middleware	architectures	
	Mobile agents	<i>Computer arithmetic</i>	
	Software agents	USE:	Digital arithmetic
	Software packages		
NT:	Application virtualization	<i>Computer assisted diagnosis</i>	
	Big Data applications	USE:	Computer aided diagnosis
	Bot (Internet)		
	Computer aided analysis	<i>Computer automated measurement and control</i>	
engineering	Computer aided	USE:	CAMAC
	Computer aided instruction		
	Computer generated music	Computer bugs	
	Computer integrated	UF:	Bugs
manufacturing		BT:	Computer crashes
	Control engineering		
computing		<i>Computer buses</i>	
	Engineering computing	USE:	Data buses
	Green computing		
	High energy physics	<i>Computer control</i>	
instrumentation computing		USE:	Digital control
	Knowledge management		
	Mathematics computing	Computer crashes	
	Medical information	BT:	Computer errors
systems		NT:	Buffer overflows
	Military computing		Computer bugs
	Mobile applications		
	Physics computing	Computer crime	
	Power engineering	UF:	Cyber crime
computing			Cyber-crime
	Power system analysis		Cybercrime
computing			Hacking
	Publishing		Piracy (software)
	Scientific computing		Software piracy
	Telecommunication	BT:	Computer security
computing		RT:	Botnet
	Virtual assistants		Computer viruses
	Virtual enterprises		Computer worms
	Virtual manufacturing		Control system security
	Web sites		Data security
	World Wide Web		Digital rights management
			Distributed denial-of-service
Computer architecture		attack	
UF:	Architecture (computer)		Hardware security



JULY 2025 IEEE Thesaurus

	Identity theft		Surface fitting
	Privacy-invasive software		Visual effects
	Threat modeling		Workstations
	Unsolicited e-mail	NT:	Data visualization
NT:	Counterfeiting		Emojis
	Cyber terrorism		Rendering (computer
	Cyber threat intelligence	graphics)	
	Cyberattack		Shadow mapping
	SQL injection		Sprites (computer)

Computer displays

BT:	Displays
RT:	Computer graphics
	Computer peripherals
	Workstations
NT:	Mesh generation
	Touch sensitive screens

Computer documentation

USE:	Documentation
------	---------------

Computer engineering education

USE:	Computer science
education	

Computer errors

BT:	Computer performance
NT:	Computer crashes

Computer games

USE:	Video games
------	-------------

Computer generated music

UF:	CGM
	Computer music
BT:	Computer applications
	Music

Computer graphics

BT:	Graphics
RT:	Animation
	Art
	Character generation
	Computational geometry
	Computer displays
	Computer peripherals
	Curve fitting
	Fractals
	Graphics processing units
	Mesh generation
	Modeling
	Multimedia computing
	Photorealistic images
	Ray tracing
	Simulation

Computer hacking

UF:	Hacker
	Hacks
BT:	Computer security
NT:	Hackathon

Computer hardware

USE:	Hardware
------	----------

Computer industry

UF:	DP industry
BT:	Industries
RT:	Computers and information
processing	

Computer integrated manufacturing

UF:	CIM
BT:	Computer applications
	Manufacturing automation
RT:	Agile manufacturing
	CADCAM
	Computer aided
manufacturing	
	Virtual manufacturing

Computer interfaces

BT:	Computers and information
processing	
RT:	Computer peripherals
	Data buses
	Interface management
	User interfaces
NT:	Application programming
interfaces	
	Browsers
	Field buses
	Firewire
	HDMI
	Haptic interfaces
	Hypertext systems
	Input devices



JULY 2025 IEEE Thesaurus

interfaces	Interface phenomena	virtualization	Network function
	Interface states	networking	Software defined
	Musical instrument digital	NT:	Traffic control
Computer languages	Ports (computers)	networking	Computer network reliability
	System buses	base	Disruption tolerant
	UF: Programming languages		Management information
languages	BT: Formal languages		Middleboxes
	RT: Data structures		Network address translation
	Natural languages		Network synthesis
Execution Language	Software		Source address validation
	NT: Architecture description		
	Business Process		
languages	C languages	Computer network reliability	
	Command languages	BT: Computer network	
	Database languages	management	
Language	Hardware design	NT: Network topology	
	High level languages	networks	Fault tolerant computer
	Markup languages		
communication	Python	Computer networks	
	R language	UF: Mice flows	
	Specification languages	BT: Communication systems	
communication	Style sheet languages	processing	Computers and information
	Systems Modeling	RT: Bit rate	
	Visual BASIC		Cyber terrorism
Computer mediated communication	UF: Computer-mediated		Cyber warfare
	Mediated communication		Data communication
	Mediated discourse		Delay estimation
communication	Mediated interaction		Distributed computing
	Mediated technology		Edge computing
	Technology mediated		File servers
communication	Technoloy-mediated		Firewalls (computing)
	BT: Social networking (online)		Frame relay
			Hypercubes
<i>Computer music</i>	USE: Computer generated music		IEEE 802.11 Standard
	AND		IEEE 802.11g Standard
	Music		IEEE 802.11n Standard
Computer network management			IEEE 802.16 Standard
	BT: Computer networks		IEEE 802.3 Standard
	RT: Bandwidth		IPTV
	Computer security		Internetworking
	Data security		LAN interconnection
		interconnection	Middleware
			Multiprocessing systems
			Multiprocessor
			Network security
			Open systems
			Personal area networks
			Ports (computers)



JULY 2025 IEEE Thesaurus

networks	Radial basis function	BT:	Computers and information
	TCPIP	processing	
	Web sites	RT:	Computer displays
NT:	Ad hoc networks		Computer graphics
	Computer network		Computer interfaces
management			Device drivers
	Content distribution		Firewire
networks			Flash memories
	Cyberspace	NT:	User interfaces
	Diffserv networks		Disk drives
	Domain Name System		Keyboards
	Ethernet		Modems
	Heterogeneous networks		Printers
	IP networks		
	Internet	<i>Computer pipeline processing</i>	
	Intserv networks	USE:	Pipeline processing
	Metropolitan area networks	<i>Computer ports</i>	
	Multiprocessor	USE:	Ports (computers)
interconnection networks		<i>Computer programming</i>	
virtualization	Network function	USE:	Programming
	Network servers	<i>Computer programming profession</i>	
	Next generation networking	USE:	Programming profession
	Overlay networks		
	Peer-to-peer computing		
	Software defined	Computer science	
networking		BT:	Computers and information
	Storage area networks	processing	
	Token networks	RT:	Function approximation
	Unicast		Logic
	Virtual private networks		Software
	Wide area networks	NT:	Computational
	Wireless access points	neuroscience	
			Formal languages
			Network theory (graphs)
			Programming
Computer numerical control		Computer science education	
UF:	CNC	UF:	Computer engineering
	NC machines	education	
BT:	Manufacturing automation	BT:	Engineering education
RT:	Digital control		
	Industrial control		
<i>Computer operating systems</i>		Computer security	
USE:	Operating systems	UF:	cyber security
			cybersecurity
Computer performance		BT:	Computers and information
BT:	Computers and information	processing	
NT:	Computer errors		Security
	Hardware acceleration	RT:	Access control
	Performance loss		Blockchains
			Computer network
Computer peripherals		management	
UF:	Computer terminals		Cryptography
	Peripheral equipment		Cyber threat intelligence



JULY 2025 IEEE Thesaurus

technologies	Data protection	Computer viruses	UF:	Viruses (computer)
	Data security		BT:	Malware
	Digital forensics		RT:	Anti-virus software
	Digital policy			Computer crime
	Eavesdropping			Computer worms
	Hardware security			
	Operating systems			
	Privacy			
	Privacy enhancing			
	Privacy-invasive software			
NT:	Session hijacking	Computer vision	BT:	Robots
	Threat modeling		RT:	Activity recognition
	Trust management			Advanced driver assistance
	Application security			
	Authentication			
	Cloud computing security			
	Computer crime			
	Computer hacking			
	Cross-site scripting			
	Cyber espionage			
systems	Cyber warfare	systems		Conditional random fields
	Cyberattack			Fine-grained image
	Data integrity			
	Denial-of-service attack			
	Firewalls (computing)			
	Honey pot (computing)			
	Identity management			
	Internet security			
	Mobile security			
	Passwords			
systems	Penetration testing	recognition		Gait recognition
	Permission			Gaze tracking
	Phishing			Image capture
	Proof of Work			Indoor navigation
	Trusted computing			One shot learning
				Pattern recognition
				Pose estimation
				Video restoration
			NT:	Active appearance model
				Blob detection
Computer simulation	Simulation	Computer worms	UF:	Worms (computer)
	Digital twins		BT:	Malware
	EMTP		RT:	Computer crime
	Fish schools			Computer viruses
	Human in the loop			
	Multiphysics			
	Synthetic data			
<i>Computer software</i>	Software	<i>Computer-aided design</i>	USE:	Design automation
<i>Computer speech recognition</i>	Speech to text	<i>Computer-aided diagnosis</i>	USE:	Computer aided diagnosis
<i>Computer terminals</i>	Computer peripherals	<i>Computer-aided instruction</i>	USE:	Computer aided instruction
		<i>Computer-aided learning</i>	USE:	Computer aided instruction
		<i>Computer-assisted diagnosis</i>	USE:	Computer aided diagnosis



JULY 2025 IEEE Thesaurus

Computer-mediated communication

USE: Computer mediated communication

Computerised axial tomography

USE: Computed tomography

Computerised instrumentation

USE: Computerized instrumentation

Computerised monitoring

USE: Computerized monitoring

Computerised tomography

USE: Computed tomography

Computerized axial tomography

USE: Computed tomography

Computerized instrumentation

UF: Computerised instrumentation

BT: Instrumentation and measurement

computing

Computerized monitoring

UF: Computerised monitoring

BT: Monitoring

RT: Computer applications

Computerized tomography

USE: Computed tomography

Computers

UF: Computing technology

BT: Computers and information processing

RT: Cyberspace

NT: Analog computers

Calculators

Digital computers

Microcomputers

Parallel machines

Supercomputers

Tablet computers

Wearable devices

systems

Computers and information processing

RT: Associative processing

Biology computing

Computer industry

Data processing

Electronic learning

Home computing

Information systems

Logic circuits

Multimedia computing

Multiprocessing systems

NT: Approximate computing

Computer applications

Computer architecture

Computer interfaces

Computer networks

Computer performance

Computer peripherals

Computer science

Computer security

Computers

Concurrency control

DNA computing

Data systems

Database machines

Digital systems

Distributed computing

File servers

Hardware

High performance

Image processing

Memory

Mobile computing

Molecular computing

Multitasking

Open systems

Optical computing

Parallel processing

Pattern recognition

Pervasive computing

Petascale computing

Platform virtualization

Probabilistic computing

Probability computing

Quantum computing

Real-time systems

Software

Software engineering

System recovery

Time sharing computer

Virtual machine monitors

Computing technology

USE: Computers

Concatenated codes

BT: Programming

Concave programming

BT: Optimization methods



JULY 2025 IEEE Thesaurus

Concentric tube robots

BT: Continuum robots
RT: Minimally invasive surgery

Concept drift

BT: Data science
Machine learning
Predictive analytics

Concrete

BT: Building materials
RT: Pressure vessels

Concurrency

USE: Concurrent computing

Concurrency control

BT: Computers and information processing
RT: Distributed computing
Distributed databases
Multiprocessing systems
Parallel processing
Protocols
Synchronization
NT: Processor scheduling

Concurrent computing

UF: Concurrency
BT: Computation theory
RT: Granular computing
Model checking

Concurrent engineering

BT: Engineering - general
RT: Product design
Project management
Quality function deployment
Research and development

management

Time to market
Virtual manufacturing

Condensation trails

USE: Contrails

Condition monitoring

BT: Preventive maintenance

Conditional random fields

UF: CRF
BT: Graph theory
Random processes
Statistical analysis
RT: Computer vision

Feature extraction
Image segmentation
Learning (artificial

intelligence)

Natural language

processing

Text analysis

Conditions of employment

USE: Employee welfare

Conducting bodies

USE: Conductors

Conducting materials

BT: Materials
RT: Conductivity
Conductors
Semiconductor materials
NT: Electrolytes

Conductive adhesives

BT: Adhesives

Conductive films

BT: Films
NT: Anisotropic conductive films

Conductivity

UF: Electric conductivity
Electrical conductivity
Resistivity
BT: Electric variables
RT: Charge carriers
Conducting materials
Conductivity measurement
Grain boundaries
Impact ionization
Transmission line theory
NT: Photoconductivity
Semiconductivity
Transconductance

Conductivity measurement

UF: Resistivity measurement
BT: Electric variables
measurement
RT: Conductivity

Conductors

UF: Conducting bodies
BT: Electric machines
RT: Cables
Conducting materials
Core loss



JULY 2025 IEEE Thesaurus

Power cables
Power distribution lines
Power transmission lines
Proximity effects
Skin effect
Thermal noise
Three-phase electric power
Wire
Wireless power
transmission
Wiring

Conference management

BT: Management

Conferences

UF: Meetings (technical)
Symposia
Workshops
BT: Meetings

Configuration management

BT: Systems engineering and
theory
RT: Complex systems
Maintenance engineering
System analysis and design

Conformal mapping

BT: Mathematics
RT: Coplanar waveguides
Wave functions
Waveguide components
Waveguide theory

Conformance testing

UF: Compliance testing
Conformity assessment
Type testing
BT: Testing
RT: Accreditation
Certification
Quality of service
Standards
Surveillance

Conformity assessment

USE: Conformance testing

Confusion matrices

BT: Statistical learning
RT: Visualization

Congestive heart failure

BT: Medical conditions

Conifers

USE: Non-flowering plants

Connected cars

USE: Connected vehicles

Connected vehicles

UF: Connected cars
BT: Vehicles
RT: Controller area networks
Intelligent vehicles

Connecting

USE: Joining processes

Connective tissue

BT: Biological tissues

Connectors

BT: Electronic components
NT: Plugs
Sockets

Consensus algorithm

BT: Algorithm design and
theory

Consensus control

BT: Decentralized control
RT: Decentralized applications
Swarm robotics

Consensus mechanism

USE: Consensus protocol

Consensus protocol

UF: Consensus mechanism
BT: Blockchains
Protocols
RT: Ecosystems

Conservation areas

USE: Protected areas

Consortia

BT: Engineering management
RT: Business

Constellation diagram

UF: Signal constellation
BT: Digital modulation

Constraint handling

UF: Constraint programming
BT: Logic programming



JULY 2025 IEEE Thesaurus

Constraint optimization

BT: Design optimization
RT: Electronics packaging

Constraint programming

USE: Constraint handling

Constraint theory

UF: Theory of constraints
BT: Integer linear programming
RT: Stability plasticity

Construction

UF: Erection
BT: Industries
RT: Building materials
Civil engineering
Construction industry
Structural engineering
NT: Buildings
Green buildings
Modular construction
Prefabricated construction
Stairs

Construction industry

BT: Industries
RT: Building automation
Building materials
Buildings
Construction
Excavation
Floors
Mortar
Shipbuilding industry
Smart cities
NT: Prefabricated construction

Consumer behavior

UF: Consumer behaviour
Customer behavior
Customer behaviour
BT: Behavioral sciences
RT: Consumer products
Customer profiles
Customer relationship

management

Electronic commerce
Food waste
Market opportunities
Technology acceptance

model

NT: Neuromarketing
Self-service

Consumer behaviour

USE: Consumer behavior

Consumer electronics

UF: Kindle
RT: Consumer products
Digital systems
Firewire
Flat panel displays
Microcomputers
Video equipment
NT: Ambient intelligence
Audio systems
Home automation
Home computing
Low power electronics
Microwave ovens
Multimedia systems

Consumer products

BT: Manufactured products
RT: Commercial law
Consumer behavior
Consumer electronics
Domestic safety
Electrical products
Food industry
Food manufacturing
Food products
Footwear industry
Market research
Plastic products
Product liability
Product safety
Watches
NT: Backpacks
Clothing
Games
Home appliances
Microwave ovens

Consumer protection

BT: Law
Product safety engineering
RT: Censorship
Commercial law
Customer relationship

management

Quality assurance

Consumer satisfaction

USE: Customer satisfaction

Consumer-generated media

USE: User-generated content



JULY 2025 IEEE Thesaurus

Contact resistance

BT: Contacts

Contact tracing

BT: Public healthcare
RT: Epidemiology
Infectious diseases

Contactors

BT: Switches

Contacts

BT: Circuits and systems
RT: Semiconductor devices
NT: Brushes
Contact resistance
Ohmic contacts

Containers

BT: Material storage
Materials handling
equipment
RT: Bulk storage
Canning
Filling
Fuel storage
Loading
Measurement
Pallets
Production
Stacking
NT: Freight containers

Contamination

BT: Materials science and
technology
RT: Chemical hazards
Decontamination
Hazards
Impurities
Microfiltration
Pollution
Quality control
Radiation protection
Soil remediation
NT: Surface contamination

Content addressable memory

USE: Associative memory

Content addressable storage

BT: Memory
RT: Content-based retrieval

Content analysis

USE: Content management

Content based retrieval

USE: Content-based retrieval

Content delivery networks

USE: Content distribution
networks

Content distribution networks

UF: Content delivery networks
BT: Computer networks

Content management

UF: Content analysis
BT: Electronic publishing
Management
RT: Blockchains
Document handling
MPEG 7 Standard
Multimedia computing
Publish subscribe systems
Semantic Web
Web design
Web sites

Content-based retrieval

UF: Content based retrieval
BT: Information retrieval
RT: Content addressable
storage
Cross modal retrieval

Content-centric networking

USE: Information-centric
networking

Context

BT: Professional
communication
RT: Pragmatics

Context aware

USE: Context-aware services

Context awareness

BT: Artificial intelligence
RT: Context management
Intelligent control
Intelligent systems
Knowledge acquisition
Learning systems
Pervasive computing
Semantic search



JULY 2025 IEEE Thesaurus

Context management

BT: Artificial intelligence
RT: Context awareness

Context modeling

BT: Modeling
RT: Computational linguistics

Context-aware applications

USE: Context-aware services

Context-aware computing

USE: Context-aware services

Context-aware services

UF: Context aware
Context-aware applications
Context-aware computing
BT: Ubiquitous computing

Continental crust

BT: Geology
RT: Oceanic crust
Rocks
Tectonics

Continents

BT: Geoscience
NT: Africa
Asia
Australia
Europe
North America
South America

Contingency management

BT: Management
NT: Crisis management
Disaster management
Mission critical systems

Continual learning

USE: Continuing education

Continuing education

UF: Continual learning
Further education
BT: Career development
Educational programs
RT: Computer aided instruction
Engineering education
Management training
Training

Continuing professional development

UF: Life long learning
BT: Human resource
management
RT: Qualifications
Training

Continuous glucose monitoring

BT: Biomedical monitoring
Glucose
RT: Medical devices

Continuous improvement

UF: Kaizen
BT: Total quality management
RT: Production management
Quality awards

Continuous integration

BT: Software development
management

Continuous phase modulation

BT: Phase modulation

Continuous production

BT: Flow production systems
Production control
RT: Process control
Production management

Continuous systems

USE: Continuous time systems

Continuous time models

USE: Continuous time systems

Continuous time systems

UF: Continuous systems
Continuous time models
BT: Time factors

Continuous wavelet transforms

BT: Wavelet transforms

Continuous-stirred tank reactor

BT: Chemical reactions

Continuously variable transmission

USE: Mechanical power
transmission

Continuum robots

BT: Robots
NT: Concentric tube robots



JULY 2025 IEEE Thesaurus

Contract law

BT: Law
RT: Contracts
Employment law

Contract management

BT: Contracts
Management
RT: Risk management

Contracts

BT: Management
RT: Business
Contract law
Procurement
Proposals
NT: Contract management
Forward contracts
Licenses
Service level agreements
Smart contracts
Subcontracting

Contrails

UF: Condensation trails
Vapor trails
Vapour trails
BT: Exhaust gases
Ice clouds

Contrast agents

UF: Contrast media
BT: Biomedical imaging

Contrast media

USE: Contrast agents

Contrast resolution

BT: Image resolution
RT: Spatial resolution

Contrastive learning

BT: Self-supervised learning

Control charts

UF: Cusum charts
Shewhart charts
BT: Production management
RT: Control systems
Quality management

Control design

BT: Control systems
RT: Feedback
Lyapunov methods

Control engineering

BT: Control systems
RT: Control engineering
education
NT: Predictive control
Control system security

Control engineering computing

BT: Computer applications
RT: Control engineering
education
simulation
Hardware-in-the-loop

Control engineering education

BT: Engineering education
RT: Control engineering
Control engineering
computing

Control equipment

BT: Control systems
RT: Manipulators
Mechatronics
Robots
NT: Actuators
Fasteners
Microcontrollers
Regulators
Remote control
Servosystems
Switches
Switchgear
Telecontrol equipment
Thermostats

Control nonlinearities

BT: Control theory
RT: Nonlinear control systems
NT: Backstepping
Feedback linearization

Control system analysis

BT: System analysis and design
RT: Piecewise linear techniques
NT: State-space methods

Control system security

BT: Control engineering
Security
RT: Computer crime
Control systems
Cyber-physical systems
Industrial control
National security



JULY 2025 IEEE Thesaurus

	Power system control		Transfer functions
	Safety		Uncertain systems
function	NT: Physical unclonable	vessels	Underactuated surface
		NT:	Admittance control
Control system synthesis			Automatic control
UF:	Control systems synthesis		Automatic generation
BT:	Control systems	control	
RT:	Circuit synthesis		Automotive control
	Hardware-in-the-loop		Autopilot
simulation			Bidirectional control
	Linearization techniques		Block signalling
	Piecewise linear techniques		Brakes
			CAMAC
Control systems			Centralized control
RT:	Active perception		Closed loop systems
	Actuators		Control design
	Adaptive control		Control engineering
	Air traffic control		Control equipment
	Communication system		Control system synthesis
control			Controllability
	Control charts		Controller area networks
	Control system security		Cruise control
	Cybernetics		Decentralized control
	Discrete-event systems		Delay systems
	Discrete-time systems		Digital control
	Estimation		Fault tolerant control
	Flexible structures		Feedback
	Force control		Feedback linearization
	Game theory		Fluid flow control
	H infinity control		Fluidics
	Interconnected systems		Gaze tracking
	Inventory control		Homeostasis
	Legged locomotion	systems	Linear feedback control
	Linear systems		
	Linearization techniques		Magnetic variables control
	MIMO	control	Mechanical variables
	Manipulators		
	Microcontrollers		Medical control systems
	Microsensors		Missile control
	Mobile robots		Moisture control
	Neuromodulation		Motion compensation
	Nonlinear systems		Networked control systems
	Parameter estimation		Nonlinear control systems
	Poles and zeros		Open loop systems
	Real-time systems		Optical control
	Robots		Optimal control
	Robustness		PD control
	Sensitivity		PI control
	Stability		Pneumatic systems
	State estimation		Positive train control
	Stochastic systems		Pressure control
	Switched systems		Proportional control
	Target tracking		Radio control
	Time-varying systems		Robot control



JULY 2025 IEEE Thesaurus

	SCADA systems		Inrush current
	Sensorless control		Pulse width modulation
	Sliding mode control		Pulse width modulation
	Supervisory control	inverters	
	Thermal variables control		Rectennas
	Traffic control		Space vector pulse width
<i>Control systems synthesis</i>		modulation	
USE:	Control system synthesis	NT:	AC-AC converters
			DC-AC power converters
			Digital-to-frequency
Control theory		converters	
BT:	Cybernetics		Frequency conversion
RT:	Dynamics		Multilevel converters
	Feedback circuits		Power conversion
NT:	Control nonlinearities	converters	Pulse width modulation
	Iterative learning control		Resonant converters
	Observability		Static power converters
			Voltage-source converters
			Wavelength converters
Controllability			
BT:	Control systems		
Controller area networks		<i>Convertors</i>	
UF:	CAN	USE:	Converters
BT:	Control systems		
RT:	Connected vehicles	Convex functions	
	Intelligent systems	UF:	Convex optimization
			Convex programming
Convection		BT:	Mathematics
UF:	Mixed convection	NT:	Convex hulls
	Rayleigh-Benard		Semidefinite programming
convection			
BT:	Heat transfer	Convex hulls	
		BT:	Convex functions
Convergence		<i>Convex optimization</i>	
BT:	Mathematics	USE:	Convex functions
Convergence of numerical methods		<i>Convex programming</i>	
BT:	Numerical analysis	USE:	Convex functions
<i>Conversational AI</i>			
USE:	Conversational artificial	Convolution	
intelligence		BT:	Signal processing
		RT:	Deconvolution
			Numerical analysis
Conversational artificial intelligence		NT:	Convolvers
UF:	Conversational AI		
BT:	Artificial intelligence	Convolutional codes	
RT:	Digital humans	UF:	Trellis codes
NT:	Chatbots	BT:	Codes
	Virtual assistants	RT:	Channel coding
			Digital multimedia
Converters		broadcasting	
UF:	Convertors		Error correction
	Switching convertors		Error correction codes
BT:	Power electronics		Radio communication
RT:	Data conversion		



JULY 2025 IEEE Thesaurus

	Satellite communications	Evaporative cooling	
	Telecommunications	Heat sinks	
<i>Convolutional networks</i>		Immersion cooling	
USE:	Convolutional neural	Laser cooling	
networks		Liquid cooling	
		Refrigeration	
<i>Convolutional neural nets</i>		Solar cooling	
USE:	Convolutional neural	Space cooling	
networks		Thermal quenching	
		Trigeneration	
		Ultracold atoms	
		Ventilation	
Convolutional neural networks			
UF:	CNN		
	Convolutional networks		
	Convolutional neural nets	<i>Cooperative cache</i>	
BT:	Artificial neural networks	USE:	System performance
RT:	Deep learning		
	Generative adversarial	Cooperative caching	
networks		BT:	System performance
	Graph neural networks	Cooperative communication	
	Image augmentation	UF:	Amplify-and-forward
	Machine learning	cooperative communication	
	Vision transformers	BT:	Federated learning
NT:	Graph convolutional	RT:	Wireless communication
networks			Communication
		effectiveness	
Convolvers			Professional
BT:	Convolution	communication	
<i>Cookie hijacking</i>		<i>Cooperative networks</i>	
USE:	Session hijacking	USE:	Cooperative systems
<i>Cookie side-jacking</i>		<i>Cooperative operation</i>	
USE:	Session hijacking	USE:	Cooperative systems
<i>Cookie sidejacking</i>		Cooperative systems	
USE:	Session hijacking	UF:	Cooperative networks
			Cooperative operation
Coolants		BT:	Artificial intelligence
UF:	Antifreeze materials	RT:	Artificial bee colony
BT:	Cooling		
RT:	Space cooling	algorithm	
NT:	Refrigerants		
		<i>Cooperative work</i>	
Cooling		USE:	Federated learning
BT:	Temperature control		
RT:	Electronics cooling	Coordinate measuring machines	
	Electronics packaging	UF:	CMM
	HVAC	BT:	Measurement
	Heat pipes	RT:	Inspection
	Thermal engineering		Machine tools
	Water pumps		Quality control
NT:	Air conditioning		
	Cold plates	<i>COPD</i>	
	Coolants	USE:	Chronic obstructive
		pulmonary disease	



JULY 2025 IEEE Thesaurus

Coplanar transmission lines

BT: Planar transmission lines
NT: Coplanar waveguides

Coplanar waveguides

UF: CPW
BT: Coplanar transmission lines
RT: Conformal mapping
Electromagnetic

waveguides

Copper

UF: Cu
BT: Metals
NT: Copper alloys
Copper compounds

Copper alloys

BT: Copper
RT: Alloying

Copper compounds

BT: Copper

Coprocessors

BT: Circuits
Integrated circuits
Microprocessors
RT: AI accelerators
Digital arithmetic

Copyright protection

BT: Legal factors
RT: Digital rights management
Plagiarism
Public domain software
Publishing
Trademarks
Watermarking
NT: Intellectual property
Software protection

Coral reef

BT: Aquaculture

Core dumps

BT: System recovery

Core loss

UF: Core losses
BT: Energy loss
RT: Conductors
Transformers

Core losses

USE: Core loss

Core-shelf nanostructures

USE: Nanostructured materials

Cornea

BT: Eyes
RT: Ophthalmology

Corner cube prisms

USE: Retroreflectors

Corner detection

BT: Computer vision
Image processing
RT: Image edge detection
Motion detection

Corner-cube prisms

USE: Retroreflectors

Corona

BT: Electric breakdown
RT: Partial discharges

Corona virus

USE: Coronaviruses

Coronary arteriosclerosis

BT: Arteriosclerosis

Coronaviruses

UF: Corona virus
BT: Viruses (medical)
RT: Epidemics
Pandemics
NT: COVID-19

Corporate acquisitions

UF: Mergers
BT: Organizational aspects
RT: Business process re-

engineering

Corpse

USE: Cadaver

Corpus amygdaloideum

USE: Amygdala

Corpus callosum

UF: Callosal commissure
BT: Brain



JULY 2025 IEEE Thesaurus

Correlation

BT: Statistics
RT: Correlation coefficient
NT: Autocorrelation

Correlation coefficient

BT: Statistics
RT: Correlation
Regression analysis

Correlators

BT: Electromagnetic radiation
RT: Signal detection
Signal processing

Corrosion

BT: Surfaces
RT: Coatings
Corrosion inhibitors
Galvanizing
Grain boundaries
Magnetic flux leakage
Passivation

Corrosion inhibitors

BT: Inhibitors
Materials
RT: Corrosion
Galvanizing
Materials preparation
Materials processing

Corrugated surfaces

BT: Rough surfaces
Surfaces

Cortana

USE: Virtual assistants

Cortical bone

BT: Bone tissue

Cortical plasticity

USE: Neuroplasticity

Cosmic gamma ray bursts

USE: Gamma-ray bursts

Cosmic rays

BT: Extraterrestrial phenomena
RT: Electrons
Elementary particles
Mesons
Neutrons
Protons

Cost accounting

UF: Valuation
BT: Costing
Management accounting
RT: Costs
Economics
Profitability

Cost analysis

USE: Cost benefit analysis

Cost benefit analysis

UF: Cost analysis
Cost-benefit analysis
BT: Costs
RT: Functional point analysis

Cost function

BT: Optimization

Cost of living index

USE: Economic indicators

Cost-benefit analysis

USE: Cost benefit analysis

Cost-of-living index

USE: Economic indicators

Costing

UF: Capital cost reduction
Operating cost reduction
BT: Financial management
NT: Cost accounting

Costs

BT: Economics
RT: Cost accounting
Econometrics
Exchange rates
Levelized cost of energy
NT: Cost benefit analysis

Cotton

BT: Agricultural products
Textiles
RT: Natural fibers
Textile fibers
Textile industry
Weaving

Counseling

USE: Employee welfare



JULY 2025 IEEE Thesaurus

<i>Counselling</i>			Path planning
USE:	Employee welfare		
<i>Counterfeit goods</i>		<i>Course-correction</i>	
USE:	Counterfeiting AND Manufactured products	USE:	Course correction
Counterfeiting		Courseware	
UF:	Counterfeit goods	BT:	Educational technology
BT:	Computer crime	RT:	Authoring systems Computer aided instruction Hybrid learning Software
<i>Counters</i>		Covariance matrices	
USE:	Radiation detectors	UF:	Covariance matrix
Counting circuits		BT:	Statistics
BT:	Circuits	<i>Covariance matrix</i>	
RT:	Logic circuits Radiation detector circuits	USE:	Covariance matrices
<i>Coupled circuits</i>		COVID-19	
USE:	Coupling circuits	BT:	Coronaviruses
Coupled mode analysis		RT:	Pandemics Viruses (medical)
BT:	Circuit analysis	Cows	
RT:	Multiconductor transmission lines	UF:	Cattle
Couplers		BT:	Bovine
BT:	Communications	<i>CPR</i>	
technology		USE:	Cardiopulmonary resuscitation
RT:	Apertures Coupling circuits Electromagnetic coupling	<i>CPU</i>	
NT:	Directional couplers	USE:	Central Processing Unit
<i>Coupling (process)</i>		<i>CPW</i>	
USE:	Joining processes	USE:	Coplanar waveguides
Coupling circuits		<i>Cr</i>	
UF:	Coupled circuits	USE:	Chromium
BT:	Circuits	<i>Cramer Rao bound</i>	
RT:	Couplers	USE:	Cramer-Rao bounds
Couplings		<i>Cramer Rao bounds</i>	
UF:	Linkages	USE:	Cramer-Rao bounds
BT:	Mechanical products	Cramer-Rao bounds	
RT:	Fasteners Joining processes Machine components Shafts	UF:	Cramer Rao bound Cramer Rao bounds Cramer-Rao inequality Information inequality
Course correction		BT:	Estimation theory
UF:	Course-correction		
BT:	Navigation		
RT:	Aircraft navigation		



JULY 2025 IEEE Thesaurus

Cramer-Rao inequality

USE: Cramer-Rao bounds

Cranes

BT: Lifting equipment

Cranial

BT: Nervous system

NT: Cranial pressure

Cranial pressure

BT: Cranial

NT: Intracranial system

Cranium

BT: Head

Crawlers

BT: Web search

RT: Bot (Internet)

CRC codes

USE: Cyclic redundancy check codes

Creativity

BT: Innovation management

Credit cards

UF: American Express

Mastercard

Visa gold

BT: Financial management

Creep

BT: Material properties

CRF

USE: Conditional random fields

Criminal law

BT: Law

Crimping

BT: Joining processes

Crisis management

BT: Contingency management

CRISPR

UF: Clustered regularly interspaced short palindromic repeats

BT: Genetic engineering

RT: Gene therapy

Genetic mutations

Critical current density

BT: Superconductivity

RT: Superconducting materials

Thermal factors

Critical infrastructure

UF: Critical national infrastructure

BT: Public infrastructure

Critical national infrastructure

USE: Critical infrastructure

Crohn's disease

BT: Inflammatory bowel disease

RT: Ulcerative colitis

Crop yield

BT: Crops

Measurement units

RT: Agribusiness

Agriculture

Farming

Crops

BT: Agricultural products

Vegetation

RT: Fertilizers

Greenhouses

Irrigation

Water storage

Yield estimation

NT: Crop yield

Seeds (agriculture)

Cross cultural communication

USE: Cross-cultural communication

Cross layer design

UF: Cross-layer design

BT: Communication systems

RT: Ad hoc networks

Cellular radio

IEEE 802.16 Standard

Military communication

Radio communication

Cross modal retrieval

UF: Cross-modal retrieval

BT: Information retrieval

RT: Content-based retrieval

Data retrieval

Image retrieval

Music information retrieval



JULY 2025 IEEE Thesaurus

Query processing		Crowdfunding	
Search methods		UF:	Crowd funding
Visual information retrieval		BT:	Crowdsourcing
			Finance
<i>Cross phase modulation</i>		RT:	Entrepreneurship
USE:	Cross-phase modulation		Internet
			Investment
<i>Cross platform virtualization</i>			Project management
USE:	Application virtualization		
		Crowdsensing	
Cross-cultural communication		BT:	Crowdsourcing
UF:	Cross cultural	RT:	Collective intelligence
communication			Mobile computing
BT:	Global communication		
RT:	Cultural differences	Crowdsourcing	
		BT:	Federated learning
<i>Cross-layer design</i>			Internet
USE:	Cross layer design	RT:	Collective intelligence
			Distributed processing
<i>Cross-modal retrieval</i>			Mobile computing
USE:	Cross modal retrieval		Outsourcing
			Social computing
Cross-phase modulation			Social networking (online)
UF:	Cross phase modulation	NT:	Crowdfunding
	XPM		Crowdsensing
BT:	Optical modulation		Product development
	Phase modulation		
RT:	Kerr effect	<i>CRT</i>	
	Nonlinear optics	USE:	Cathode ray tubes
	Refractive index		
<i>Cross-platform virtualization</i>		Cruise control	
USE:	Application virtualization	BT:	Control systems
			Electromechanical systems
Cross-site scripting		RT:	Velocity control
UF:	XSS	<i>Cryobanking</i>	
BT:	Computer security	USE:	Cryopreservation
Crosstalk		Cryobiology	
UF:	Crosstalk noise	BT:	Biology
BT:	Interference		Temperature measurement
RT:	Electromagnetic		
interference		Cryogenic electronics	
	Interchannel interference	BT:	Industrial electronics
	Transmission line theory	RT:	Cryogenics
			Superconducting devices
<i>Crosstalk noise</i>			Superconducting materials
USE:	Crosstalk	Cryogenics	
		UF:	Cryonics
Crowd dynamics		BT:	Industry applications
BT:	Psychology		Temperature measurement
	Sociology	RT:	Cryogenic electronics
<i>Crowd funding</i>		NT:	Cryopreservation
USE:	Crowdfunding		Liquid nitrogen



JULY 2025 IEEE Thesaurus

Cryonics

USE: Cryogenics

Cryopreservation

UF: Cryobanking

BT: Cryogenics

Cryotherapy

BT: Medical treatment
Temperature measurement

Crypto currency

USE: Cryptocurrency

Cryptocurrency

UF: Crypto currency

BT: Cryptography

Currencies

RT: Blockchains

Digital economy

Digital systems

Distributed ledger

Finance

Fintech

Micropayments

Nonfungible tokens

Online banking

Proof of stake

NT: Bitcoin

Cryptograph

USE: Ciphers

Cryptographic

USE: Cryptography

Cryptographic accelerators

USE: Hardware acceleration

Cryptographic hash function

BT: Cryptography
Hash functions

Cryptographic protocols

BT: Protocols

Cryptography

UF: Cryptographic

BT: Data security

Security

RT: Bitcoin

Chaotic communication

Codes

Communication system

security

Computer security

Data handling

Encoding

Hash functions

Message authentication

Physical unclonable

function

Privacy

Quantum key distribution

Random sequences

Trust management

Blockchains

Brute force attacks

Chaotic mapping

Ciphers

Cryptocurrency

Cryptographic hash

function

Encryption

Multi-party computation

Nonce

Public key

Quantum cryptography

Random number

generation

S Box

Side-channel attacks

Steganography

Zero knowledge proof

Crystal growth

BT: Crystallization

RT: Epitaxial growth

Semiconductor growth

Crystal microstructure

BT: Crystals

RT: Electron backscatter

diffraction

Microstructure

Crystalline materials

BT: Materials

NT: Martensite

Nanocrystals

Perovskites

Superlattices

Crystallisation

USE: Crystallization

Crystallisers

USE: Crystallizers



JULY 2025 IEEE Thesaurus

Crystallization

UF: Crystallisation
BT: Crystallography
NT: Crystal growth

Crystallizers

UF: Crystallisers
BT: Chemical technology
RT: Chemical reactions
Colloidal crystals
Crystallography
Crystals

Crystallography

BT: Crystals
RT: Crystallizers
Diffraction
X-ray detectors
NT: Crystallization
Vacancy defects

Crystals

BT: Materials
RT: Crystallizers
Epitaxial growth
Materials science and
technology
growth
Molecular beam epitaxial
Phonons
Piezoelectric materials
Semiconductor materials
Solids
NT: Colloidal crystals
Crystal microstructure
Crystallography
Grain boundaries
Grain size
Liquid crystals
Quartz crystals

CSA Group

UF: Canadian Standards
Association
BT: Standards organizations

CSA Group Standards

BT: Standards publications

CSMA

USE: Multiaccess communication

CSP

USE: Chip scale packaging

CSTR

USE: Chemical reactions

CT scan

USE: Computed tomography

CTI

USE: Cyber threat intelligence

Cu

USE: Copper

CubeSat

BT: Small satellites

Cultural aspects

BT: Social implications of
technology
RT: Inclusive language
Museums
NT: Cultural competence
Cultural differences

Cultural competence

UF: Intercultural competence
BT: Cultural aspects
RT: Behavioral sciences
Cognition
Linguistics

Cultural differences

BT: Cultural aspects
Social implications of
technology
RT: Anthropology
Cross-cultural
communication
Developing countries
Digital divide
Ethnicity
Memetics
Museums
Social intelligence
Virtual museums

Curing

BT: Materials processing
RT: Heat treatment
Kilns

Currencies

BT: Finance
NT: Cryptocurrency



JULY 2025 IEEE Thesaurus

Current

UF: Electric current
 BT: Electric variables
 RT: Breakdown voltage
 Current control
 Current limiters
 Current measurement
 Current supplies
 Current transformers
 Electrosurgery
 NT: Bioimpedance
 Current slump
 Dark current
 Fault currents
 Inrush current
 Leakage currents
 Persistent currents
 Short-circuit currents
 Threshold current

Current control

UF: Current regulation
 BT: Electric variables control
 RT: Current
 Current measurement
 Regulators
 Switches
 Switchgear
 NT: Electric current control
 Electrical ballasts

Current crowding

USE: Proximity effects

Current density

BT: Current measurement
 RT: Density measurement
 Particle measurements
 NT: Skin effect

Current distribution

BT: Current measurement
 RT: Antenna theory

Current limiters

BT: Power electronics
 RT: Current
 Current measurement
 NT: Fault current limiters

Current measurement

UF: Electric current
 measurement
 BT: Electric variables
 measurement

RT: Ammeters
 Current
 Current control
 Current limiters
 Inrush current
 NT: Current density
 Current distribution

Current measurement (water)

USE: Sea measurements

Current mirrors

BT: Circuit topology

Current mode circuits

USE: Current-mode circuits

Current regulation

USE: Current control

Current slump

BT: Current

Current supplies

BT: Power supplies
 RT: Current

Current transformers

BT: Transformers
 RT: Current

Current voltage characteristics

USE: Current-voltage
 characteristics AND
 Electric variables

Current-mode circuits

UF: Current mode circuits
 BT: Integrated circuits

Current-voltage characteristics

UF: Current voltage
 characteristics
 BT: Electric variables

Curriculum development

BT: Educational courses
 RT: Educational programs
 STEM

Curve fitting

BT: Approximation methods
 Visualization
 RT: Computer graphics
 Interpolation



JULY 2025 IEEE Thesaurus

approximations	Least squares	<i>Cusum charts</i>	USE: Control charts
	Splines (mathematics)	<i>Cut-off frequency</i>	USE: Cutoff frequency
	Surface fitting	Cutoff frequency	UF: Cut-off frequency
<i>Custom integrated circuits</i>		BT: Integrated circuit modeling	
integrated circuits	USE: Application specific		
<i>Customer behavior</i>			
	USE: Consumer behavior	<i>Cutting fluids</i>	USE: Lubricants
<i>Customer behaviour</i>			
	USE: Consumer behavior	Cutting tools	BT: Production equipment
Customer profiles		RT: Blades	
management	BT: Customer relationship		Dies
	RT: Consumer behavior		Machine tools
	Market opportunities		Metalworking machines
Customer relationship management		NT: Metal cutting tools	
	BT: Management		Water jet cutting
	RT: Consumer behavior	<i>CVD</i>	USE: Chemical vapor deposition
	Consumer protection		
	Data-driven modeling	Cyanobacteria	BT: Bacteria
	Management information		
systems		<i>Cyber attack</i>	USE: Cyberattack
	Public relations		
	Quality management	<i>Cyber attacks</i>	USE: Cyberattack
	Supply chain management		
	NT: Customer profiles	<i>Cyber bullying</i>	USE: Cyberbullying
	Customer satisfaction		
	Customer services	<i>Cyber crime</i>	USE: Computer crime
	Market research		
	Stakeholders	<i>Cyber eavesdropping</i>	USE: Eavesdropping
Customer satisfaction			
	UF: Consumer satisfaction	Cyber espionage	UF: Cyber spying
	BT: Customer relationship		Cyberespionage
management	RT: Customer services		Cyberspying
	Electronic commerce	BT: Computer security	
	Market research		Information security
	Product customization	RT: Malware	
	Quality management		Trojan horses
	NT: Churn		
	Quality of experience	<i>Cyber ethics</i>	USE: Cyberethics
	Quality of service		
Customer services			
management	BT: Customer relationship		
	RT: Customer satisfaction		
	NT: Self-service		



JULY 2025 IEEE Thesaurus

Cyber forensics

USE: Digital forensics

Cyber harrassment

USE: Cyberbullying

cyber security

USE: Computer security

Cyber sickness

USE: Cybersickness

Cyber spying

USE: Cyber espionage

Cyber terrorism

UF: Cyberterrorism

BT: Computer crime
Terrorism

RT: Computer networks

Cyber threat intelligence

UF: CTI

BT: Computer crime

RT: Computer security
Cyberattack
Information integrity
Information security
Information sharing
Threat modeling

Cyber warfare

UF: Cyberwarfare

BT: Computer security

RT: Computer networks
Cyberattack
National security

Cyber-crime

USE: Computer crime

Cyber-physical systems

UF: Cyberphysical

BT: System of systems

RT: Collaboration
Control system security
Embedded systems
Human computer

interaction

Internet of Things
Operating systems
Smart cities
Smart grids
Wireless sensor networks

NT: Digital twins

Cyber-space

USE: Cyberspace

Cyberattack

UF: Cyber attack

Cyber attacks

BT: Computer crime

Computer security

RT: Cyber threat intelligence

Cyber warfare

Cyberethics

Security information and

event management

Threat modeling

US Department of

Homeland Security

NT: Session hijacking

Cyberbullying

UF: Cyber bullying

Cyber harrassment

Cyberharrassment

Internet bullying

Online bullying

BT: Cyberspace

Social computing

Social networking (online)

User experience

RT: Behavioral sciences

Cyberethics

Privacy

Social implications of

technology

Unsolicited e-mail

Cybercare

BT: Medical services

Cybercrime

USE: Computer crime

Cybereavesdropping

USE: Eavesdropping

Cyberespionage

USE: Cyber espionage

Cyberethics

UF: Cyber ethics

BT: Ethics

RT: Behavioral sciences

Cyberattack

Cyberbullying

Intellectual property

Privacy



JULY 2025 IEEE Thesaurus

technology	Social implications of		Internet
			Telematics
			Virtual reality
<i>Cyberforensics</i>			World Wide Web
USE:	Digital forensics	NT:	Cyberbullying
<i>Cyberharrassment</i>		<i>Cyberspying</i>	
USE:	Cyberbullying	USE:	Cyber espionage
Cybernetics		<i>Cyberterrorism</i>	
UF:	Biocybernetics	USE:	Cyber terrorism
BT:	Systems, man, and		
cybernetics		<i>Cyberwarfare</i>	
RT:	Automata	USE:	Cyber warfare
	Cognitive systems		
	Control systems	<i>Cyborgs</i>	
	Cyberspace	USE:	Human-machine systems
	Econometrics		
	Ergonomics	<i>Cycle sharing</i>	
	Human-machine systems	USE:	Shared transport
	Information theory		
	Learning systems	Cyclic redundancy check	
	Neural networks	BT:	Mathematics
	Radial basis function	RT:	Algorithms
networks			Data communication
	Robots		Error analysis
NT:	Adaptive systems		Error correction
	Cognitive informatics		Information theory
	Cognitive science		Noise
	Computational cybernetics	NT:	Cyclic redundancy check
	Control theory	codes	
	Econophysics		
	Emergent phenomena	Cyclic redundancy check codes	
	Intelligent control	UF:	CRC codes
	Linear feedback control	BT:	Codes
systems			Cyclic redundancy check
		RT:	Decoding
<i>Cyberphysical</i>			Error analysis
USE:	Cyber-physical systems		Error correction
<i>cybersecurity</i>		Cyclones	
USE:	Computer security	UF:	Polar cyclones
		BT:	Geoscience
		NT:	Hurricanes
			Tropical cyclones
Cybersickness		<i>Cyclonic storms</i>	
UF:	Cyber sickness	USE:	Tropical cyclones
BT:	Medical conditions		
	Virtual reality		
Cyberspace		Cyclostationary process	
UF:	Cyber-space	BT:	Signal processing
BT:	Communication networks		Statistics
	Computer networks		
RT:	Computers	Cyclotrons	
	Cybernetics	BT:	Particle accelerators
	Electromagnetics		



JULY 2025 IEEE Thesaurus

<i>Cyphers</i>	USE:	Ciphers		Transient response	
				Vibration control	
				Vibrations	
Cytometry	BT:	Cells (biology)	Dams	BT:	Geotechnical structures
		Measurement			Water storage
	RT:	Medical tests		RT:	Environmental
<i>Cytotherapy</i>			management		Hydroelectric power
USE:	Cell therapy		generation		Reservoirs
D-HEMTs	UF:	Depletion mode HEMTs			
		Depletion-mode HEMTs	<i>Dance</i>	USE:	Humanities
	BT:	HEMTs			
<i>D/A</i>	USE:	Digital-analog conversion	<i>DAO</i>	USE:	Decentralized autonomous
			organization		
<i>D/A conversion</i>	USE:	Digital-analog conversion	<i>dapp</i>	USE:	Decentralized applications
<i>D/A converters</i>	USE:	Digital-analog conversion	<i>DAQ</i>	USE:	Data acquisition
<i>D2D</i>	USE:	Device-to-device	Dark current	BT:	Current
communication					
Dairy products	UF:	Butter	Dark energy	BT:	Physics
		Cheese			
		Milk	Dark matter	BT:	Astrophysics
	BT:	Agricultural products			
		Food products	<i>Dark net</i>	USE:	Dark Web
	RT:	Agriculture			
		Fermentation			
Damascene integration	BT:	Electronic equipment	Dark states	BT:	Laser applications
manufacture					
	RT:	Very large scale integration	Dark Web	UF:	Dark net
<i>Dampers</i>	USE:	Shock absorbers		BT:	Darknet
				RT:	Internet
Damping	BT:	Mechanical factors			Overlay networks
	RT:	Hysteresis			Web services
		Impedance	<i>Darknet</i>	USE:	Dark Web
		Oscillators			
		Propagation	<i>DARPANET</i>	USE:	ARPANET
		Shock absorbers			
		Stability			
		Transfer functions			



JULY 2025 IEEE Thesaurus

Data acquisition

UF: DAQ
BT: Data systems
RT: Analog-digital conversion
Data handling
Data processing
High energy physics

instrumentation computing

Measurement
NT: Data transparency
Fastbus
User-generated content

Data aggregation

BT: Data collection
RT: Data assimilation
Data handling
Data integration
Database systems
Information management

Data analysis

UF: Data analytics
BT: Data processing
RT: Aerial computing
Big Data applications
Data collection
Data mining
Digital economy
Digital twins
Formal concept analysis
R language
Text categorization
Tiny machine learning
Trend analysis
NT: Business intelligence
Data augmentation
Data science
Functional data analysis
Itemsets
Training data

Data analytics

USE: Data analysis

Data assimilation

BT: Data handling
RT: Data aggregation
Meteorology

Data augmentation

BT: Data analysis
Data handling
RT: Deep learning
Image augmentation

Learning (artificial intelligence)

Machine learning
Synthetic data

Data authentication

USE: Message authentication

Data breach

UF: Data spill
BT: Information security
RT: Data security
Privacy breach
NT: Network intrusion

Data buses

UF: Computer buses
BT: Communication systems
Data communication
RT: CAMAC
Computer interfaces
IEEE 1394 Standard
NT: Backplanes

Data center power

BT: Data centers
Power systems

Data centers

UF: Data centres
BT: Data systems
NT: Data center power

Data centres

USE: Data centers

Data collection

UF: Data generation
BT: Data processing
RT: Blockchains
Data analysis
Information processing
Privacy enhancing

technologies

NT: Big Data
Data aggregation
Data lakes

Data communication

UF: Data transmission
BT: Communication systems
RT: Ad hoc networks
B-ISDN
CAMAC
Computer networks



JULY 2025 IEEE Thesaurus

interconnection		Cyclic redundancy check		Data conversion		
		Data dissemination	BT:		Data systems	
		Data security	RT:		Converters	
		Digital communication	NT:		Analog-digital conversion	
		Distributed computing			Digital-analog conversion	
		Extranets		Data dissemination		
		File servers	BT:		Data handling	
		Firewire			Information sharing	
		HTTP	RT:		Data communication	
		IEEE 1394 Standard			Data integration	
		ISDN			Mobile computing	
		Modems				
		Multiprocessor		Data encapsulation		
			BT:		Data handling	
communication	NT:	Office automation		Data engineering		
		Packet loss	BT:		Data systems	
		Personal area networks		Data enhancement		
		TCPIP	BT:		Data handling	
		Telecontrol equipment			Data integrity	
		Teletext				
		Videotex				
mode		Asynchronous		Data envelopment analysis		
		Asynchronous transfer	BT:		Linear programming	
		Data buses		Data flow computing		
		Data transfer	BT:		Multiprocessing systems	
		LoRa		<i>Data flow graphs</i>		
		Telecommunication buffers	USE:		Flow graphs	
		Telemetry		<i>Data freshness</i>		
		Teleprinting	USE:		Data integrity	
		Visible light communication		<i>Data fusion</i>		
			USE:		Data integration	
Data compression				<i>Data generation</i>		
	BT:	Data systems	USE:		Data collection	
	RT:	Encoding		Data gloves		
		Entropy coding	BT:		Haptic interfaces	
		Fourier series		Data governance		
		Quantization (signal)	BT:		Data handling	
		Rate-distortion			Organizational aspects	
		Streaming media	RT:		Business data processing	
		Transcoding			Data integrity	
	NT:	Video compression			Data models	
		Adaptive coding			Data privacy	
		Audio compression			Data protection	
		Huffman coding			Data security	
		Neural network			Database systems	
	compression		Point cloud compression			Quality management
		Source coding				
		Test data compression				
		Transform coding				
Data confidentiality						
	USE:	Data privacy				



JULY 2025 IEEE Thesaurus

NT:	Government policies	NT:	Data enhancement
			Non-repudiation
Data handling		Data lakes	
UF:	Electronic data interchange	UF:	Data swamp
BT:	Data systems	BT:	Data collection
RT:	Big Data	RT:	Big Data
	Cryptography		Data mesh
	Data acquisition		Data mining
	Data aggregation		Data warehouses
	Data processing		
	Data security		
	Encoding	Data mesh	
	Enterprise resource	BT:	Database systems
planning		RT:	Data integration
	General Data Protection		Data lakes
Regulation			Data structures
NT:	Data assimilation		Decentralized applications
	Data augmentation		Sociotechnical systems
	Data dissemination		
	Data encapsulation	Data mining	
	Data enhancement	BT:	Pattern recognition
	Data governance	RT:	Artificial intelligence
	Data ingestion		Big Data
	Data integrity		Business intelligence
	Data retrieval		Data analysis
	Document handling		Data lakes
	Merging		Data visualization
	Open data		Digital forensics
	Sorting		Knowledge discovery
	Turing completeness		NSL-KDD
			Naive Bayes methods
Data ingestion			Nearest neighbor methods
BT:	Data handling		Predictive analytics
RT:	Intake systems		R language
		NT:	Anomaly detection
<i>Data intake</i>			Association rule learning
USE:	Intake systems		Data privacy
			Process mining
Data integration			Text analysis
UF:	Data fusion		Text mining
BT:	Data processing		Web mining
RT:	Data aggregation		
	Data dissemination	Data models	
	Data mesh	BT:	Modeling
		RT:	Data governance
			Database systems
Data integrity			Semantic Web
UF:	Data freshness		Semantic technology
	Data quality	NT:	Data-driven modeling
BT:	Computer security		High dimensional data
	Data handling		Metadata
RT:	Data governance		NSL-KDD
	Decentralized identity		
	Digital preservation		
	Quality assurance		
	Quality control		



JULY 2025 IEEE Thesaurus

Data over cable service interface specification

UF: DOCSIS
BT: Communication standards

Differential privacy
Information security
Privacy
NT: General Data Protection

Regulation

Data preprocessing

BT: Data processing

Data quality

USE: Data integrity

Data privacy

UF: Data confidentiality
Privacy preserving data

Data representation

USE: Data visualization

mining

BT: Data mining
RT: Data governance
Decentralized identity
Digital policy
Privacy
Privacy enhancing

Data retrieval

BT: Data handling
RT: Cross modal retrieval
Information retrieval
Query processing

technologies

NT: Synthetic data
Threat modeling
Data protection
Differential privacy

Data science

BT: Data analysis
RT: Knowledge discovery
Neuroinformatics
NT: Concept drift

Data processing

BT: Data systems
RT: CAMAC
Computers and information

Data security

UF: Security of data
System privacy

processing

Data acquisition
Data handling
Database systems
Enterprise resource

management

BT: Security
RT: Communication system

security

Computer crime
Computer network

planning

NT: Signal processing
Smart cards
Technology management
Associative processing
Business data processing
Data analysis
Data collection
Data integration
Data preprocessing
Data transfer
Information exchange
Spreadsheet programs
Text processing
Virtual enterprises

management

Computer security
Data breach
Data communication
Data governance
Data handling
Data protection
Decentralized identity
Network intrusion
Privacy
Privacy breach
Security information and

event management

NT: Threat modeling
Virtual private networks
Cryptography
Message authentication
Tokenization

Data protection

BT: Data privacy
RT: Computer security
Data governance
Data security
Decentralized identity

Data sources

USE: Soft sensors



JULY 2025 IEEE Thesaurus

Data spill

USE: Data breach

Data storage

USE: Memory

Data storage systems

USE: Buffer storage

Data structures

BT: Computer architecture
RT: Computer languages
Data mesh
Database systems
File systems
NoSQL databases
NT: Arrays
Binary decision diagrams
Null value
Octrees
Persistent identifiers
Table lookup
Tree data structures

Data swamp

USE: Data lakes

Data systems

BT: Computers and information processing
Information systems
RT: Big Data applications
NT: Buffer storage
Data acquisition
Data centers
Data compression
Data conversion
Data engineering
Data handling
Data processing
Data warehouses

Data transfer

BT: Data communication
Data processing
RT: Packet switching
NT: Handover
Simultaneous wireless information and power transfer

Data transmission

USE: Data communication

Data transparency

BT: Data acquisition

Data visualisation

USE: Data visualization

Data visualization

UF: Data representation
Data visualisation
BT: Computer graphics
User interfaces
RT: Biomedical imaging
Data mining
Graph neural networks
Modeling
R language
NT: Graph drawing
Heat maps
Isosurfaces

Data warehouses

BT: Data systems
RT: Data lakes
NoSQL databases

Data-driven modeling

BT: Data models
Modeling
RT: Customer relationship management

Database languages

UF: Query languages
BT: Computer languages
RT: Database systems
NT: Structured Query Language

Database machines

BT: Computers and information processing
RT: Database systems
Information systems

Database management systems

USE: Database systems

Database systems

UF: Database management systems
Technical data
management
BT: Databases
Information systems
RT: Data aggregation
Data governance
Data models
Data processing
Data structures



JULY 2025 IEEE Thesaurus

	Database languages	RT:	Pulse width modulation
	Database machines		Rotating machines
	File systems		
	Hypertext systems	DC machines	
	Information architecture	UF:	Direct current machines
	Linked data	BT:	Electric machines
	Triples (Data structure)	RT:	Pulse width modulation
NT:	Audio databases		Sensorless control
	Data mesh	NT:	DC generators
	Deductive databases		DC motors
	Image databases		Homopolar machines
	Indexes		
	Multimedia databases	DC motors	
	NoSQL databases	UF:	Direct current motors
	Object oriented databases	BT:	DC machines
	Query processing		Motors
	Sharding	RT:	Pulse width modulation
			Pulse width modulation
Databases		inverters	
BT:	Professional		Space vector pulse width
communication		modulation	
NT:	Database systems	NT:	Brushless DC motors
	Deductive databases		Commutators
	Distributed databases		
	Image databases	DC power transmission	
	Multimedia databases	UF:	Direct current power
	Object oriented databases	transmission	
	Relational databases	BT:	Power transmission
	Spatial databases	RT:	DC distribution systems
	Transaction databases		
	Visual databases	DC-AC power converters	
Daylighting		UF:	DC-AC power convertors
BT:	Lighting	BT:	Converters
			Power conversion
		RT:	Microinverters
<i>DBR</i>		<i>DC-AC power converters</i>	
USE:	Distributed Bragg reflectors	USE:	DC-AC power converters
<i>DBS</i>		<i>DC-DC converters</i>	
USE:	Satellite broadcasting	USE:	DC-DC power converters
DC distribution systems		<i>DC-DC power conversion</i>	
BT:	Network systems	USE:	DC-DC power converters
	Power distribution		
RT:	DC power transmission	DC-DC power converters	
	HVDC transmission	UF:	DC-DC converters
	Power transmission lines		DC-DC power conversion
			DC-DC power convertors
<i>DC fast charging</i>		BT:	Power conversion
USE:	Fast charging	RT:	Machine vector control
			Pulse width modulation
DC generators		inverters	
UF:	Direct current generators	NT:	Buck converters
BT:	DC machines		
	Generators		



JULY 2025 IEEE Thesaurus

DC-DC power convertors

USE: DC-DC power converters

Machining

Polishing machines

DCT

USE: Discrete cosine transforms

Decarbonisation

USE: Low carbon economy

DDoS

USE: Distributed denial-of-service attack

Decarbonised economy

USE: Low carbon economy

DDos attack

USE: Denial-of-service attack

Decarbonization

USE: Low carbon economy

DDSM

USE: Delta-sigma modulation

Decarbonized economy

USE: Low carbon economy

De broglie hypothesis

USE: Matter waves

Decentralised applications

USE: Decentralized applications

De Broglie methods

USE: Matter waves

Decentralised apps

USE: Decentralized applications

De-noising

USE: Noise reduction

Decentralised autonomous organization

USE: Decentralized autonomous organization

Dead reckoning

BT: Navigation

Decentralised control

USE: Decentralized control

Deadlocks (computers)

USE: System recovery

Decentralised identity

USE: Decentralized identity

Deafness

BT: Medical conditions

RT: Sign language

Decentralized applications

UF: Decentralised applications

Decentralised apps

Decentralized apps

dapp

Death

BT: Pathological processes

NT: Asphyxia

BT: Application software

Distributed computing

RT: Consensus control

Data mesh

Peer-to-peer computing

Smart contracts

Death rate

USE: Mortality

Deblurring

BT: Image restoration

RT: Image dehazing

Image quality

Superresolution

Video restoration

Decentralized apps

USE: Decentralized applications

Decentralized autonomous organization

UF: DAO

Decentralised autonomous

organization

BT: Organizations

RT: Blockchains

Debugging

BT: System recovery

Deburring

BT: Surface finishing

RT: Drilling

Decentralized control

UF: Decentralised control



JULY 2025 IEEE Thesaurus

	Distributed control	Persuasive systems
	Distributed generation	Trust management
	Distributed modeling	
BT:	Control systems	Decision support systems
RT:	Flexible structures	BT: Decision making
NT:	Consensus control	Information systems
	Distributed parameter	RT: Competitive intelligence
systems		Knowledge based systems
		MCDM
Decentralized identity		
UF:	Decentralised identity	
BT:	Digital control	Decision theory
RT:	Blockchains	BT: Statistics
	Data integrity	RT: Probability
	Data privacy	Statistical analysis
	Data protection	Statistical learning
	Data security	NT: Decision making
	Digital management	Decision trees
	Identity management	TOPSIS
systems		Weighted sum model
	Information management	
	Information security	Decision trees
	Privacy	UF: Tree searching
	Semantic Web	BT: Decision theory
		RT: Random forests
		NT: Classification tree analysis
Decision analysis		Regression tree analysis
BT:	Decision making	
	Information analysis	<i>Decoder</i>
RT:	MCDM	USE: Decoding
Decision feedback equalizers		
BT:	Equalizers	
Decision making		Decoding
BT:	Decision theory	UF: Decoder
RT:	Deep reinforcement	BT: Information theory
learning		RT: Autoencoders
	Expert systems	Codecs
	Fish schools	Codes
	Fuzzy cognitive maps	Cyclic redundancy check
	Planning	
	Risk analysis	codes
	Signal detection	Demodulation
	Stakeholders	Parity check codes
	Strategic planning	Product codes
	TOPSIS	Signal processing
	User preference	Space-time codes
NT:	Analytic hierarchy process	Speech codecs
	Collective intelligence	Video codecs
	Decision analysis	NT: Maximum likelihood
	Decision support systems	decoding
	Distributed decision making	
	Game theory	Decontamination
	MCDM	BT: Materials handling
	Pattern classification	RT: Chemical technology
		Contamination
		Environmental monitoring
		Pollution control
		Purification



JULY 2025 IEEE Thesaurus

Deconvolution

BT: Inverse problems
RT: Convolution
Integral equations
Numerical analysis
Signal processing
Signal restoration

recognition

Fine-grained image

Generative Pre-trainer

transformer

Graph neural networks
Image classification
Image segmentation
Large language models
Learning systems
Model compression
Neural networks
Recurrent neural networks
Reinforcement learning
Semantic segmentation
Supervised learning
Unsupervised learning
Batch normalization
Deep reinforcement

Decorrelation

BT: Signal processing

Dedicated short range communication

UF: DSRC
BT: Wireless communication
RT: Intelligent vehicles
On board unit
Vehicular ad hoc networks

NT:

Deductive databases

UF: Intelligent databases
BT: Database systems
Databases
RT: Knowledge based systems

learning

Few shot learning
Neural radiance field
Zero shot learning

Deep architecture

UF: Deep learning architecture
BT: Software architecture
Systems architecture
RT: Machine learning
Neural networks
NT: Deep learning

Deep learning architecture

USE: Deep architecture

Deep level transient spectroscopy

BT: Semiconductor materials
Spectroscopy

Deep neural networks

USE: Artificial neural networks

Deep brain stimulation

BT: Brain stimulation
Neurosurgery
RT: Neural implants
Neurostimulation

Deep reinforcement learning

BT: Deep learning
Machine learning
Reinforcement learning
RT: Decision making

Deep etching

USE: Etching

Deep space

USE: Deep-space
communications

Deep fake

USE: Deepfakes

Deep structured learning

USE: Deep learning

Deep learning

UF: Deep structured learning
Hierarchical learning
BT: Deep architecture
Machine learning
RT: Attention mechanisms
Behavior recognition
Convolutional neural

Deep-space communications

UF: Deep space
BT: Space communications
RT: Telemetry

networks

Data augmentation
Feature extraction

Deepfakes

UF: Deep fake
BT: Fake news
Videos



JULY 2025 IEEE Thesaurus

RT:	Information integrity Photorealism	Delay effects	UF:	Time delay
Defect detection			BT:	Electromagnetic analysis
BT:	Detection algorithms		RT:	Delay lines Delay systems Distortion Phase distortion Propagation delay
<i>Defence industry</i>			NT:	
USE:	Defense industry			
Defense industry		Delay estimation		
UF:	Defence industry	BT:	Delays	
BT:	Industries	RT:	Computer networks Multiaccess communication Speech processing	
RT:	Military equipment Weapons			
Defibrillation		Delay lines		
BT:	Medical treatment	BT:	Delay systems	
RT:	Cardiology Fibrillation	RT:	Delay effects	
<i>Definitions</i>		<i>Delay lock loops</i>		
USE:	Terminology	USE:	Tracking loops	
Deforestation		Delay systems		
UF:	Forest clearance Forest clearing	BT:	Control systems	
BT:	Agricultural engineering Environmental degradation Forestry Land use planning	RT:	Delay effects Telerobotics Added delay Delay lines	
RT:	Rainforests Reforestation	NT:		
Deformable models		Delays		
BT:	Modeling	BT:	Timing	
Deformation		RT:	Quality of transmission	
BT:	Mechanical factors	NT:	Delay estimation	
RT:	Electron backscatter	<i>Delivery of goods</i>		
diffraction		USE:	Product delivery	
Degenerative disc disease		Delta modulation		
BT:	Medical conditions	BT:	Analog-digital conversion Digital signal processing Delta-sigma modulation Sigma-delta modulation	
RT:	Spine	NT:		
Degenerative diseases		<i>Delta sigma</i>		
BT:	Diseases	USE:	Sigma-delta modulation	
Degradation		<i>Delta sigma modulators</i>		
BT:	Materials science and technology	USE:	Delta-sigma modulation	
NT:	Desertification	Delta-sigma modulation		
Delamination		UF:	DDSM Delta sigma modulators Delta-sigma modulators	
BT:	Materials testing	BT:	Delta modulation	



JULY 2025 IEEE Thesaurus

Delta-sigma modulators

USE: Delta-sigma modulation

Demagnetisation

USE: Demagnetization

Demagnetization

UF: Demagnetisation

BT: Magnetics

Demand forecasting

BT: Forecasting

RT: Production planning

Demand response

BT: Power demand

Demand side management

BT: Energy management

RT: Power system planning
Vehicle-to-grid

Dementia

BT: Medical conditions

NT: Alzheimer's disease

Demodulation

UF: Demodulators

BT: Modulation

RT: Amplitude modulation

Decoding

Detectors

Frequency modulation

Mixers

Modems

Phase modulation

Pulse modulation

Receivers

Signal detection

Demodulators

USE: Demodulation

Demography

BT: Social factors

NT: Population density

Dempster?Shafer theory

USE: Evidence theory

Demultiplexing

BT: Multiplexing

RT: Arrayed waveguide gratings

Dendrites (neurons)

UF: Dendrons

BT: Neurons

Dendrons

USE: Dendrites (neurons)

Dengue fever

BT: Diseases

Denial-of-service attack

UF: DDos attack

DoS attack

BT: Communication system

security

Computer security

RT: Proof of Work

NT: Distributed denial-of-service

attack

Denitrification

BT: Nitrogen

Denoising

USE: Noise reduction

Density estimation robust algorithm

UF: DER

BT: Algorithms

Density function

USE: Density functional theory

Density function theory

USE: Density functional theory

Density functional theory

UF: Density function

Density function theory

Density-function

BT: Quantum mechanics

Density measurement

BT: Measurement

RT: Bone density

Current density

Pressure gauges

NT: Hydrometers

Population density

Density-function

USE: Density functional theory

Dental

USE: Dentistry



JULY 2025 IEEE Thesaurus

Dentistry

UF: Dental
BT: Medical treatment

Deny lists

USE: Blocklists

Deoxyribonucleic acid

USE: DNA

Dependability management

BT: Management
RT: Reliability
Safety management

Depletion mode HEMTs

USE: D-HEMTs

Depletion-mode HEMTs

USE: D-HEMTs

Deployable structures

USE: Flexible structures

Depression

UF: Major depressive disorder
BT: Medical conditions
RT: Psychiatry

Depth estimation

USE: Depth measurement

Depth measurement

UF: Depth estimation
BT: Measurement
RT: Distance measurement
Geophysical measurements
Semiconductor device

measurement

DER

USE: Density estimation robust

algorithm

Derailments

USE: Railway accidents

Dermatology

BT: Medical specialties
RT: Psoriasis

Dermis

BT: Skin

Desalination

BT: Water conservation
Water resources
RT: Reverse osmosis

Description logic

BT: Knowledge representation
Ontologies

Descriptive statistics

BT: Statistical analysis
RT: Inferential statistics

Desertification

BT: Degradation
RT: Deserts

Deserts

BT: Geography
RT: Desertification

Design

USE: Design methodology

Design automation

UF: CAD
Circuit CAD
Circuit design (CAD)
Circuit layout CAD
Computer aided design
Computer-aided design
Electronic design

automation and methodology

RT: Automatic test pattern

generation

Circuit simulation
Design tools
EMTDC
Hardware design

languages

Laser sintering

SPICE

NT: CAD/CAM

Logic design

PSCAD

Design engineering

BT: Engineering - general
RT: Building information

management

Design optimization

Digital twins

NT: Design tools



JULY 2025 IEEE Thesaurus

Design for disassembly

BT: Design methodology
RT: Pollution
Process design
Product design
Waste reduction

Design for experiments

BT: Design methodology

Design for manufacturability

USE: Design for manufacture

Design for manufacture

UF: Design for manufacturability
BT: Design methodology
RT: Design tools

Design for quality

BT: Design methodology
RT: Process design
Product design
Quality assurance
Quality control
Quality management
Total quality management

Design for testability

UF: Design-for-test
Design-for-testability
Design-for-testing
BT: Design methodology
RT: Built-in self-test
Combinatorial testing
Logic design
Logic testing

Design methodology

UF: Design
BT: Electronic design
automation and methodology
RT: Ergonomics
Industrial engineering
Logic design
Optical design techniques
Rapid prototyping
System analysis and design
NT: Design for disassembly
Design for experiments
Design for manufacture
Design for quality
Design for testability
Design standards
Design tools
Extensibility

Graphics
Green design
Integrated design
Inverse design
Process design
Product design
Prototypes
Technical drawing
Time to market
User centered design
Virtual prototyping

Design optimization

BT: Optimization methods
RT: Design engineering
NT: Constraint optimization
Space mapping

Design standards

BT: Design methodology

Design tools

BT: Design engineering
Design methodology
RT: Design automation
Design for manufacture
Instruments
Media
Product design
Visualization

Design-for-test

USE: Design for testability

Design-for-testability

USE: Design for testability

Design-for-testing

USE: Design for testability

Desktop publishing

BT: Electronic publishing
Publishing
RT: Document handling
Office automation
Page description languages
Text processing

Detection (signal)

USE: Signal detection

Detection algorithms

BT: Algorithms
NT: Defect detection



JULY 2025 IEEE Thesaurus

Detectors

BT: Sensor systems and applications
RT: Chemical sensors
Demodulation
Fall detection
Nonlinear filters
Readout electronics
NT: Envelope detectors
Semiconductor detectors

Deuterium

BT: Hydrogen

Developing countries

BT: Economics
Social factors
RT: Cultural differences
Digital divide
Globalization
Government policies
International trade
Investment

Device chargers

USE: Battery chargers

Device drivers

BT: Input-output programs
RT: Computer peripherals

Device under test

UF: Equipment under test
Unit under test
BT: Testing

Device-to-device communication

UF: D2D
BT: Communication systems
RT: Base stations
Cellular networks
Sidelink

DevOps

BT: Information technology
Software development
management

Dew computing

UF: Cloud-dew architecture
Cloud-dew computing
Dew servers
BT: Distributed processing
Software architecture
RT: Client-server systems

Cloud computing
Edge computing

Dew servers

USE: Dew computing

DFA

USE: Doped fiber amplifiers

DFIG

USE: Doubly fed induction generators

DFT

USE: Discrete Fourier transforms

DGPS

USE: Global Positioning System

DH-HEMTs

UF: Double heterojunction

HEMTs

BT: HEMTs

DHBTs

USE: Double heterojunction bipolar transistors

Diabetes

UF: Diabetic
BT: Medical conditions
RT: Endocrinology
Insulin pumps
NT: Diabetic retinopathy
Gestational diabetes

Diabetic

USE: Diabetes

Diabetic retinopathy

BT: Diabetes
Retinopathy
RT: Retinal vessels

Diacs

USE: Thyristors

Diagnosis (medical)

USE: Medical diagnosis

Diagnostic expert systems

BT: Expert systems
RT: Failure analysis
Fault diagnosis



JULY 2025 IEEE Thesaurus

Diagnostic radiography

BT: Radiography
RT: Attenuation
Magnetic resonance
imaging
Medical diagnosis
X-ray detection

Diakoptics

BT: System analysis and design

Diamagnetic materials

BT: Magnetic materials

Diamond

BT: Carbon

Diamond carbon

USE: Diamond-like carbon

Diamond like carbon

USE: Diamond-like carbon

Diamond-like carbon

UF: Diamond carbon
Diamond like carbon
Hard amorphous carbon
BT: Amorphous materials
RT: Biomedical materials
Thin films
Tissue engineering

DICOM

UF: Digital Imaging and
Communications in Medicine
BT: Biomedical imaging
Digital communication

Dictionaries

BT: Information services
Terminology
Writing

Dictionary learning

USE: Machine learning

Didi

USE: Ride hailing

Die attach

USE: Microassembly

Die bonding

USE: Microassembly

Die casting

BT: Casting
RT: Automobile manufacture
Dies
Materials handling
Melt processing
Metals

Dielectric barrier discharges

USE: Discharges (electric)

Dielectric breakdown

UF: Dielectric strength
Voltage breakdown
BT: Electric breakdown
RT: Dielectric measurement
Insulation
Lightning
NT: Arc discharges
Discharges (electric)
Electrostatic discharges
Flashover
Glow discharges
Partial discharges
Surface discharges
Vacuum breakdown

Dielectric constant

BT: Dielectrics
RT: Capacitors
Permittivity
NT: High-k gate dielectrics

Dielectric devices

BT: Dielectrics
RT: Dielectric materials
Dielectric resonator

antennas

Electrets
NT: Capacitors
Ferroelectric devices
Piezoelectric devices
Pyroelectric devices

Dielectric elastomer actuators

BT: Actuators
NT: Dielectric elastomers

Dielectric elastomers

UF: Smart elastomers
BT: Dielectric elastomer

actuators

RT: Smart materials



JULY 2025 IEEE Thesaurus

Dielectric electroactive polymer actuators

USE: Actuators

Dielectric films

BT: Dielectric materials
Films

RT: Planarization
Thick films
Thin films

NT: Dielectric thin films
Piezoelectric films

Dielectric liquids

UF: Liquid insulation
BT: Dielectric materials

Dielectric loss measurement

BT: Dielectric measurement
RT: Dielectric losses

Dielectric losses

UF: Dielectric loss
BT: Dielectrics
RT: Dielectric loss

measurement

Insulation

Dielectric materials

UF: Antiferroelectric materials
Paraelectric materials
BT: Materials
RT: Ceramics

Dielectric devices
Dielectric thin films
Electrohydrodynamics
Electrokinetics
Ferroelectric materials
Glass
Insulation
Loaded waveguides
Permittivity
Plastic insulation
NT: Dielectric films
Dielectric liquids
Electrets
Epoxy resins
High-k dielectric materials
Piezoelectric materials

Dielectric measurement

UF: Dielectric measurements
BT: Electric variables

measurement

RT: Capacitance measurement
Dielectric breakdown

measurements

NT: Dielectric loss

measurement

Electromagnetic

Permittivity measurement

Dielectric measurements

USE: Dielectric measurement

Dielectric properties

USE: Dielectrics

Dielectric resonator antennas

BT: Antennas
RT: Dielectric devices
Resonance

Dielectric strength

USE: Dielectric breakdown

Dielectric substrate

USE: Dielectric substrates

Dielectric substrates

UF: Dielectric substrate
BT: Dielectrics

Dielectric thin films

BT: Dielectric films
RT: Dielectric materials
Polymer films
Semiconductor films

Dielectrics

UF: Dielectric properties
Electrical insulation
BT: Dielectrics and electrical

insulation

NT: Dielectric constant
Dielectric devices
Dielectric losses
Dielectric substrates
Dielectrophoresis
Electrohydrodynamics
Electrokinetics
Electrostriction

Dielectrics and electrical insulation

NT: Dielectrics
Electric breakdown
Electromagnetic fields
Insulation

Dielectrophoresis

BT: Dielectrics



JULY 2025 IEEE Thesaurus

Dielectric loss

USE: Dielectric losses

Dies

UF: Dies (machine tools)

BT: Machine tools

RT: Cutting tools

Die casting

Presses

Dies (machine tools)

USE: Dies

Diesel engines

BT: Internal combustion

engines

RT: Automotive engineering

Difference engines

BT: Calculators

Difference equations

BT: Equations

RT: Discrete-time systems

Numerical analysis

Piecewise linear techniques

Differential algebraic equations

BT: Differential equations

Differential amplifiers

BT: Amplifiers

Differential diagnosis

BT: Medical diagnosis

Differential equations

BT: Calculus

RT: Differential games

Higher order statistics

Integrodifferential equations

Numerical analysis

Predator prey systems

Stability analysis

Time invariant systems

NT: Differential algebraic

equations

Differential operators

Navier-Stokes equations

Ordinary differential

equations

Partial differential equations

Transfer functions

Differential games

BT: Game theory

RT: Differential equations

Differential gears

USE: Gears

Differential GPS

USE: Global Positioning System

Differential operators

BT: Differential equations

Differential phase shift keying

UF: DPKS

Differential phase-shift

keying

BT: Phase modulation

Differential phase-shift keying

USE: Differential phase shift

keying

Differential privacy

BT: Data privacy

Statistics

RT: Data protection

Information security

Privacy

Differential quadrature phase shift keying

BT: Quadrature phase shift

keying

Differentiated services networks

USE: Diffserv networks

Diffraction

UF: Wave diffraction

BT: Interference

RT: Bragg gratings

Crystallography

Fourier transforms

X-ray detection

NT: Electron backscatter

diffraction

Diffraction gratings

BT: Optical diffraction

RT: Bragg gratings

DiffServ

USE: Diffserv networks



JULY 2025 IEEE Thesaurus

Diffserv networks

UF: DiffServ
Differentiated services
networks
BT: Computer networks
Distributed computing
RT: Internet
Multimedia communication

Diffuse reflectance spectra

USE: Diffuse reflectance
spectroscopy

Diffuse reflectance spectroscopy

UF: Diffuse reflectance spectra
BT: Reflectivity
Spectroscopy

Diffusion bonding

BT: Bonding processes
RT: Ceramics

Diffusion models

UF: Diffusion probabilistic
models
BT: Machine learning

Diffusion probabilistic models

USE: Diffusion models

Diffusion processes

BT: Semiconductor device
manufacture
RT: Brownian motion
Buffer layers
Charge carrier processes
Image denoising
Image processing
Stochastic processes
NT: Electromigration

Diffusion tensor imaging

UF: DT-MRI
DTI
Diffusion tensor magnetic
resonance imaging
BT: Magnetic resonance
imaging
RT: Brain

Diffusion tensor magnetic resonance imaging

USE: Diffusion tensor imaging

Digestive system

BT: Anatomy

RT: Endomicroscopy
Inflammatory bowel disease
Microbiome
NT: Colon
Esophagus
Gallbladder
Gastrointestinal tract
Intestines
Liver
Mouth
Pancreas
Pharynx
Stomach
Tongue

Digital age

USE: Information age

Digital agriculture

USE: Smart agriculture

Digital alloys

BT: Metals

Digital arithmetic

UF: Computer arithmetic
BT: Arithmetic
RT: Calculators
Coprocessors

Digital art

BT: Art
RT: Virtual museums

Digital audio broadcasting

UF: Digital audio broadcasts
Podcast
BT: Broadcasting
Digital communication
RT: Audio systems
HDMI
Portable media players
NT: Digital Radio Mondiale
Digital audio players

Digital audio broadcasts

USE: Digital audio broadcasting

Digital audio players

UF: MP3
BT: Digital audio broadcasting

Digital camera

USE: Digital cameras



JULY 2025 IEEE Thesaurus

Digital cameras

UF: Digital camera
BT: Cameras
RT: Digital photography

Digital certificates

USE: Public key

Digital circuits

BT: Circuits
RT: Digital computers
Logic circuits
Pulse circuits
Register transfer level
Switching circuits
NT: Circuit topology
Digital integrated circuits

Digital communication

UF: Digital radio
BT: Communication systems
RT: Bluetooth
Data communication
Digital recording
Musical instrument digital

interfaces

Synchronous digital

hierarchy

NT: TCPIP
Teleprinting
Baseband
DICOM
DSL
Digital audio broadcasting
Digital images
Digital multimedia

broadcasting

Digital video broadcasting
ISDN
Passband
Portable media players
SONET
Spread spectrum

communication

Digital computers

BT: Computers
RT: Digital circuits
Digital systems
Digital-analog conversion
Parallel processing
Programming
Turing machines
NT: Mainframes

Digital control

UF: Computer control
BT: Control systems
RT: Computer numerical control
NT: Decentralized identity
Programmable control

Digital currency

USE: Online banking

Digital data

USE: Digital information

Digital devices

USE: Personal digital devices

Digital divide

UF: Digital inclusion
BT: Sociology
RT: Cultural differences
Developing countries
Economics
Ethical aspects
Gender issues
Social factors
Social implications of

technology

Digital economy

BT: Economics
RT: Artificial intelligence
Business
Cryptocurrency
Data analysis
Digital systems
Electronic commerce
Information technology
Internet
Internet of Things
Online banking
NT: Blockchains

Digital elevation modeling

USE: Digital elevation models

Digital elevation models

UF: Digital elevation modeling
Digital terrain model
Digital terrain modeling
Digital terrain models
BT: Modeling
Terrain mapping

Digital factories

USE: Virtual manufacturing



JULY 2025 IEEE Thesaurus

Digital filters

BT: Filters
RT: Frequency response
Line enhancers
Optical resonators
Transversal filters
NT: Finite impulse response

filters

Digital forensics

UF: Cyber forensics
Cyberforensics
BT: Forensics
RT: Computer security
Data mining
Law enforcement
Non-repudiation

Digital governance

USE: Digital policy

Digital health

USE: Electronic healthcare

Digital healthcare

USE: Electronic healthcare

Digital humans

BT: Avatars
RT: Artificial intelligence
Chatbots
Conversational artificial

intelligence

interaction

processing

Human computer

Human factors
Natural language

Social factors
Virtual assistants
Virtual reality

Digital images

UF: Digital imaging
BT: Digital communication
NT: Pixel
Virtual museums

Digital imaging

USE: Digital images

Digital Imaging and Communications in Medicine

USE: DICOM

Digital inclusion

USE: Digital divide

Digital information

UF: Digital data
BT: Information management
RT: Digital systems
Information systems
Symbols

Digital integrated circuits

BT: Digital circuits
Integrated circuits
RT: Adders
Logic circuits
Multiplying circuits
NT: Integrated memory circuits

Digital intelligence

UF: Digital literacy
BT: Human intelligence
Human-machine systems
RT: Behavioral sciences
Cognition
Competitive intelligence
Digital systems
Ethics
Human factors
Psychology
Social intelligence

Digital literacy

USE: Digital intelligence

Digital magnetic recording

BT: Magnetic recording

Digital management

BT: Management
RT: Decentralized identity

Digital microfluidic biochips

BT: Biochips

Digital micromirror devices

USE: Micromirrors

Digital modulation

BT: Modulation
NT: Constellation diagram
Partial response signaling

Digital multimedia broadcasting

UF: DMB



JULY 2025 IEEE Thesaurus

broadcasts
 BT: Broadcasting
 Digital communication
 RT: Cellular radio
 Convolutional codes
 Digital TV
 MPEG 4 Standard
 MPEG 7 Standard
 MPEG standards
 Multimedia communication
 Radio broadcasting
 Video on demand

Digital multimedia broadcasts

 USE: Digital multimedia
 broadcasting

Digital photography

 BT: Photography
 RT: CCD image sensors
 Cameras
 Digital cameras
 Transform coding
 Virtual museums

Digital policy

 UF: Digital governance
 Internet governance
 BT: Digital systems
 Guidelines
 RT: Computer security
 Data privacy
 Government policies
 Information security
 Privacy

Digital preservation

 BT: Digital systems
 Information management
 RT: Data integrity
 Virtual museums

Digital printing

 BT: Printing
 RT: Publishing

Digital publishing

 USE: Electronic publishing

Digital radio

 USE: Digital communication

Digital Radio Mondiale

 BT: Digital audio broadcasting

Digital recording

 BT: Recording
 RT: Digital communication
 Digital systems
 Virtual museums

Digital relays

 BT: Relays

Digital representation

 BT: Encoding
 Image representation
 Information representation
 RT: Augmented reality
 Quantization (signal)
 Virtual museums
 Virtual reality

Digital rights management

 BT: Intellectual property
 RT: Computer crime
 Copyright protection
 Software protection

Digital sequences

 USE: Sequences

Digital signal processing

 UF: DSP
 BT: Signal processing
 RT: Aerospace and electronic

systems

 Digital TV
 Fast Fourier transforms
 OFDM
 NT: Delta modulation
 Digital signal processing

chips

Digital signal processing chips

 BT: Digital signal processing

Digital signal processors

 BT: Circuits
 RT: Signal processing

Digital signatures

 BT: Security
 RT: Message authentication
 Message systems

Digital simulation

 BT: Simulation
 RT: Computer aided analysis
 Modeling



JULY 2025 IEEE Thesaurus

computing	Power system analysis	<i>Digital to analog conversion</i>	USE: Digital-analog conversion
NT:	Digital twins	<i>Digital to analog converters</i>	USE: Digital-analog conversion
	Discrete event simulation		
Digital storage		Digital transformation	
BT:	Digital systems	BT:	Analog-digital conversion
	Storage management	RT:	Augmented reality
NT:	DNA data storage		Business
	Solid state drives		Digital systems
			Digitization
<i>Digital subscriber lines</i>			Internet of Things
USE: DSL			Virtual reality
<i>Digital subscriber loops</i>		NT:	Fifth Industrial Revolution
USE: DSL			Fourth Industrial Revolution
Digital systems		Digital TV	
BT:	Computers and information	BT:	TV
processing		RT:	Digital multimedia
RT:	Communication systems	broadcasting	
	Computational and artificial		Digital signal processing
intelligence			HbbTV Standards
	Consumer electronics		Text to speech
	Cryptocurrency	NT:	HDTV
	Digital computers		IPTV
	Digital economy		
	Digital information	Digital twins	
	Digital intelligence	UF:	virtual twins
	Digital recording	BT:	Cyber-physical systems
	Digital transformation		Digital simulation
	Persistent identifiers	RT:	Artificial intelligence
	Personal communication		Augmented reality
networks			Computer simulation
NT:	Digital policy		Data analysis
	Digital preservation		Design engineering
	Digital storage		Internet of Things
	ISDN		Product design
	Internet		Solid modeling
	Local area networks		Systems engineering and
	Metropolitan area networks	theory	Virtual reality
	Smart agriculture		
	Token networks		
	Virtual artifact		
<i>Digital terrain model</i>		<i>Digital versatile discs</i>	USE: DVD
USE: Digital elevation models			
<i>Digital terrain modeling</i>		Digital video broadcasting	
USE: Digital elevation models		UF:	Digital video broadcasts
		BT:	Broadcasting
			Digital communication
<i>Digital terrain models</i>		<i>Digital video broadcasts</i>	
USE: Digital elevation models		USE: Digital video broadcasting	



JULY 2025 IEEE Thesaurus

Digital video discs

USE: DVD

Digital watermarking

USE: Watermarking

Digital-analog

USE: Digital-analog conversion

Digital-analog conversion

UF: D/A
D/A conversion
D/A converters
Digital to analog conversion
Digital to analog converters
Digital-analog
Digital-analog converters
Digital-analogue conversion
Digital-analogue converters
Digital-to-analog conversion
Digital-to-analog converters
BT: Data conversion
RT: Digital computers
Interpolation

Digital-analog converters

USE: Digital-analog conversion

Digital-analogue conversion

USE: Digital-analog conversion

Digital-analogue converters

USE: Digital-analog conversion

Digital-controlled oscillators

BT: Oscillators

Digital-to-analog conversion

USE: Digital-analog conversion

Digital-to-analog converters

USE: Digital-analog conversion

Digital-to-frequency converters

BT: Converters

Digitization

BT: Analog-digital conversion
RT: Digital transformation

Dike

USE: Levee

DIL

USE: Electronics packaging

Dimension reduction

USE: Dimensionality reduction

Dimensionality reduction

UF: Dimension reduction
BT: Information retrieval
Machine learning
Statistics
NT: Manifold learning

Dinosaurs

BT: Animals

Diode lasers

UF: Laser diodes
BT: Diodes
Lasers

Diodes

BT: Electronic components
Voltage multipliers
RT: Breakdown voltage
Optical transmitters
Semiconductor diodes
NT: Active matrix organic light

emitting diodes

Diode lasers
Light emitting diodes
Organic light emitting

diodes

P-i-n diodes
Schottky diodes
Semiconductor lasers
Superluminescent diodes

DIP

USE: Electronics packaging

Dip coating

BT: Coatings

Dipole antennas

BT: Antennas

Direct broadcast satellites

USE: Satellite broadcasting

Direct current generators

USE: DC generators

Direct current machines

USE: DC machines

Direct current motors

USE: DC motors



JULY 2025 IEEE Thesaurus

Direct current power transmission

USE: DC power transmission

Direct sequence CDMA

USE: Direct-sequence code-division multiple access

Direct sequence code division multiple access

USE: Direct-sequence code-division multiple access

Direct sequence spread spectrum communication

BT: Radio spectrum management

RT: Bandwidth Modulation

Direct-sequence CDMA

USE: Direct-sequence code-division multiple access

Direct-sequence code-division multiple access

UF: Direct sequence CDMA
Direct sequence code division multiple access

BT: Direct-sequence CDMA
Multiaccess communication

Directed acyclic graph

BT: Graph theory
RT: Blockchains

Directed graphs

BT: Graph theory
NT: Fuzzy cognitive maps

Direction of arrival

USE: Direction-of-arrival estimation

Direction of arrival estimation

USE: Direction-of-arrival estimation

Direction-finding

USE: Navigation

Direction-of-arrival estimation

UF: Bearing estimation
DOA estimation
Direction of arrival
Direction of arrival estimation

of arrival

BT: Parameter estimation
RT: Array signal processing
Position measurement
Spectral analysis
Time of arrival estimation

Directional antennas

BT: Antennas

Directional couplers

BT: Couplers
RT: Hybrid junctions

Directive antennas

BT: Antennas

Disabled people

USE: People with disabilities

Disabled persons

USE: People with disabilities

Disaster and recovery

USE: Disaster management

Disaster management

UF: Disaster and recovery
Disaster planning
Prevention and mitigation
BT: Contingency management
RT: Disasters
Stormwater
NT: Prevention and mitigation

Disaster planning

USE: Disaster management

Disasters

UF: Calamities
BT: Safety
RT: Disaster management
Hazards

Discharge lamps

BT: Lamps
NT: High intensity discharge lamps

Discharges (electric)

UF: Dielectric barrier discharges
Gas discharges
Ozone generators
Ozonizers



JULY 2025 IEEE Thesaurus

BT: Dielectric breakdown
RT: Electrostatic processes
Gas discharge devices
Gases
Ionization
Plasmas

Discrete cosine transforms

UF: DCT
BT: Discrete transforms
RT: Chebyshev approximation

Discrete element method

USE: Finite element analysis

Discrete event simulation

BT: Digital simulation
NT: Time warp simulation

Discrete event systems

USE: Discrete-event systems

Discrete Fourier transforms

UF: DFT
BT: Fourier transforms
RT: Discrete Hartley transforms
Signal processing
Text detection

Discrete Hartley transforms

BT: Discrete transforms
RT: Discrete Fourier transforms

Discrete time systems

USE: Discrete-time systems

Discrete transforms

BT: Transforms
NT: Discrete Hartley transforms
Discrete cosine transforms

Discrete wavelet transforms

BT: Wavelet transforms
RT: Finite impulse response

filters

Text detection

Discrete-event systems

UF: Discrete event systems
BT: Signal analysis
RT: Control systems
Manufacturing
Petri nets
Production systems

Discrete-time systems

UF: Discrete time systems
BT: Time factors
RT: Asymptotic stability
Control systems
Difference equations
Time invariant systems
NT: Sampled data systems

Discussion forums

BT: Collaboration

Diseases

BT: Medical conditions
RT: Epidemics
Medical diagnosis
Metastasis
Pandemics
Pathology

NT: Acquired immune deficiency syndrome

Alcoholism
Allergies
Alzheimer's disease
Arteriosclerosis
Arthritis
Autoimmune diseases
Bacterial infections
Bone diseases
Cancer
Cardiovascular diseases
Cholera
Degenerative diseases
Dengue fever
Epilepsy
Eye diseases
Human immunodeficiency

virus

Infectious diseases
Influenza
Malaria
Multiple sclerosis
Muscular dystrophy
Neurological diseases
Parasitic diseases
Parkinson's disease
Pathogens
Plant diseases
Pulmonary diseases
Schizophrenia
Tuberculosis

Disentangled learning

USE: Disentangled representation learning



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Disentangled representation learning

UF: Disentangled learning
BT: Representation learning

Disinformation

USE: Fake news

Disk drives

BT: Computer peripherals
RT: Disk recording
Perpendicular magnetic

recording

Disk recording

BT: Recording
RT: Disk drives

Disks (structures)

USE: Structural discs

Dismissal

USE: Termination of employment

Dispatching

BT: Object oriented
programming
RT: Materials handling

Dispersed power generation

USE: Distributed power
generation

Dispersion

UF: Dispersion effect
Dispersion measurement
Dispersion relations
Dispersive
BT: Signal processing
RT: Refractive index
NT: Chromatic dispersion
Optical fiber dispersion

Dispersion effect

USE: Dispersion

Dispersion measurement

USE: Dispersion

Dispersion relations

USE: Dispersion

Dispersive

USE: Dispersion

Displacement control

BT: Mechanical variables
control

Displacement measurement

BT: Mechanical variables
measurement

Display systems

BT: Displays

Displays

BT: Optical devices
RT: Character generation
Graphics
Thin film transistors
User interfaces
NT: Active matrix technology
Cathode ray tubes
Computer displays
Display systems
Flat panel displays
Head-mounted displays
Head-up displays
Liquid crystal devices
Microdisplays
Readout electronics
Three-dimensional displays
Two-dimensional displays

Disruption tolerant networking

BT: Computer network
management

Disruptive innovation

BT: Business
RT: Disruptive technologies
Entrepreneurship
Market opportunities
Technological innovation

Disruptive technologies

BT: Technology
RT: Disruptive innovation
Market opportunities
Technological innovation

Dissolved air flotation

USE: Wastewater treatment

Dissolved gas analysis

BT: Fault diagnosis

Distance

USE: Distance measurement



JULY 2025 IEEE Thesaurus

Distance learning

UF: Remote learning
BT: Learning (artificial intelligence)
RT: Adaptive learning
Electronic learning
Hybrid learning
Mobile learning

Distance measurement

UF: Distance
Ranging
BT: Measurement
RT: Depth measurement
Micrometers
Position measurement
NT: Euclidean distance
Odometers

Distance relays

USE: Protective relaying

Distance work

USE: Remote working

Distillation columns

USE: Distillation equipment

Distillation equipment

UF: Distillation columns
BT: Chemical technology

Distortion

UF: Distortion information
BT: Signal processing
RT: Delay effects
Distortion measurement
Image restoration
Interference
Noise
Rate distortion theory
Signal restoration
NT: Acoustic distortion
Four-wave mixing
Jitter
Nonlinear distortion
Phase distortion

Distortion information

USE: Distortion

Distortion measurement

UF: Acoustic distortion
measurement

measurement

measurement

BT: Measurement
RT: Distortion
Noise measurement
NT: Total harmonic distortion

Distributed algorithms

BT: Algorithms

Distributed amplifiers

BT: Amplifiers

Distributed antennas

USE: Antenna arrays

Distributed Bragg reflectors

UF: DBR
BT: Mirrors
RT: Integrated optics
Vertical cavity surface

emitting lasers

Distributed computing

UF: Autonomic computing
BT: Computers and information processing
RT: Cloud computing
Computer networks
Concurrency control
Data communication
Distributed ledger
Local area networks
Metropolitan area networks
Mobile agents
Multiprocessing systems
Semantic Web
Software agents
Software architecture
NT: Client-server systems
Cluster computing
Decentralized applications
Diffserv networks
Distributed databases
Distributed information

systems

Internet
Metacomputing
Peer-to-peer computing

Distributed control

USE: Decentralized control



JULY 2025 IEEE Thesaurus

Distributed databases

BT: Databases
Distributed computing
RT: Concurrency control
Distributed ledger
NoSQL databases
NT: Blockchains

Distributed decision making

BT: Decision making

Distributed denial-of-service attack

UF: DDoS
BT: Denial-of-service attack
RT: Botnet
Computer crime

Distributed energy resources

USE: Distributed power
generation

Distributed feedback devices

UF: Distributed feedback lasers
BT: Laser applications
RT: Feedback circuits
Optical feedback

Distributed feedback lasers

USE: Distributed feedback
devices

Distributed generation

USE: Decentralized control AND
Distributed power
generation

Distributed information systems

BT: Distributed computing
Information systems
NT: Distributed management
Publish-subscribe

Distributed learning

USE: Hybrid learning

Distributed ledger

UF: DLT
Hyper ledger
Hyperledger
Shared ledger
BT: Online banking
RT: Blockchains
Cryptocurrency
Distributed computing
Distributed databases

Nonfungible tokens

Peer-to-peer computing

Distributed management

BT: Distributed information
systems

Management
RT: Collaborative intelligence

Distributed management task force

USE: DMTF

Distributed modeling

USE: Decentralized control

Distributed parameter circuits

UF: Nonuniform transmission
lines

Transmission line circuits
BT: Circuits
RT: Microwave circuits
Millimeter wave circuits
Transmission lines

Distributed parameter systems

BT: Decentralized control

Distributed power generation

UF: Dispersed power
generation

Distributed energy

resources
Distributed generation
Embedded power

generation

BT: Power generation
RT: Hybrid power systems
Microgrids
Vehicle-to-grid
NT: Virtual power plants

Distributed processing

UF: Volunteer computing
BT: System analysis and design
RT: Cluster computing
Crowdsourcing
Software defined

networking

NT: Dew computing
Edge computing
Message passing
Sharding

Distributed vision networks

BT: System analysis and design



JULY 2025 IEEE Thesaurus

Distribution functions

BT: Statistical distributions
RT: Probability
Probability density function

DLT

USE: Distributed ledger

Distribution networks

BT: Supply chains

DMB

USE: Digital multimedia
broadcasting

Distribution of electric power

USE: Power distribution

DMTF

UF: Distributed management
task force

BT: Standards organizations

Distribution strategy

BT: Marketing management

DNA

District heating

UF: Central heating
District heating and cooling
Heat networks
Teleheating
BT: Heating systems
RT: Space heating
Water heating

UF: Deoxyribonucleic acid
BT: Genetics
RT: Biological cells
Biological information

theory

District heating and cooling

USE: District heating

Cloning
Codons
DNA computing
Electrophoresis
Epigenetics
Genetic communication
Molecular biophysics
Nucleic acids
Transcriptomics
NT: DNA data storage
DNA sequencing
Genetic mutations

Disturbance observers

BT: Observers
RT: Adaptive control
Robust control

Diversity gain

USE: Diversity methods

DNA computing

BT: Computers and information
processing

Diversity methods

UF: Diversity gain
BT: Transmitters
RT: Fading channels
Multipath channels
Radio communication

RT: Nanobioscience
DNA
Molecular computing

Diversity reception

BT: Signal resolution
RT: SIMO
SISO
Telecommunications

DNA data storage

UF: DNA digital data storage
BT: DNA
Digital storage

Diversity schemes

BT: Telecommunication
network reliability
RT: Fading channels
Interference

DNA sequencing

BT: DNA
RT: Nucleic acids
Sequential analysis

Diving equipment

USE: Underwater equipment

DOA estimation

USE: Direction-of-arrival
estimation



JULY 2025 IEEE Thesaurus

Docking stations

BT: Charging stations

DOCSIS

USE: Data over cable service interface specification

Doctor

USE: Medical services

Document delivery

BT: Information services

Document handling

BT: Data handling
Information management

RT: Content management
Desktop publishing
Information retrieval
Office automation
Publishing
Semantic Web
Text processing

NT: Document image processing
Portable document format

Document image processing

BT: Document handling
RT: Portable document format

Documentation

UF: Computer documentation
Software documentation

BT: Writing
RT: Engineering drawings
Manuals
Software
NT: Point of care

DoD

USE: US Department of Defense

DoE

USE: US Department of Energy

Dogs

BT: Animals

Dolphins

BT: Marine animals

Domain Name System

BT: Computer networks

Domain specific languages

UF: Domain-specific languages
BT: Specification languages

Domain wall memory

USE: Racetrack memory

Domain-specific languages

USE: Domain specific languages

Domain-wall memory

USE: Racetrack memory

Domestic appliances

USE: Home appliances

Domestic induction appliances

USE: Home appliances

Domestic safety

UF: Safety in the home
BT: Safety
RT: Accidents
Consumer products
Electrical safety
Occupational health
Occupational safety
Smoke detectors
NT: Fall detection

Doped fiber amplifiers

UF: DFA
BT: Optical amplifiers

Doping

BT: Materials preparation
RT: Semiconductor device

doping

NT: Silicon devices
Doping profiles

Doping profiles

BT: Doping
RT: Optimization
Thin film devices

Doppler

USE: Doppler effect

Doppler effect

UF: Doppler
BT: Waves
RT: Doppler measurement
Doppler radar
NT: Doppler shift



JULY 2025 IEEE Thesaurus

Doppler measurement

BT: Measurement
RT: Doppler effect
Doppler radar
Frequency measurement
Motion measurement
Velocity measurement

Doppler radar

BT: Radar
RT: Doppler effect
Doppler measurement

Doppler shift

BT: Doppler effect

DoS attack

USE: Denial-of-service attack

Dosimetry

UF: Radiation dosimetry
BT: Measurement
RT: Collimators
Neutron capture therapy
Phantoms
Radiation detectors
Radiation monitoring
Radiation protection

DOT

USE: US Department of Transportation

Double gate FETs

USE: Double-gate FETs

Double heterojunction bipolar transistors

UF: DHBTs
BT: Heterojunction bipolar transistors

Double heterojunction HEMTs

USE: DH-HEMTs

Double-gate FETs

UF: Double gate FETs
BT: Field effect transistors
RT: Silicon-on-insulator

Doubly fed induction generators

UF: DFIG
BT: Induction generators
RT: Wind turbines

Downlink

BT: Satellite communications
RT: Cellular radio

DP industry

USE: Computer industry

DPKS

USE: Differential phase shift

keying

Drag

BT: Fluid dynamics
RT: Friction

DRAM

USE: DRAM chips

DRAM chips

UF: DRAM
BT: Random access memory
RT: Solid state drives

Drama

USE: Humanities

Dredging

USE: Excavation

Drift velocity

USE: Electron mobility

Drilling

BT: Machining
RT: Boring
Deburring
Drilling machines
Geoengineering
Oil drilling

Drilling machines

BT: Machine tools
RT: Drilling

Drilling oil

USE: Oil drilling

Driver behavior

UF: Driver behaviour
Driving behavior
Driving behaviour
BT: Vehicle driving
RT: Advanced driver assistance

systems



JULY 2025 IEEE Thesaurus

interaction	Human computer	RT:	Hydrogels
	Human vehicle systems	NT:	Nanocarriers
			Targeted drug delivery
<i>Driver behaviour</i>		<i>Drug delivery systems</i>	
USE:	Driver behavior	USE:	Drug delivery
Driver circuits		Drug discovery	
BT:	Circuits	BT:	Pharmacology
RT:	Power transistors	RT:	Drugs
			Pharmaceutical industry
<i>Driver free automobiles</i>		Drug interactions	
USE:	Autonomous automobiles	BT:	Pharmacodynamics
<i>Driver free cars</i>		Drug resistance	
USE:	Autonomous automobiles	BT:	Medical conditions
<i>Driver-free car</i>		RT:	Pharmacodynamics
USE:	Autonomous automobiles		
<i>Driverless automobiles</i>		Drugs	
USE:	Autonomous automobiles	BT:	Pharmaceuticals
<i>Driverless cars</i>		RT:	Biochemistry
USE:	Autonomous automobiles		Chemical analysis
			Chemistry
Drives			Chemotherapy
BT:	Machinery		Drug discovery
RT:	Mechanical power		Medicinal plants
transmission			Molecular biomarkers
	Sensorless control		Pharmaceutical industry
	Torque converters		Pharmacodynamics
NT:	Hydraulic drives	NT:	Pharmacokinetics
	Motor drives		Pharmacology
	Variable speed drives		Antibiotics
			Antidepressants
<i>Driving behavior</i>			Aspirin
USE:	Driver behavior		Cancer drugs
<i>Driving behaviour</i>			Insulin
USE:	Driver behavior		Opioids
Drones		Dry electrodes	
UF:	Flying robots	BT:	Electrodes
BT:	Remotely guided vehicles	RT:	Biomedical electrodes
RT:	Autonomous aerial vehicles		
	Mobile robots	Dry etching	
	Quadrotors	BT:	Etching
Droughts		DSL	
BT:	Meteorology	UF:	Digital subscriber lines
			Digital subscriber loops
Drug delivery		BT:	Digital communication
UF:	Drug delivery systems		
BT:	Biomedical engineering	<i>DSP</i>	
		USE:	Digital signal processing



JULY 2025 IEEE Thesaurus

DSRC

USE: Dedicated short range communication

DT-MRI

USE: Diffusion tensor imaging

DTI

USE: Diffusion tensor imaging

Dual band

UF: Dual-band
Dualband
BT: Mobile communication
RT: GSM
Mobile handsets
Roaming

Dual inline packaging

USE: Electronics packaging

Dual-band

USE: Dual band

Dualband

USE: Dual band

Ducts

BT: Structural shapes
RT: Air conditioning
Vents

Duplex communication systems

BT: Communication systems
NT: Full-duplex system
Half-duplex system

Dust masks

USE: Face masks

Dusty plasma

USE: Dusty plasmas

Dusty plasmas

UF: Dusty plasma
BT: Plasma properties

DVD

UF: DVD-ROM
Digital versatile discs
Digital video discs
BT: Video coding
RT: Video recording

DVD-ROM

USE: DVD

Dynamic algorithms

USE: Heuristic algorithms

Dynamic compiler

BT: Runtime

Dynamic equilibrium

BT: Measurement techniques
NT: Steady-state

Dynamic program analysis

USE: Performance analysis

Dynamic programming

BT: Algorithms
RT: Markov processes
Neural networks
Temporal difference

learning

Viterbi algorithm

Dynamic range

BT: Measurement
NT: High dynamic range

Dynamic response

BT: Dynamics
Mechanical engineering

Dynamic scheduling

BT: Scheduling

Dynamic service delivery

USE: Network resource management

Dynamic spectrum access

BT: Radio transceivers
RT: Telecommunication
network topology
Wireless communication

Dynamic systems

USE: Dynamical systems

Dynamic voltage scaling

UF: Self-dynamic voltage
scaling
BT: Computer architecture
Voltage



JULY 2025 IEEE Thesaurus

Dynamical systems

UF: Dynamic systems
BT: Mathematics
NT: Nonlinear dynamical

systems

E-coli

USE: Escherichia coli

E-commerce

USE: Electronic commerce

Dynamics

BT: Mechanical factors
RT: Control theory
Force
Friction
Vibrations
NT: Aerodynamics
Dynamic response
Elastodynamics
Electrodynamics
Hydrodynamics
Magnetohydrodynamics

E-currency

USE: Online banking

E-government

USE: Electronic government

E-health records

USE: Electronic medical records

E-learning

USE: Electronic learning

E-mail

USE: Electronic mail

E-publishing

USE: Electronic publishing

E-reader

USE: Electronic publishing

E-skin

USE: Electronic skin

E-voting

USE: Electronic voting

E-wallets

USE: Online banking

E-waste

USE: Electronic waste

E. coli

USE: Escherichia coli

EAM

USE: Electro-absorption modulators

Ear

BT: Head
Sense organs
RT: Cochlear implants

EAROM

USE: EPROM

Dynamo

USE: Generators

Dynamometers

UF: Dyno
BT: Force measurement
Meters
Power measurement
Torque measurement

Dyno

USE: Dynamometers

Dyslexia

BT: Medical conditions
Neurology
RT: Learning systems

Dysprosium

BT: Chemical elements

E health

USE: Electronic healthcare

E learning

USE: Electronic learning

e-agriculture

USE: Smart agriculture

E-banking

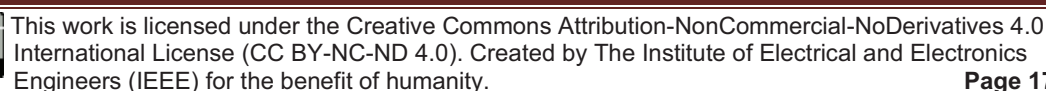
USE: Online banking

E-books

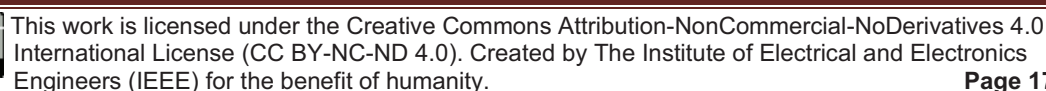
USE: Electronic publishing



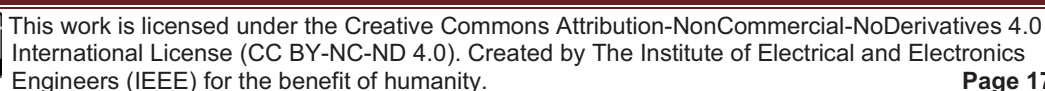
<i>Earphones</i>	USE:	Headphones	BT:	Bulimia nervosa	
Earth	BT:	Geoscience	Eavesdropping	Mental disorders	
	RT:	Planets	UF:	Cyber eavesdropping	
		Geophysics		Cybereavesdropping	
		Remote sensing	BT:	Privacy	
		Soil	RT:	Computer security	
		Terrain factors		Information leakage	
		Terrain mapping	<i>EBSD</i>		
<i>Earth atmosphere</i>	USE:	Terrestrial atmosphere	diffraction	USE:	Electron backscatter
<i>Earth observation images</i>	USE:	Satellite images	<i>ECC</i>	USE:	Elliptic curve cryptography
<i>Earth observation system</i>	USE:	Earth Observing System	AND		Error correction codes
Earth Observing System	UF:	EOS	<i>ECCM</i>	USE:	Electronic countermeasures
		Earth observation system	<i>ECG</i>	USE:	Electrocardiography
	BT:	Artificial satellites	<i>Echo cancellation</i>	USE:	Echo cancellers
		Observers			
	NT:	GOSAT	Echo cancellers	UF:	Echo cancellation
		Global Earth Observation		BT:	Active noise reduction
System of Systems		Landsat	Echo interference	BT:	Interference
		Satellite images		RT:	Clutter
		Sentinel-1			TV interference
<i>Earth science</i>	USE:	Geoscience	Echo sounders	UF:	Echosounders
<i>earthing</i>	USE:	Grounding		BT:	Sonar equipment
Earthquake engineering	UF:	Seismic retrofitting		RT:	Hydrophones
	BT:	Earthquakes			Sonar detection
	RT:	Seismology	Echo state networks	BT:	Recurrent neural networks
Earthquakes	BT:	Geoscience	Echocardiography	UF:	ECHOEG
	RT:	Seismic waves		BT:	Cardiography
		Seismology	<i>ECHOEG</i>	USE:	Echocardiography
	NT:	Earthquake engineering	<i>Echosounders</i>	USE:	Echo sounders
Eating disorders	UF:	Anorexia			
		Anorexia nervosa			
		Binge eating			
		Bulimia			



ECM			BT:	Economics
	USE:	Electronic countermeasures	RT:	Economic forecasting
				Exchange rates
Eco design			NT:	Share prices
	USE:	Ecodesign		
			Economics	
Eco-design			BT:	Engineering management
	USE:	Ecodesign	RT:	Bankruptcy
				Commercial law
Ecodesign				Cost accounting
	UF:	Eco design		Digital divide
		Eco-design		Econophysics
	BT:	Green design		Finance
	RT:	Energy conservation		Food security
		Environmental factors		Freeports
				Planning
Ecology			NT:	Access charges
	BT:	Environmental factors		Costs
	RT:	Entomology		Developing countries
		Seeds (agriculture)		Digital economy
	NT:	Habitats		Econometrics
				Economic indicators
Ecommerce				Electronic commerce
	USE:	Electronic commerce		Environmental economics
				Exchange rates
Econometrics				Free economic zones
	BT:	Economics		Fuel economy
	RT:	Costs		International trade
		Cybernetics		Macroeconomics
		Mathematics		Mechanism design
		Profitability		Microeconomics
		Regression analysis		Monopoly
		Statistics		Oligopoly
	NT:	Economic forecasting		Power generation
			economics	
Economic forecasting				Profitability
	BT:	Econometrics		Sharing economy
		Forecasting		Socioeconomics
	RT:	Economic indicators		Stock markets
				Supply and demand
Economic indicators				Trade agreements
	UF:	Cost of living index		Venture capital
		Cost-of-living index		Virtual enterprises
		GDP		
		GNP	Economies of scale	
		Gross domestic product	BT:	Microeconomics
		Gross national product	RT:	Industrial economics
		Harmonised index of		
consumer prices			Econophysics	
		Harmonized index of	BT:	Cybernetics
consumer prices			RT:	Chaos
		Index of production		Complexity theory
		Interest rates		Economics
		RPI		Fractals
		Retail price index		Information theory



systems	Knowledge acquisition	RT:	Distributed processing
	Nonlinear dynamical		5G mobile communication
considerations	Philosophical		Aerial computing
	Science - general		Cloud computing
Ecosystems			Computer applications
BT:	Environmental factors		Computer networks
RT:	Consensus protocol		Dew computing
	Environmental degradation		Internet of Things
	Low carbon economy	NT:	Mobile computing
NT:	Aquatic ecosystems		Resource management
	Estuaries	computing	Wireless sensor networks
	Grasslands		Edge AI
	Rainforests	<i>Edge detection</i>	Multi-access edge
	Tundra	USE:	Image edge detection
	Wetlands		
Eczema		<i>EDTV</i>	
UF:	Atopic dermatitis	USE:	HDTV
BT:	Medical conditions	Education	
<i>EDA</i>		UF:	Inverted classroom
USE:	Electronic design		Reverse teaching
automation and methodology		RT:	Teaching
			Hybrid learning
<i>Eddy current losses</i>			Immersive learning
USE:	Eddy currents	NT:	Personnel
			Adaptive learning
Eddy current testing			Career development
BT:	Eddy currents		Educational courses
RT:	Finite element analysis		Educational institutions
			Educational programs
Eddy currents			Educational technology
UF:	Eddy current losses		Engineering education
BT:	Electromagnetic induction		Humanities
RT:	Magnetic losses		Training
NT:	Eddy current testing	Educational courses	
<i>EDFA</i>		BT:	Education
USE:	Erbium-doped fiber	RT:	Computer aided instruction
amplifiers			Educational programs
			Hybrid learning
Edge AI			STEM
UF:	Edge artificial intelligence	NT:	Curriculum development
BT:	Artificial intelligence		Open Educational
	Edge computing	Resources	
<i>Edge artificial intelligence</i>		Educational institutions	
USE:	Edge AI	UF:	Colleges
			Schools
Edge computing			Universities
UF:	Fog computing	BT:	Education
BT:	Application virtualization	RT:	Hybrid learning
		NT:	Museums



JULY 2025 IEEE Thesaurus

Educational programs

BT: Education
 RT: Curriculum development
 Educational courses
 NT: Accreditation
 Continuing education
 Pre-college engineering
 STEM
 Scholarships
 Self-study courses
 Seminars
 Tutorials

Educational robots

BT: Robots
 RT: Engineering education
 Social robots

Educational technology

UF: Audio-visual instructional
 aids
 Instructional aids
 Programmed instruction
 Smart education
 Smart learning
 BT: Education
 RT: Audio-visual systems
 Visualization
 NT: Computer aided instruction
 Courseware
 Electronic learning

EEG

USE: Electroencephalography

EEPROM

USE: EPROM

Effective mass

BT: Energy states

EFFF

USE: Field-flow fractionation

Effluents

BT: Waste materials
 RT: Flue gases
 Industrial waste
 Waste disposal
 Waste management
 Water pollution

Ehealth

USE: Electronic healthcare

Eigenfunctions

USE: Eigenvalues and
 eigenfunctions

Eigenfunctions and eigenvalues

USE: Eigenvalues and
 eigenfunctions

Eigenplaces

USE: Eigenvalues and
 eigenfunctions

Eigenvalues

USE: Eigenvalues and
 eigenfunctions

Eigenvalues and eigenfunctions

UF: Eigenfunctions
 Eigenfunctions and
 eigenvalues

Eigenplaces
 Eigenvalues
 BT: Mathematics
 RT: Asymptotic stability
 Functional analysis
 Linear algebra
 Vectors

EKG

USE: Electrocardiography

El Nino

BT: Climate variability
 RT: Sea surface temperature
 NT: El Nino-Southern

Oscillation

El Nino-Southern Oscillation

UF: ENSO
 El-Nino-Southern

Oscillation

BT: Climate variability
 El Nino
 RT: Sea surface temperature

El-Nino-Southern Oscillation

USE: El Nino-Southern
 Oscillation

Elastic computing

BT: Cloud computing
 Resource management



JULY 2025 IEEE Thesaurus

Elastic optical networks

UF: EON
BT: Optical fiber networks

Elastic recovery

BT: Materials testing

Elasticity

BT: Material properties
RT: Strain

Elastodynamics

BT: Dynamics
RT: Seismic waves
Vibrations

Elastography

BT: Biomedical imaging

Elastomers

BT: Polymers

Elbow

BT: Extremities

Elderly

USE: Older adults

Elearning

USE: Electronic learning

Electrets

BT: Dielectric materials
RT: Capacitors
Ceramics
Dielectric devices

Electric admittance

USE: Admittance

Electric ballast

USE: Electronic ballasts

Electric breakdown

UF: Breakdown
BT: Dielectrics and electrical
insulation
RT: Aging
Electrostatic discharge
protection
NT: Fault currents
Avalanche breakdown
Corona
Dielectric breakdown
Sparks

Electric characteristics

USE: Electric variables

Electric coils

USE: Coils

Electric condensers

USE: Capacitors

Electric conductivity

USE: Conductivity

Electric current

USE: Current

Electric current control

BT: Current control
RT: Inrush current
Power control
Power transmission
Voltage control
NT: Power factor correction
Shunts (electrical)

Electric current measurement

USE: Current measurement

Electric distortion measurement

USE: Distortion measurement

Electric fences

BT: Electric machines

Electric field

USE: Electric fields

Electric fields

UF: Electric field
BT: Electromagnetic fields
RT: Electrohydrodynamics
Electrokinetics
Electrostatic analysis
Electrostatic discharge
protection
Electrostatic processes
Inrush current
Maxwell equations
Synchrotrons
NT: Acoustoelectric effects
Casimir effect
Nonuniform electric fields

Electric generators

BT: Generators
RT: Nanogenerators



JULY 2025 IEEE Thesaurus

Electric heating

USE: Resistance heating

Occupational health
Occupational safety
Safety

Electric impedance

USE: Impedance

Electric stimulation therapy

USE: Electrical stimulation

Electric machines

BT: Machinery
RT: Windings
NT: AC machines
Alternators
Brushless machines
Compressors
Conductors
DC machines
Electric fences
Generators
Permanent magnet

machines

Rotating machines
Rotors
Stators
Washing machines

Electric motors

BT: Motors
NT: Planar motors

Electric potential

BT: Electric variables
RT: Electrostatic discharge

protection

Electric power

USE: Power electronics AND
Power systems

Electric power distribution

USE: Electrical power distribution

Electric resistance

UF: Electrical resistivity
BT: Resistance

Electric sensing devices

BT: Sensor systems and
applications

Electric shock

UF: Electrocution
Shock
BT: Bioelectric phenomena
RT: Accidents
Electrical accidents
Grounding

Electric utilities

USE: Electricity supply industry

AND

Power industry

Electric variables

UF: Current voltage
characteristics

Electric characteristics
Electrical characteristics
Instrumentation and

BT: measurement

RT: Electric variables control
Electric variables

measurement

NT: Frequency
Admittance
Capacitance
Capacitance-voltage

characteristics

Conductivity
Current
Current-voltage

characteristics

Electric potential
Gain
Impedance
Impedance matching
Inductance
Permittivity
Piezoresistance
Q-factor
Resistance
Voltage
Wiring

Electric variables control

BT: Power engineering and
energy

RT: Electric variables
Frequency control
Phase control
Regulators

NT: Current control
Gain control
Power control
Power system control
Reactive power control



JULY 2025 IEEE Thesaurus

Electrical engineering industry

BT: Industries

NT: Fault protection
Grounding

Electrical equipment industry

BT: Power industry
RT: Electrical products industry
Electricity supply industry
Electronics industry

Electrical stimulation

UF: Electric stimulation therapy
Electrical brain stimulation
Microelectronic stimulation
Spinal cord stimulation
BT: Medical treatment

Electrical fault detection

BT: Circuit faults
RT: Electrostatic discharge

Electrically alterable read only memory
USE: EPROM

protection

Electrically erasable programmable read only memory

Electrical impedance tomography

BT: Tomography

USE: EPROM

Electrical insulation

USE: Dielectrics

Electricity

BT: Science - general
NT: Photoelectricity
Piezoelectricity
Pyroelectricity
Thermoelectricity
Triboelectricity

Electrical power distribution

UF: Electric power distribution
Electricity distribution
BT: Power distribution

Electricity distribution

USE: Electrical power distribution

Electrical products

UF: Electrical appliances
BT: Electrical products industry
Manufactured products
RT: Consumer products
NT: Washing machines

Electricity grids

USE: Power grids

Electrical products industry

BT: Manufacturing industries
RT: Electrical equipment

Electricity market

USE: Electricity supply industry

industry

Electronics industry
NT: Electrical products

Electricity markets

USE: Power markets

Electrical resistance measurement

UF: Ohmmeters
BT: Electric variables
measurement
RT: Resistance

Electricity supply industry

UF: Electric utilities
Electricity market
Power supply industry
BT: Power industry
RT: Electrical equipment

Electrical resistivity

USE: Electric resistance

industry

Electrical safety

BT: Power system protection
RT: Domestic safety
Electrical accidents
Islanding
Partial discharge

Feed in tariff
Power demand
Power distribution
Power quality
Power system faults
Power system planning
Power system restoration
Public infrastructure
Renewable Portfolio

measurement

Standard

NT: Battery storage plants



JULY 2025 IEEE Thesaurus

deregulation Electricity supply industry

Electricity supply industry deregulation

UF: Electricity supply industry
liberalisation

Electricity supply industry
liberalization

Electricity supply industry
privatisation

Electricity supply industry
privatization

BT: Electricity supply industry
Power generation

economics
RT: Power system economics
NT: Power markets

Electricity supply industry liberalisation
USE: Electricity supply industry
deregulation

Electricity supply industry liberalization
USE: Electricity supply industry
deregulation

Electricity supply industry privatisation
USE: Electricity supply industry
deregulation

Electricity supply industry privatization
USE: Electricity supply industry
deregulation

Electricity trading
USE: Power markets

Electrification

BT: Power engineering
RT: Carbon neutral
Electric vehicles
Low carbon economy
Power generation
Renewable energy sources
Sustainable development

Electro hydraulics
USE: Electrohydraulics

Electro oculography
USE: Electrooculography

Electro-absorption modulators

UF: EAM

modulators Electroabsorption

modulators Electroabsorptive

BT: Franz-Keldysh effect
RT: Optical modulators
Laser beams

Electro-chromic devices

USE: Electrochromic devices

Electro-fluid dynamics

USE: Electrohydrodynamics

Electro-oculography

USE: Electrooculography

Electro-optic deflectors

UF: Electrooptic devices
Electrooptical devices
BT: Electro-optic devices

Electro-optic devices

UF: Electro-optical devices
Electrooptic devices
Electrooptical devices
BT: Lasers and electrooptics
RT: Electro-optic effects
Electroluminescent devices
Liquid crystal devices
Optical bistability
Optoelectronic devices
NT: Electro-optic deflectors
Electrochromic devices

Electro-optic effects

UF: Electrooptic effects
Electrooptical effects
BT: Lasers and electrooptics
RT: Electro-optic devices
Electroluminescence
Nonlinear optics
NT: Electrochromism
Kerr effect
Optical bistability
Stark effect

Electro-optic modulators

UF: Electro-optical modulators
Electrooptic modulators
Electrooptical modulators
Pockels readout optical

modulator

BT: Optical modulators
RT: Integrated optics



JULY 2025 IEEE Thesaurus

Intensity modulation
Laser beams
Microwave photonics
Optical waveguides
P-i-n diodes
Phase modulation
Quantum well devices

Electro-optical devices

USE: Electro-optic devices

Electro-optical modulators

USE: Electro-optic modulators

Electro-optical waveguides

UF: EO waveguides
Electrooptic waveguides
Electrooptical waveguides
BT: Optical waveguides

Electro-osmosis

BT: Osmosis

Electro-thermal actuators

USE: Electrothermal actuators

Electroabsorption modulators

USE: Electro-absorption
modulators

Electroabsorptive modulators

USE: Electro-absorption
modulators

Electroacoustic devices

USE: Acoustoelectric devices

Electroacoustic effects

USE: Acoustoelectric effects

Electroactive polymer actuators

USE: Actuators

Electroactive polymers

USE: Polymers

Electrobiolology

USE: Bioelectric phenomena

Electrocardiography

UF: ECG
EKG
BT: Cardiology
RT: Biomedical equipment

Electrocatalysis

BT: Catalysis
Electrochemistry
RT: Electrocatalysts

Electrocatalysts

BT: Catalysts
RT: Electrocatalysis
Electrochemistry
Mesoporous materials

Electroceuticals

USE: Neurostimulation

Electrochemical deposition

UF: Electroplating
BT: Surface treatment
RT: Materials processing
Vapor deposition

Electrochemical devices

BT: Industry applications
RT: Electrochemical processes
Power engineering and

energy

Synapses
NT: Amperometric sensors
Batteries
Battery management

systems

Fuel cells
Supercapacitors

Electrochemical impedance spectroscopy

BT: Spectroscopy
RT: Electrochemical processes

Electrochemical machining

UF: Electrolytic machining
BT: Machining
RT: Micromachining

Electrochemical processes

UF: Electrolysis
BT: Industry applications
RT: Chemical industry
Electrochemical devices
Electrochemical impedance

spectroscopy

Electrolytes

Electrochemistry

BT: Chemistry
RT: Electrocatalysts
NT: Electrocatalysis



JULY 2025 IEEE Thesaurus

Electrochromic devices

UF: Electro-chromic devices
BT: Electro-optic devices
RT: Electrochromism

Electrochromism

BT: Electro-optic effects
RT: Color
Electrochromic devices

Electrocution

USE: Electric shock

Electrodeless lamps

BT: Lamps

Electrodes

BT: Electronic components
RT: Air gaps
Electron emission
Electron tubes
Electrophysiology
Metal-insulator structures
Spark gaps
NT: Anodes
Cathodes
Dry electrodes
Microelectrodes
Textile electrodes
Wet electrodes

Electrodynamics

BT: Dynamics
Waves
RT: Electromagnetic fields
Electron beams
Electron optics
Electron tubes
Ion beams
Particle beam optics
NT: Electromagnetic wave

polarization

Electroencephalography

UF: EEG
BT: Biomedical measurement
RT: Bioelectric phenomena
Biomedical equipment
Brain
Electrooculography
Medical diagnosis

Electrofluid dynamics

USE: Electrohydrodynamics

Electrohydraulics

UF: Electro hydraulics
BT: Hydraulic systems
RT: Fluid flow
Liquids
Magnetohydrodynamics

Electrohydrodynamics

UF: Electro-fluid dynamics
Electrofluid dynamics
Electrostrictive

hydrodynamics

BT: Dielectrics
Hydrodynamics
RT: Dielectric materials
Electric fields
Electrokinetics

Electrokinetics

BT: Dielectrics
RT: Dielectric materials
Electric fields
Electrohydrodynamics

Electroluminescence

BT: Luminescence
RT: Chemiluminescence
Electro-optic effects
Organic light emitting

diodes

NT: Electroluminescent devices

Electroluminescent devices

BT: Electroluminescence
Light sources
Luminescent devices
RT: Electro-optic devices

Electrolysis

USE: Electrochemical processes

Electrolytes

BT: Conducting materials
RT: Electrochemical processes
Supercapacitors

Electrolytic machining

USE: Electrochemical machining

Electromagnetic absorbers

BT: Electromagnetic wave
absorption



JULY 2025 IEEE Thesaurus

Electromagnetic analysis

BT: Electromagnetics
 RT: Electrostatic analysis
 Magnetic analysis
 Mie scattering
 NT: Air gaps
 Characteristic mode
 analysis
 Computational
 electromagnetics
 Delay effects
 Electromagnetic forces
 Electromagnetic refraction
 Permeability
 Spark gaps
 Time-domain analysis

Electromagnetic beams

USE: Beams

Electromagnetic compatibility

UF: EMC
 BT: Electromagnetic
 compatibility and interference
 NT: Immunity testing
 Reverberation chambers

Electromagnetic compatibility and interference

RT: Electromagnetic
 interference
 Open area test sites
 TEM cells
 NT: Electromagnetic
 compatibility
 Electromagnetics
 Interference
 Radar

Electromagnetic coupling

BT: Electromagnetics
 RT: Circulators
 Couplers
 Electromagnetic induction
 Electromagnetic shielding
 NT: Mutual coupling
 Optical coupling

Electromagnetic devices

BT: Electromagnetics
 RT: Magnetic gears
 NT: Baluns

Electromagnetic diffraction

BT: Electromagnetic
 propagation
 RT: Electromagnetic fields
 NT: Optical diffraction
 Physical theory of
 diffraction
 X-ray diffraction

Electromagnetic field theory

BT: Electromagnetic fields
 RT: Computational
 electromagnetics
 Optical fiber theory

Electromagnetic fields

BT: Dielectrics and electrical
 insulation
 RT: Computational
 electromagnetics
 Electrodynamics
 Electromagnetic diffraction
 Electromagnetic
 propagation
 Electromagnetic radiation
 Electromagnetic reflection
 Electromagnetic refraction
 Electromagnetic scattering
 Magnetic fields
 Mie scattering
 NT: Electric fields
 Electromagnetic field theory
 Electromagnetic spectrum
 Windings

Electromagnetic forces

BT: Electromagnetic analysis
 RT: Electromagnetic launching
 Magnetic forces
 Mie scattering

Electromagnetic guns

USE: Electromagnetic launching

Electromagnetic heating

UF: Microwave heating
 BT: Heating systems
 RT: Hyperthermia
 Induction heating

Electromagnetic induction

UF: Induction (electromagnetic)
 BT: Electromagnetics
 RT: Electromagnetic coupling
 Geomagnetism



JULY 2025 IEEE Thesaurus

	NT:	Magnetic communication		Submillimeter wave
		Eddy currents	measurements	
		Inductive power		
transmission			Electromagnetic metamaterials	
			BT:	Electromagnetics
				Metamaterials
Electromagnetic interference			RT:	Optical metamaterials
	UF:	EMI		Photonics
		Electromagnetic noise		Split ring resonators
		RF interference	NT:	Microwave metamaterials
		Radio interference		Terahertz metamaterials
	BT:	Interference		
	RT:	Crosstalk		
		Electromagnetic		
compatibility and interference			<i>Electromagnetic model</i>	
		Environmental factors	USE:	Electromagnetic modeling
		Immunity testing		
		Noise	Electromagnetic modeling	
		Open area test sites	UF:	Electromagnetic model
		TEM cells		Electromagnetic modelling
	NT:	Radiofrequency	BT:	Electromagnetic
interference			measurements	
		Specific absorption rate	<i>Electromagnetic modelling</i>	
			USE:	Electromagnetic modeling
Electromagnetic launching			<i>Electromagnetic noise</i>	
	UF:	Electromagnetic guns	USE:	Electromagnetic
		Electromagnetic propulsion	interference	
(electromagnetic)		Launching		
	BT:	Propulsion	Electromagnetic propagation	
	RT:	Electromagnetic forces	UF:	Electromagnetic wave
		Electrothermal launching	propagation	
	NT:	Coilguns	BT:	Antennas and propagation
		Railguns		Propagation
			RT:	Electromagnetic fields
Electromagnetic measurements				Electromagnetic transients
	BT:	Measurement		Electromagnetic
	RT:	Anechoic chambers	waveguides	
		Antenna measurements		Magnetostatic waves
		Dielectric measurement		Mie scattering
		Electric variables		Waves
measurement			NT:	Electromagnetic diffraction
		Frequency measurement		Electromagnetic
		Mie scattering	propagation in absorbing media	
		Photogrammetry		Electromagnetic reflection
		Reflectometry		Microwave propagation
		Wavelength measurement		Millimeter wave
	NT:	Electromagnetic modeling	propagation	
		Linearity		Optical propagation
		Microwave measurement		Propagation constant
measurements		Millimeter wave		Propagation losses
				Radio propagation
		Parameter extraction		Radiowave propagation
		Polarimetry	propagation	Submillimeter wave
		Radiometry		
				UHF propagation



JULY 2025 IEEE Thesaurus

Electromagnetic propagation in absorbing media

BT: Electromagnetic propagation

Electromagnetic propulsion

USE: Electromagnetic launching

Electromagnetic pulse propagation

USE: Electromagnetic transients

Electromagnetic pulse scattering

USE: Electromagnetic transients

Electromagnetic pulses

BT: Electromagnetics
RT: EMP radiation effects
Geomagnetic storms
Nuclear weapons
Pulse generation
Radiofrequency exposure

Electromagnetic radiation

BT: Electromagnetics
RT: Electromagnetic fields
Electromagnetic wave

polarization

Radiofrequency exposure
Radiofrequency safety
Waves
X-ray detection
X-ray detectors
X-rays

NT: Bremsstrahlung
Correlators
Electromagnetic wave

absorption

Frequency
Gamma-rays
Line-of-sight propagation
Terahertz radiation

Electromagnetic radiative interference

BT: Interference

Electromagnetic reflection

UF: Electromagnetic wave
reflection

BT: Electromagnetic propagation

RT: Reflection
Electromagnetic fields
Electromagnetic scattering
Reflectometry

NT: Optical reflection

Electromagnetic refraction

BT: Electromagnetic analysis
RT: Electromagnetic fields

Electromagnetic scattering

UF: Electromagnetic wave
scattering

Electromagnetic waves
BT: Scattering
RT: Coherence time
Electromagnetic fields
Electromagnetic reflection
Electromagnetic transients
Waves
NT: Coherence
Microwave plasmas
Mie scattering
Optical scattering
Polarization
Radar scattering
Raman scattering
Rayleigh scattering

Electromagnetic shielding

BT: Electromagnetics
RT: EMP radiation effects
Electromagnetic coupling
NT: Cable shielding
Magnetic shielding

Electromagnetic spectrum

BT: Electromagnetic fields

Electromagnetic transient program

USE: EMTF

Electromagnetic transients

UF: Electromagnetic pulse
propagation

Electromagnetic pulse
scattering

BT: Electromagnetics
RT: Electromagnetic

propagation

Electromagnetic scattering
Transient analysis
NT: EMP radiation effects
EMTDC
EMTP
Power system transients
Surges

Electromagnetic transients DC

USE: EMTDC



JULY 2025 IEEE Thesaurus

Electromagnetic transients including DC

USE: EMTDC

Electromagnetic wave absorption

BT: Electromagnetic radiation
NT: Electromagnetic absorbers
Terahertz wave absorption

Electromagnetic wave attenuation

USE: Attenuation

Electromagnetic wave polarisation

USE: Electromagnetic wave
polarization

Electromagnetic wave polarization

UF: Electromagnetic wave
polarisation
BT: Electrodynamics
RT: Electromagnetic radiation
Photonic band gap

Electromagnetic wave propagation

USE: Electromagnetic
propagation

Electromagnetic wave reflection

USE: Electromagnetic reflection

Electromagnetic wave scattering

USE: Electromagnetic scattering

Electromagnetic waveguides

BT: Transmission lines
RT: Coaxial cables
Coplanar waveguides
Electromagnetic
propagation
Helical antennas
Microwave devices
Microwave propagation
Optical fibers
Propagation
Waveguide discontinuities
NT: Circular waveguides
Gap waveguide
Hollow waveguides
Loaded waveguides
Planar waveguides
Rectangular waveguides
Waveguide components
Waveguide lasers
Waveguide theory

Electromagnetic waves

USE: Electromagnetic scattering

Electromagnetics

BT: Electromagnetic
compatibility and interference
RT: Cyberspace
Neuroradiology
NT: Electromagnetic analysis
Electromagnetic coupling
Electromagnetic devices
Electromagnetic induction
Electromagnetic
metamaterials
Electromagnetic pulses
Electromagnetic radiation
Electromagnetic shielding
Electromagnetic transients
Proximity effects

Electromagnets

BT: Magnets
RT: Coils
Magnetic confinement
Magnetic levitation
Magnetic levitation vehicles
NT: Superconducting magnets

Electromechanical devices

BT: Electromechanical systems
NT: Armature
SAW filters

Electromechanical sensors

BT: Sensors
NT: Microsensors

Electromechanical systems

BT: Industry applications
NT: Cruise control
Electromechanical devices

Electromigration

BT: Diffusion processes

Electromyography

UF: EMG
BT: Biomedical measurement
RT: Bioelectric phenomena

Electron accelerators

BT: Particle accelerators
RT: Electron beams
Electron sources
Electrons



JULY 2025 IEEE Thesaurus

Electron backscatter diffraction

UF: EBSD
 BT: Backscatter
 Diffraction
 RT: Crystal microstructure
 Deformation
 Grain boundaries
 Grain size
 Scanning electron

microscopy

Electron beam applications

BT: Electron beams
 RT: Flyback transformers
 Scanning electron

microscopy

Electron beam pumping

USE: Laser excitation

Electron beams

BT: Particle beams
 RT: Electrodynamics
 Electron accelerators
 Electron emission
 Electron sources
 Electrons
 Flyback transformers
 Free electron lasers
 Gyrotrons
 Relativistic effects
 Transmission electron

microscopy

NT: Electron beam applications

Electron carriers

USE: Charge carrier processes

Electron devices

RT: Threshold current
 NT: Cathode ray tubes
 Electron guns
 Electron multipliers
 Electron tubes
 Mechatronics
 Microelectromechanical

systems

Microfluidics
 Micromechanical devices
 Photoelectricity
 Photovoltaic cells
 Quantum computing
 Quantum well devices
 Semiconductivity
 Semiconductor devices

Single electron devices
 Thick film devices
 Thin film devices
 Tunneling
 Vacuum technology

Electron emission

UF: Field electron emission
 Secondary electron

emission

BT: Nuclear and plasma

sciences

RT: Cathodes
 Electrodes
 Electron beams
 Electron guns
 Electron multipliers
 Electron sources
 Electron tubes
 Electrons
 Photoelectricity
 Thermionic emission
 Vacuum arcs
 Vacuum breakdown
 NT: Ballistic transport

Electron guns

BT: Electron devices
 RT: Electron emission

Electron microscopy

BT: Microscopy
 NT: Photoelectron microscopy
 Scanning electron

microscopy

microscopy

Transmission electron

Electron mobility

UF: Drift velocity
 BT: Charge carrier processes
 RT: Plasma properties

Electron multipliers

BT: Electron devices
 RT: Electron emission
 Electron tubes
 Photomultipliers

Electron optics

BT: Optics
 Particle beam optics
 RT: Electrodynamics



JULY 2025 IEEE Thesaurus

Electron paramagnetic resonance

UF: Biological EPR
Electron spin resonance
BT: Spectroscopy

Electron sources

BT: Electrons
RT: Electron accelerators
Electron beams
Electron emission

Electron spin resonance

USE: Electron paramagnetic resonance

Electron traps

BT: Charge carrier processes
RT: Leakage currents
Reliability

Electron tubes

UF: Thermionic valves
Tubes
Vacuum tubes
BT: Electron devices
RT: Anodes
Cathodes
Electrodes
Electrodynamics
Electron emission
Electron multipliers
Gettering
NT: Field emitter arrays
Klystrons
Magnetrons
Thyratrons
Traveling wave tubes

Electronic ballasts

UF: Ballasts
Electric ballast
Electrical ballast
BT: Ballistic transport

Electronic banking

USE: Online banking

Electronic books

USE: Electronic publishing

Electronic circuits

BT: Circuits
NT: Breadboard
Central Processing Unit
Multivibrators

Stripboard circuit

Electronic commerce

UF: E-commerce
Ecommerce
Home shopping
Online shopping
BT: Economics
RT: Consumer behavior
Customer satisfaction
Digital economy
Financial management
Internet
Marketing management
Neuromarketing
Online banking
Product delivery
Supply chain management
Virtual enterprises
Web sites

Electronic components

BT: Components, packaging, and manufacturing technology
NT: Capacitors
Coils
Connectors
Diodes
Electrodes
Fuses
Inductors
Resistors
Structural plates
Switches
Transducers

Electronic counter-countermeasures

USE: Electronic countermeasures

Electronic countermeasures

UF: ECCM
ECM
Electronic counter-countermeasures
BT: Electronic warfare
RT: Jamming
Military communication
Radar countermeasures
Radio communication
countermeasures
Spread spectrum
communication
Spread spectrum radar
Weapons



JULY 2025 IEEE Thesaurus

Electronic currency

USE: Online banking

Electronic data interchange

USE: Data handling

Electronic design automation and methodology

UF: EDA
RT: VHDL
NT: Design automation
Design methodology

Electronic education

USE: Electronic learning

Electronic equipment

BT: Electronics industry
RT: Electronic equipment
manufacture
Electronic equipment
testing
NT: Low power electronics
Electronic voting systems
Microelectronics
Organic electronics
Smart devices
Soft electronics

Electronic equipment manufacture

BT: Components, packaging,
and manufacturing technology
RT: Electronic equipment
Electronics industry
Optical device fabrication
NT: Damascene integration
Micromachining
Radiation hardening
(electronics)
Semiconductor device
manufacture

Electronic equipment testing

BT: Testing
RT: Electronic equipment
TEM cells
NT: Immunity testing

Electronic government

UF: E-government
BT: Government

Electronic health records

USE: Electronic medical records

Electronic healthcare

UF: Digital health
Digital healthcare
E health
Ehealth
BT: Information processing
Medical services
RT: Smart healthcare
Wearable Health Monitoring
Systems

Electronic learning

UF: E learning
E-learning
Elearning
Electronic education
Online learning
Virtual learning
BT: Educational technology
Learning systems
RT: Computer aided instruction
Computers and information
processing
Distance learning
Internet
Learning (artificial
intelligence)
Learning management
systems
Online services
TV
Training
Wide area networks
NT: Mobile learning

Electronic mail

UF: E-mail
Email
Mail (electronic)
BT: Message systems
RT: Blogs
Office automation
Postal services
Social networking (online)
Voice mail
NT: Unified messaging
Unsolicited e-mail

Electronic medical prescriptions

BT: Medical treatment
RT: Electronic medical records

Electronic medical records

UF: E-health records
Electronic health records



JULY 2025 IEEE Thesaurus

BT: Medical information
systems
RT: Electronic medical
prescriptions
Patient monitoring

Electronic messaging

UF: Text messaging
BT: Message systems
RT: Emojis
NT: Instant messaging
Unified messaging

Electronic music

BT: Music
NT: Synthesizers

Electronic noses

BT: Chemical analysis
RT: Intelligent sensors

Electronic packaging thermal management

BT: Thermal management of
electronics

Electronic portfolios

USE: Portfolios

Electronic publishing

UF: Digital publishing
E-books
E-publishing
E-reader
Electronic books
Epublishing
Kindle
BT: Publishing
RT: CD-ROMs
Journalism
Multimedia systems
Open data
NT: Content management
Desktop publishing

Electronic skin

UF: E-skin
BT: Flexible electronics
Skin
RT: Haptic interfaces
Tactile sensors

Electronic switching systems

BT: Communication switching
Switching systems

Electronic textiles

USE: Smart textiles

Electronic visual prosthesis

USE: Visual prosthesis

Electronic voting

UF: E-voting
Online voting
BT: Voting

Electronic voting systems

BT: Electronic equipment

Electronic wallets

USE: Online banking

Electronic warfare

BT: Aerospace and electronic
systems
RT: Communication system
security
Radio communication
countermeasures
Spread spectrum
communication
Spread spectrum radar
NT: Electronic countermeasures
Jamming
Radar countermeasures

Electronic waste

UF: E-waste
WEEE
Waste electrical and
electronic equipment
BT: Waste materials

Electronics cooling

BT: Thermal management of
electronics
RT: Cooling

Electronics engineering education

BT: Electrical engineering
education

Electronics industry

UF: Integrated circuits industry
Semiconductor electronics
industry
Semiconductor industry
BT: Manufacturing industries
RT: Electrical equipment
industry



JULY 2025 IEEE Thesaurus

Electrical products industry
Electronic equipment
manufacture
NT: Toy manufacturing industry
Electronic equipment

Electronics packaging

UF: DIL
DIP
Dual inline packaging
PGA
Pin grid arrays
QFP
Quad flat packs
BT: Components, packaging,
and manufacturing technology
RT: Constraint optimization
Cooling
Plastic packaging
Printed circuits
NT: Antenna-in-package
Ball grid arrays
Chip scale packaging

Electrons

BT: Elementary particles
RT: Beta rays
Cosmic rays
Electron accelerators
Electron beams
Electron emission
Elementary particle
exchange interactions
Impact ionization
Phonons
Schrodinger equation
NT: Electron sources
Quantum wells
Trions

Electrooculography

UF: EOG
Electro oculography
Electro-oculography
BT: Biomedical measurement
Gaze tracking
RT: Bioelectric phenomena
Electroencephalography
Eyes

Electrooptic devices

USE: Electro-optic deflectors
AND
Electro-optic devices

Electrooptic effects

USE: Electro-optic effects

Electrooptic modulators

USE: Electro-optic modulators

Electrooptic waveguides

USE: Electro-optical waveguides

Electrooptical devices

USE: Electro-optic deflectors
AND
Electro-optic devices

Electrooptical effects

USE: Electro-optic effects

Electrooptical modulators

USE: Electro-optic modulators

Electrooptical waveguides

USE: Electro-optical waveguides

Electropermeabilization

USE: Electroporation

Electrophoresis

BT: Separation processes
RT: DNA
Medical diagnosis

Electrophotography

UF: Xerography
BT: Electrostatic processes
Photoconducting devices
RT: Gas discharge devices
Photography

Electrophotoluminescence

USE: Photoluminescence

Electrophysiology

BT: Biomedical measurement
RT: Biomedical electrodes
Electrodes
Voltage

Electroplating

USE: Electrochemical deposition

Electroporation

UF: Electropermeabilization
BT: Medical treatment
Microbiology



JULY 2025 IEEE Thesaurus

Electrostatic actuation

USE: Electrostatic actuators

Electrostatic actuators

UF: Electrostatic actuation

BT: Actuators

RT: Electrostatic devices

Electrostatic analysis

BT: Electrostatic processes

RT: Electric fields

Electromagnetic analysis

Electrostatic measurements

Electrostatic charges

USE: Electrostatic discharges

AND

Electrostatics

Electrostatic devices

BT: Industry applications

RT: Electrostatic actuators

Electrostatic processes

Electrostatic discharge protection

UF: ESD protection

BT: Electrostatic discharges
Protection

RT: Electric breakdown

Electric fields

Electric potential

Electrical fault detection

Failure analysis

Integrated circuit reliability

Integrated circuit

technology

Semiconductor device

reliability

Triboelectricity

Electrostatic discharges

UF: Charged device model
ESD

Electrostatic charges

BT: Dielectric breakdown

RT: Arc discharges

Electrostatic interference

NT: Electrostatic discharge

protection

Electrostatic induction

UF: Induction (electrostatic)

BT: Electrostatic processes

Electrostatic interference

BT: Interference

RT: Electrostatic discharges

NT: Immunity testing

Electrostatic levitation

BT: Electrostatics

Levitation

Electrostatic measurements

BT: Electric variables

measurement

RT: Electrostatic analysis

NT: Charge measurement

Electrostatic precipitators

BT: Industry applications

RT: Pollution control

Electrostatic processes

BT: Industry applications

RT: Discharges (electric)

Electric fields

Electrostatic devices

Lightning

NT: Aerosols

Electrophotography

Electrostatic analysis

Electrostatic induction

Electrostatics

Particle charging

Particle production

Space charge

Surface charging

Triboelectricity

Electrostatic self assembly

USE: Electrostatic self-assembly

Electrostatic self-assembly

UF: Electrostatic self assembly

BT: Self-assembly

Electrostatics

UF: Electrostatic charges

BT: Electrostatic processes

RT: Poisson equations

NT: Electrostatic levitation

Electrostriction

BT: Dielectrics

RT: Mechanical factors

Piezoelectricity



JULY 2025 IEEE Thesaurus

Electrostrictive hydrodynamics

USE: Electrohydrodynamics

Electrostrictive polymer actuators

USE: Actuators

Electrosurgery

BT: Medical treatment

Surgery

RT: Biological tissues

Current

Radio frequency

Electrothermal actuators

UF: Electro-thermal actuators

BT: Actuators

Thermal sensors

RT: Resistance heating

Thermal expansion

Electrothermal effects

BT: Thermoelectricity

RT: Electrothermal launching

NT: Proton effects

Electrothermal launching

UF: Launching (electrothermal)

BT: Propulsion

RT: Electromagnetic launching

Electrothermal effects

Elemental semiconductors

BT: Semiconductor materials

RT: Silicon

Elementary particle exchange interactions

BT: Elementary particles

RT: Electrons

Ions

Proton effects

Wave functions

Elementary particle vacuum

UF: Instanton vacuum

QCD vacuum

Quantum vacuum

String vacuum

Superstring vacuum

Vacuum energy

BT: Elementary particles

RT: Casimir effect

Elementary particles

UF: Particles (elementary)

BT: Nuclear and plasma sciences

RT: Cosmic rays

High energy physics

instrumentation computing

Microwave photonics

Nuclear thermodynamics

Proton effects

NT: Charge carriers

Electrons

Elementary particle

exchange interactions

Elementary particle vacuum

Ions

Mesons

Neutrino sources

Neutrons

Particle beams

Particle collisions

Phonons

Positrons

Protons

Elementary school engineering

USE: Pre-college engineering

Elevators

BT: Building services

RT: Buildings

Stairs

Ellipsoids

BT: Elliptic design

Ellipsometry

BT: Optical variables

measurement

RT: Polarimetry

Elliptic curve cryptography

UF: ECC

Elliptic curve cryptosystems

BT: Public key cryptography

Elliptic curve cryptosystems

USE: Elliptic curve cryptography

Elliptic curves

BT: Geometry

Elliptic design

UF: Elliptical design

BT: Geometry

NT: Ellipsoids



JULY 2025 IEEE Thesaurus

Elliptical design

USE: Elliptic design

Elongation

BT: Material properties

RT: Strain

Email

USE: Electronic mail

eMBB

USE: Enhanced mobile
broadband

Embedded computing

BT: Embedded systems

Embedded multicore processing

BT: Multicore processing

Embedded power generation

USE: Distributed power
generation

Embedded software

BT: Software

Embedded system

USE: Embedded systems

Embedded systems

UF: Embedded system

BT: Operating systems

RT: Cyber-physical systems

Hardware-in-the-loop

simulation

Microprocessors

NT: Embedded computing

Embolization

BT: Medical treatment

Noninvasive treatment

Embossing

BT: Manufacturing

Production

RT: Injection molding

Micromachining

Sheet metal processing

Watermarking

Embryo

BT: Embryonic structures

RT: Embryology

Embryology

BT: Biology

Medical specialties

RT: Embryo

Embryonic structures

BT: Anatomy

NT: Embryo

Fetus

EMC

USE: Electromagnetic
compatibility

Emergency lighting

BT: Lighting

RT: High intensity discharge

lamps

Emergency management

USE: Emergency services

Emergency medical services

USE: Medical services

Emergency medicine

UF: Accident and emergency
medicine

BT: Medical specialties

Emergency power generators

USE: Standby generators

Emergency power supplies

UF: Standby power supplies

BT: Power supplies

RT: Batteries

Standby generators

Uninterruptible power

systems

Emergency response

USE: Emergency services

Emergency services

UF: Emergency management

Emergency response

BT: Safety

RT: Accidents

Fires

Food security

Internet of Medical Things

Medical services

Rescue robots

Stormwater



JULY 2025 IEEE Thesaurus

Emergent phenomena

BT: Cybernetics
RT: System of systems

EMG

USE: Electromyography

EMI

USE: Electromagnetic interference

Emirates Mars Mission

USE: Interplanetary exploration

Emissions trading

UF: Cap and trade
Cap-and-trade
Carbon trading
BT: Environmental economics
Pollution
RT: Carbon emissions
Climate change
Market opportunities
Power markets
Pricing

Emojis

BT: Computer graphics
Symbols
RT: Electronic messaging
Emotion recognition

Emotion models

USE: Emotion recognition

Emotion recognition

UF: Emotion models
Emotion theory
Models of emotion
BT: User interfaces
RT: Affective computing
Anxiety disorders
Behavioral sciences
Emojis
Emotional responses
Image recognition
Psychology
Sentiment analysis
Social robots
Speech recognition

Emotion theory

USE: Emotion recognition

Emotional responses

BT: Psychology
RT: Emotion recognition

EMP radiation effects

BT: Electromagnetic transients
Radiation effects
RT: Electromagnetic pulses
Electromagnetic shielding

Emphysema

BT: Pulmonary diseases
RT: Asthma
Chronic obstructive
pulmonary disease
Pneumonia

Empirical mode decomposition

UF: Hilbert?Huang transforms
BT: Transforms
RT: Signal processing

Employee rights

BT: Employment

Employee welfare

UF: Conditions of employment
Counseling
Counselling
Maternity benefits
Sick pay
Working conditions
BT: Human resource
management
RT: Incentive schemes
Industrial psychology
Occupational health
Occupational safety
Occupational stress
Pensions
Psychology
Remuneration

Employment

UF: Work-place
Workplace
BT: Human resource
management
RT: Business
Employment law
Engineering profession
Jobs listings
Personnel
Programming profession
NT: Employee rights



JULY 2025 IEEE Thesaurus

	Livelihood	NT:	ASCII
	Termination of employment		Audio coding
Employment law			Channel coding
BT:	Law		Code refractoring
RT:	Contract law		Digital representation
	Employment		Entropy coding
			Precoding
			Source coding
EMTDC			Speech coding
UF:	Electromagnetic transients		Transcoding
DC			
	Electromagnetic transients	Encryption	
including DC		BT:	Cryptography
BT:	Electromagnetic transients	RT:	Chaotic mapping
	Geophysics		Ciphers
	Software packages		Information leakage
RT:	Design automation		Privacy enhancing
	PSCAD	technologies	
		NT:	Homomorphic encryption
EMTP			
UF:	Electromagnetic transient	Encyclopedias	
program		BT:	Information services
BT:	Electromagnetic transients		
RT:	Computer simulation	End effectors	
		UF:	End-effectors
Emulation		BT:	Manipulators
BT:	Modeling	RT:	Grippers
RT:	Application virtualization		
	Simulation	<i>End-effectors</i>	
		USE:	End effectors
Encapsulation			
BT:	Packaging	Endangered species	
RT:	Integrated circuit packaging	BT:	Animals
	Plastic packaging		Biodiversity
		RT:	Environmental
Encephalography		management	
BT:	Biomedical imaging		
RT:	Brain	<i>Endocrine glands</i>	
		USE:	Glands
Encoding			
UF:	Coding	Endocrine system	
BT:	Information theory	BT:	Anatomy
RT:	Autoencoders		
	Codecs	Endocrinology	
	Codes	BT:	Medical specialties
	Cryptography	RT:	Diabetes
	Data compression		Thyroid
	Data handling		
	Hash functions	Endomicroscopy	
	Modulation	BT:	Endoscopes
	Modulation coding		Microscopy
	Quantization (signal)	RT:	Biomedical equipment
	Semantic technology		Biomedical optical imaging
	Signal processing		Digestive system
	Vector quantization		Medical robotics



JULY 2025 IEEE Thesaurus

	Optical devices	BT:	Energy
	Real-time systems	RT:	Load monitoring
Endoscopes		Energy conversion	
UF:	Endoscopy	BT:	Energy
BT:	Biomedical equipment	NT:	Atomic batteries
RT:	Biomedical optical imaging		Batteries
	Image sensors		Fuel cells
	Laser applications		Motors
	Surgery		Ocean thermal energy
NT:	Endomicroscopy	conversion	
<i>Endoscopy</i>			Photovoltaic cells
USE:	Endoscopes		Potential well
Endothelial cells			Solar heating
BT:	Biological cells		Thermoelectricity
RT:	Blood vessels		Waste heat
			Wave energy conversion
			Wind energy conversion
Energy		<i>Energy demand</i>	
energy	BT:	USE:	Energy consumption
	RT:		
	NT:	Energy dissipation	
	Thermal energy	BT:	Energy
	Energy barrier		
	Energy capture	Energy efficiency	
	Energy consumption	UF:	Energy efficient
	Energy conversion	BT:	Energy management
	Energy dissipation	RT:	Energy informatics
	Energy exchange	NT:	Energy efficient computing
	Energy harvesting		Energy efficient ethernet
	Energy management		
	Energy resources	<i>Energy efficient</i>	
	Energy states	USE:	Energy efficiency
	Energy storage		
Energy barrier		Energy efficient computing	
BT:	Energy	UF:	Energy-efficient computing
Energy capture		BT:	Energy efficiency
BT:	Energy		
Energy conservation		Energy efficient ethernet	
UF:	Energy saving	UF:	EtherEEE
BT:	Energy management	BT:	Energy efficiency
RT:	Ecodesign		Ethernet
	Energy resources	Energy exchange	
	Feed in tariff	UF:	Energy transfer
	Power demand	BT:	Energy
	Waste heat	NT:	Inductive charging
NT:	Green computing	Energy harvesting	
	Potential energy	UF:	Energy scavenging
	Renewable energy sources		Power harvesting
Energy consumption		BT:	Energy
UF:	Energy demand	NT:	Nanogenerators



JULY 2025 IEEE Thesaurus

Energy informatics

BT: Energy management
Informatics
RT: Energy efficiency
Global warming
Green design
Information and
communication technology
Machine learning
Smart cities
Smart grids

Energy Internet

UF: Internet of Energy
BT: Power systems
RT: Internet
Internet of Things
Power distribution
Power engineering
computing
Power generation
Power grids
Power system control
Power system
interconnection
Power system management
Power transmission
Smart grids

Energy levels

USE: Energy states

Energy loss

BT: Energy measurement
NT: Core loss

Energy management

BT: Energy
RT: Circular economy
NT: Demand side management
Energy conservation
Energy efficiency
Energy informatics
Energy management
systems
Load management
Transactive energy

Energy management systems

BT: Energy management

Energy measurement

BT: Electric variables
measurement
RT: Calorimetry

Enthalpy
Watt-hour meters
NT: Energy loss

Energy resolution

BT: Nuclear imaging
RT: Nuclear medicine
Solid scintillation detectors

Energy resources

BT: Energy
RT: Civil engineering
Energy conservation
Environmental economics
Natural gas
Power demand
NT: Fuels
Geothermal energy
Nuclear energy
Solar energy
Wave power
Wind energy
Wind farms

Energy saving

USE: Energy conservation

Energy scavenging

USE: Energy harvesting

Energy states

UF: Energy levels
Levels, energy
BT: Energy
NT: Band structures
Effective mass
Fermi level
Orbital calculations
Polaritons
Quasi-Fermi level
Surface states

Energy storage

UF: Energy storage systems
Stored energy
BT: Energy
RT: Aging
Battery powered vehicles
Fuel cell vehicles
Fuel storage
Hybrid electric vehicles
Load management
Material storage
Pulsed power systems
Solar powered vehicles



JULY 2025 IEEE Thesaurus

NT: Batteries
Battery energy storage
system
Battery storage plants
Flywheels
Fuel cells
Hydrogen storage
Supercapacitors
Superconducting magnetic
energy storage

Energy storage systems

USE: Energy storage

Energy transfer

USE: Energy exchange

Energy-efficient computing

USE: Energy efficient computing

Engine cylinders

BT: Machine components
RT: Engines
Gaskets
Pistons
Structural rings

Engineering - general

RT: STEM
Technology
NT: Acoustical engineering
Agricultural engineering
Bio-inspired engineering
Chemical engineering
Civil engineering
Concurrent engineering
Design engineering
Electrical engineering
Engineering profession
Environmental engineering
Maintenance engineering
Marine engineering
Mechanical engineering
Optical engineering
Precision engineering
Production engineering
Research and development
Reverse engineering
Sanitary engineering
Standardization
Thermal engineering

Engineering computing

BT: Computer applications

Engineering drawings

BT: Graphics
RT: Documentation
Technical drawing
NT: Flowcharts

Engineering education

BT: Education
RT: Continuing education
Educational robots
Laboratories
Logic design
NT: Biomedical engineering

education

Communication

engineering education

Computer science

education

Control engineering

education

Electrical engineering

education

Engineering students

Physics education

Power engineering

education

Student experiments

Systems engineering

education

Engineering geology

USE: Geoengineering

Engineering in medicine and biology

NT: Biology
Biomedical communication
Biomedical computing
Biomedical engineering
Biomedical equipment
Biomedical imaging
Bionanotechnology
Bioterrorism
Computational biology
Genetic engineering
Medical services
Medical specialties
Nuclear medicine
Synthetic biology

Engineering management

NT: Business
Commercialization
Consortia
Economics
Innovation management



JULY 2025 IEEE Thesaurus

	Legal factors	Jet engines
	Market research	
	Planning	Enhanced magnetoresistance
	Product development	BT: Magnetoresistance
	Project engineering	RT: Nanocontacts
	Research and development	
management		Enhanced mobile broadband
	Research initiatives	UF: eMBB
	Software development	BT: 5G mobile communication
management		RT: 4G mobile communication
Engineering profession		Enhanced vegetation index
UF:	Careers	UF: EVI
BT:	Engineering - general	BT: Environmental
RT:	Biographies	measurement
	Electrical engineering	
	Employment	RT: Indexes
	Ethics	Vegetation
	Programming profession	
	Research and development	<i>Ensemble approach</i>
	Research and development	USE: Ensemble learning
management		
NT:	Professional aspects	Ensemble learning
		UF: Ensemble approach
Engineering students		Ensemble methods
UF:	Student engineers	BT: Machine learning
BT:	Engineering education	Statistics
		RT: Predictive models
		NT: Fish schools
<i>Engineering writing</i>		
USE:	Writing	<i>Ensemble methods</i>
		USE: Ensemble learning
Engines		
BT:	Industry applications	<i>ENSO</i>
RT:	Aircraft propulsion	USE: El Nino-Southern
	Automobile manufacture	Oscillation
	Cams	
	Camshafts	<i>Entangled states</i>
	Engine cylinders	USE: Quantum entanglement
	Exhaust systems	
	Fuel pumps	Enterprise architecture management
	Gaskets	BT: Information architecture
	Machine components	Information management
	Manifolds	RT: Best practices
	Mechanical power	Enterprise resource
transmission		planning
	Oils	
	Pistons	Enterprise resource planning
	Propellers	BT: Management
	Propulsion	RT: Business
	Rockets	Data handling
	Torque converters	Data processing
	Turbomachinery	Enterprise architecture
NT:	Heat engines	
	Internal combustion	management
engines		Software
		System integration



JULY 2025 IEEE Thesaurus

NT: Venture capital
Business process
integration

Entertainment industry

BT: Industries
RT: Broadcasting
Films
Games
Motion pictures
TV
NT: Sports

Enthalpy

BT: Thermodynamics
RT: Energy measurement
Thermal management

Entomology

BT: Zoology
RT: Biochemistry
Biomechanics
Ecology
Insects
Morphology
Physiology
NT: Apicology

Entrepreneurial

USE: Entrepreneurship

Entrepreneurship

UF: Entrepreneurial
BT: Business
RT: Crowdfunding
Disruptive innovation
Innovation management
Venture capital

Entropy

BT: Physics
RT: Heating systems
Nuclear thermodynamics

Entropy coding

BT: Encoding
RT: Data compression
NT: Huffman coding

Entry, descent and landing

USE: Aircraft navigation

Envelope detectors

BT: Detectors

Environmental degradation

BT: Environmental factors
RT: Ecosystems
Pollution
NT: Deforestation
Habitat loss

Environmental design

USE: Green design

Environmental economics

BT: Economics
Environmental factors
RT: Energy resources
Environmental

management

Pollution
NT: Carbon tax
Emissions trading

Environmental engineering

BT: Engineering - general
RT: Environmental factors
Environmental

management

Environmental science
Resource management

Environmental factors

UF: Environmental problems
BT: Geoscience and remote

sensing

Social implications of

technology

RT: Acoustic noise
Air quality
Carbon footprint
Carbon sequestration
Civil engineering
Ecodesign
Electromagnetic

interference

Environmental engineering
Environmental science
Epidemiology
Food security
Green buildings
Green computing
Green energy
Greenhouse effect
Health and safety
International collaboration
Meteorology
Occupational health
Ozonation



JULY 2025 IEEE Thesaurus

NT: Safety
Biosphere
Climate change
Ecology
Ecosystems
Environmental degradation
Environmental economics
Environmental
measurement
Environmental monitoring
Global warming
Green manufacturing
Green products
Green transportation
Habitat loss
Life cycle assessment
Pollution

Environmental management

BT: Industry applications
RT: Circular economy
Dams
Endangered species
Environmental economics
Environmental engineering
Environmental science
Global warming
International collaboration
Low carbon economy
Public infrastructure
Sanitary engineering
NT: Biodegradation
Land use planning
Net zero
Pest control
Pollution control
Recycling
Renewable energy sources
Sustainable development
Waste management
Water conservation
Water resources

Environmental measurement

UF: Environmental metrics
BT: Environmental factors
Measurement
NT: Enhanced vegetation index
Normalized difference
vegetation index
Normalized difference
water index

Environmental metrics

USE: Environmental
measurement

Environmental monitoring

BT: Environmental factors
Monitoring
RT: Decontamination
Environmental science
Green communications
Pollution control
Pollution measurement
Soil remediation

Environmental noise

USE: Working environment noise

Environmental problems

USE: Environmental factors

Environmental science

BT: Science - general
RT: Biology
Environmental engineering
Environmental factors
Environmental

management

Environmental monitoring
Geography
Physics

Environmentally friendly manufacturing techniques

BT: Components, packaging,
and manufacturing technology

Enzymatic fuel cells

USE: Fuel cells

Enzymes

BT: Proteins
RT: Hydrolysis

EO waveguides

USE: Electro-optical waveguides

EOG

USE: Electrooculography

EON

USE: Elastic optical networks

EOS

USE: Earth Observing System



JULY 2025 IEEE Thesaurus

Eosinophiles

USE: Eosinophils

Eosinophils

UF: Eosinophiles
BT: White blood cells

Epidemics

BT: Epidemiology
RT: Coronaviruses
Diseases
Influenza
Pathogens
Virology
NT: Pandemics

Epidemiology

BT: Science - general
RT: Biomedical monitoring
Contact tracing
Environmental factors
Public healthcare
NT: Epidemics

Epidermal

USE: Epidermis

Epidermis

UF: Epidermal
BT: Skin

Epigenetics

BT: Genetics
RT: DNA

Epilepsy

BT: Diseases

Epitaxial growth

UF: Epitaxy
BT: Thin films
RT: Crystal growth
Crystals
Gallium
Germanium
Molecular beams
Nanotechnology
Photonics
Semiconductor devices
Semiconductor thin films
Silicon
Substrates
NT: Molecular beam epitaxial

growth

Epitaxial layers

BT: Coatings
Films
RT: Chemical vapor deposition
Semiconductor growth
Thin films
NT: Superconducting epitaxial

layers

Epitaxy

USE: Epitaxial growth

EPON

UF: Ethernet passive optical
networks
BT: Ethernet
RT: Passive optical networks

Epoxy resins

BT: Dielectric materials
Plastics
Resins

EPROM

UF: EAROM
EEPROM
Electrically alterable read
only memory
Electrically erasable
programmable read only memory
Erasable programmable
read only memory
BT: PROM

Epublishing

USE: Electronic publishing

Equal opportunities

BT: Human resource
management
RT: Industrial relations
Labor resources
Personnel
Recruitment
NT: Gender equity
Gender issues

Equalisers

USE: Equalizers

Equalizers

UF: Equalisers
BT: Filters
RT: Channel estimation
Impedance matching



JULY 2025 IEEE Thesaurus

NT: Intersymbol interference
Adaptive equalizers
Blind equalizers
Decision feedback
equalizers

Equations

BT: Mathematics
NT: Boltzmann equation
Difference equations
Integrodifferential equations
Maxwell equations
Nonlinear equations
Polynomials
Riccati equations

Equator

BT: Geoscience

Equipment failure

BT: Failure analysis

Equipment under test

USE: Device under test

Equivalent circuits

BT: Circuits

Er

USE: Erbium

Er-doped fiber amplifier

USE: Erbium-doped fiber
amplifiers

Er-doped fiber lasers

USE: Erbium-doped fiber lasers

Erasable programmable read only memory

USE: EPROM

Erbium

UF: Er
BT: Metals
RT: Erbium-doped fiber
amplifiers
Lasers and electrooptics
Optical amplifiers
Optics

Erbium-doped fiber amplifiers

UF: EDFA
Er-doped fiber amplifier
BT: Optical amplifiers
RT: Erbium

Erbium-doped fiber laser

USE: Erbium-doped fiber lasers

Erbium-doped fiber lasers

UF: Er-doped fiber lasers
Erbium-doped fiber laser
Erbiumdoped fiber laser
BT: Fiber lasers

Erbiumdoped fiber laser

USE: Erbium-doped fiber lasers

Erection

USE: Construction

Ergonomics

UF: Human engineering
Human factors engineering
BT: Systems, man, and
cybernetics
RT: Anthropometry
Behavioral sciences
Cybernetics
Design methodology
Human factors
Human-machine systems
Keyboards
Occupational health
Working environment noise
NT: Job design
Smart spaces
User experience

Erosion

BT: Geology
RT: Sedimentation
Weathering

Error analysis

UF: Error estimation
Error rate
Error rates
Error statistics
BT: Testing
RT: Cyclic redundancy check
Cyclic redundancy check
codes
Error correction
Estimation
Mean square error methods
Measurement errors
Numerical analysis
Roundoff errors
NT: Bit error rate
Finite wordlength effects



JULY 2025 IEEE Thesaurus

Error compensation

BT: Information theory
RT: Error correction

Error correcting codes

USE: Error correction codes

Error correction

BT: Signal processing
RT: Codes
Convolutional codes
Cyclic redundancy check
Cyclic redundancy check

codes

Error analysis
Error compensation
Error correction codes
Linear codes
Power system faults
Product codes
Turbo codes
NT: Forward error correction

Error correction codes

UF: ECC
Error correcting codes
Error-correcting codes
Error-correction codes
Errorcorrection codes
BT: Codes
RT: Convolutional codes
Error correction
Polar codes
NT: Reed-Muller codes
Reed-Solomon codes

Error estimation

USE: Error analysis

Error free operation

USE: Error-free operations

Error probability

BT: Probability

Error rate

USE: Error analysis

Error rates

USE: Error analysis

Error recovery (computers)

USE: System recovery

Error statistics

USE: Error analysis

Error-correcting codes

USE: Error correction codes

Error-correction codes

USE: Error correction codes

Error-free operations

UF: Error free operation
BT: Testing

Errorcorrection codes

USE: Error correction codes

ESA

USE: European Space Agency

Escalators

BT: Transportation
RT: Buildings
Mechanical products
Stairs

Escherichia coli

UF: E-coli
E. coli
BT: Bacteria
RT: Bacterial infections

ESD

USE: Electrostatic discharges

ESD protection

USE: Electrostatic discharge protection

Esophagus

BT: Digestive system

Estimation

UF: Signal estimation
BT: Mathematics
RT: Control systems
Error analysis
Filtering theory
Kalman filters
Measurement uncertainty
Prediction methods
Prediction theory
Reduced order systems
Signal processing
Spectral analysis
NT: Estimation error



JULY 2025 IEEE Thesaurus

hierarchy Synchronous digital

Euclidean distance

UF: Euclidean measurement
Euclidean metric
BT: Distance measurement
Mathematics
NT: Hilbert space

Euclidean measurement

USE: Euclidean distance

Euclidean metric

USE: Euclidean distance

Europe

BT: Continents

European Space Agency

UF: ESA
BT: Organizations
RT: NASA

European Telecommunications Standards Institute

USE: ETSI

Europium

BT: Chemical elements

Eutrophication

BT: Aquaculture
Water resources
RT: Algae
Plankton

EUV Lithography

USE: Extreme ultraviolet

lithography

EV charging

USE: Electric vehicle charging

Evaluation models

BT: Modeling
Performance evaluation

Evaporation

BT: Liquids
Water cycle
RT: Transpiration
Water
NT: Evaporative cooling

Evaporative coolers

USE: Evaporative cooling

Evaporative cooling

UF: Evaporative coolers
BT: Cooling
Evaporation

Event detection

UF: Event-based
Event-triggered
BT: Wireless sensor networks
RT: Security information and
event management

Event-based

USE: Event detection

Event-triggered

USE: Event detection

Everyware

USE: Pervasive computing

EVI

USE: Enhanced vegetation index

Evidence theory

UF: Belief functions
Dempster?Shafer theory
BT: Uncertainty
RT: Belief propagation

Evolution (biology)

BT: Biology
NT: Memetics
Phylogeny

Evolutionary algorithm

USE: Evolutionary computation

Evolutionary computation

UF: Evolutionary algorithm
BT: Computational intelligence
RT: Evolutionary dynamics
Metaheuristics
NT: Evolutionary robotics
Particle swarm optimization

Evolutionary dynamics

BT: Computational modeling
RT: Evolutionary computation



JULY 2025 IEEE Thesaurus

Evolutionary robotics

BT: Evolutionary computation
Robots

BT: Machine components
Production systems
RT: Engines
Exhaust gases
Manifolds

Exascale computing

BT: High performance
computing
Supercomputers

Exo planets

USE: Extrasolar planets

Excavation

UF: Dredging
BT: Geotechnical engineering
RT: Construction industry
Marine technology
Mining industry
Rivers
Roads
Soil

Exo-planets

USE: Extrasolar planets

Exocrine glands

USE: Glands

Exoplanet

UF: Extrasolar planetary mass
BT: Extrasolar planets

Exchange rates

BT: Economics
RT: Costs
Economic indicators
International trade

Exoplanets

USE: Extrasolar planets

Exoskeletons

BT: User interfaces
RT: Assistive robots

Excitation of lasers

USE: Laser excitation

Expanded dynamic range

USE: High dynamic range

Excitons

BT: Charge carrier processes
RT: Quantum materials
Semiconductor materials

Expectation-maximisation algorithms

USE: Expectation-maximization
algorithms

Executive programs

USE: Operating systems

Expectation-maximization algorithms

UF: Expectation-maximisation
algorithms

BT: Iterative methods

Exhaust gases

BT: Gases
RT: Air pollution
Ash
Combustion
Exhaust systems
Flue gases
Internal combustion

Expert systems

BT: Knowledge based systems
Cause effect analysis
Decision making
Intelligent systems
Knowledge acquisition
Knowledge representation
NT: Diagnostic expert systems
Medical expert systems

engines

NT: Jet engines
Contrails

Exhaust manifolds

USE: Manifolds

Explainable AI

UF: XAI
Xplainable AI
BT: Artificial intelligence
Machine learning

Exhaust systems

UF: Catalytic converters
Catalytic convertors
Mufflers



JULY 2025 IEEE Thesaurus

Explosion protection

BT: Protection
Safety
RT: Accident prevention
Flammability
Hazards
Military equipment

Explosions

BT: Hazards
RT: Accidents
Chemical hazards
Flammability
Hazardous areas
Safety
Seismic waves
NT: Explosives

Explosives

BT: Explosions

Exponential distribution

BT: Probability distribution

Extended definition TV

USE: HDTV

Extended dynamic range

USE: High dynamic range

Extended reality

UF: HumanXR
X reality
XR
BT: Human computer
interaction
Human-machine systems
Virtual reality
RT: Augmented reality

Extensibility

BT: Design methodology
RT: Adaptive systems
Scalability

Extensible Markup Language

USE: XML

External stimuli

UF: PhysiStimuli
BT: Interactive systems
Physiology

Extinction coefficients

BT: Optics

NT: Extinction ratio

Extinction ratio

BT: Extinction coefficients

Extra solar planets

USE: Extrasolar planets

Extra-solar planets

USE: Extrasolar planets

Extracellular

BT: Cells (biology)
NT: Local field potentials

Extranets

BT: Virtual private networks
RT: Data communication
Information systems
Internet
Web sites

Extraordinary magnetoresistance

BT: Magnetoresistance

Extrapolation

BT: Approximation methods
RT: Statistics

Extrasolar planetary mass

USE: Exoplanet

Extrasolar planets

UF: Exo planets
Exo-planets
Exoplanets
Extra solar planets
Extra-solar planets
Super earths
BT: Astronomy
RT: Extraterrestrial
measurements
Extraterrestrial phenomena
NT: Exoplanet

Extraterrestrial measurements

UF: Planetary composition
Space measurements
BT: Measurement
RT: Astronomy
Extrasolar planets
Extraterrestrial phenomena
Interstellar chemistry



JULY 2025 IEEE Thesaurus

Extraterrestrial phenomena

UF: Space phenomena
 BT: Geophysics
 RT: Extrasolar planets
 Extraterrestrial
 measurements
 Planets
 Space technology
 NT: Cosmic rays
 Solar radiation

Extreme learning machines

BT: Feedforward neural
 networks
 RT: Clustering methods

Extreme ultraviolet lithography

UF: EUV Lithography
 BT: Lithography

Extremities

BT: Body regions
 NT: Buttocks
 Elbow
 Fingers
 Foot
 Hip
 Knee
 Limbs
 Shoulder
 Thigh

Eye diseases

BT: Diseases
 RT: Vision defects
 Visual impairment
 NT: Glaucoma
 Macular degeneration
 Retinopathy

Eye protection

UF: Goggles
 BT: Safety devices
 RT: Occupational health
 Occupational safety
 Protective clothing
 Safety

Eyebrows

BT: Hair

Eyelashes

BT: Eyes
 Hair

Eyelids

BT: Eyes

Eyes

BT: Sense organs
 RT: Electrooculography
 Gaze tracking
 Ophthalmology
 Optical coherence

tomography

NT: Cataracts
 Cornea
 Eyelashes
 Eyelids
 Iris
 Pupils
 Retina

FAA

UF: Federal Aviation
 Administration
 BT: US Government agencies

Fabrication

UF: Fabrication process
 BT: Manufacturing
 RT: Etching
 Materials processing
 NT: Bonding processes
 Microfabrication
 Optical device fabrication
 Soldering
 Welding

Fabrication process

USE: Fabrication

Fabrics

UF: Knitted fabric composites
 Woven fabric composites
 BT: Textiles
 RT: Clothing
 Weaving
 Wool

Fabry-Perot

BT: Interferometry
 NT: Fabry-Perot interferometers

Fabry-Perot interferometers

BT: Fabry-Perot

Face detection

BT: Computer vision
 RT: Facial animation



JULY 2025 IEEE Thesaurus

NT:	Facial features	<i>Factories</i>	USE:	Production facilities
Face masks				
UF:	Cloth face masks	<i>Factory automation</i>	USE:	Manufacturing automation
	Dust masks			
	FFP2			
	N95	<i>FACTS</i>	USE:	Flexible AC transmission
	Surgical masks			
BT:	Protective clothing	systems		
RT:	Personal protective			
equipment		Fading channels		
		BT:		Signal processing
Face recognition		RT:		Diversity methods
UF:	Facial recognition			Diversity schemes
BT:	Biometrics			Intercell interference
	Identification of persons			Meteorological factors
	Pattern recognition			Multipath channels
RT:	Gaze tracking			Radio propagation
	Image recognition	NT:		Frequency-selective fading
<i>Facebook</i>		channels		
USE:	Social networking (online)			Rayleigh channels
				Weibull fading channels
Faces		Failure analysis		
BT:	Head	UF:		Failure analytics
RT:	Stomatognathic system			Failure management
NT:	Facial muscles			Failure mechanisms
		BT:		Testing
Facial animation		RT:		Cause effect analysis
BT:	Animation			Diagnostic expert systems
RT:	Face detection			Electrostatic discharge
<i>Facial attributes</i>		protection		
USE:	Facial features			Failure state
Facial features				Fatigue
UF:	Facial attributes			Fault diagnosis
BT:	Face detection			Fault trees
				Green's function methods
Facial muscles				Life estimation
BT:	Faces			Mortality
<i>Facial recognition</i>				Quality control
USE:	Face recognition			Reliability
				Remaining life assessment
Facilities management		NT:		Root cause analysis
BT:	Building services			Shear testing
	Management			Weibull distribution
	Organizational aspects			Equipment failure
RT:	Building information	breakdown		Semiconductor device
management		<i>Failure analytics</i>		
		USE:		Failure analysis
Facsimile		<i>Failure management</i>		
BT:	Communication systems	USE:		Failure analysis
	Image communication			



JULY 2025 IEEE Thesaurus

Failure mechanisms

USE: Failure analysis

Failure state

BT: Systems engineering and theory

RT: Failure analysis

Fake content

USE: Fake news

Fake news

UF: Disinformation
Fake content
Fake reviews
False information
Misinformation

BT: Media

RT: Information diffusion

Information integrity

NT: Deepfakes

Fake reviews

USE: Fake news

Fall detection

BT: Biomechanics
Domestic safety

RT: Accelerometers
Alarm systems
Assisted living
Biomedical communication
Biomedical signal

processing

Body sensor networks
Detectors
Geriatrics
Home automation
Human activity recognition
Image motion analysis
Image recognition
Injuries
Patient monitoring
Video signal processing
Wearable devices

False information

USE: Fake news

Fans

BT: Machinery
Ventilation

RT: Air conditioning
Blades
Jet engines

Faraday effect

UF: Faraday rotation
BT: Magneto optic effects
RT: Gyromagnetism
Gyrotropism

Faraday rotation

USE: Faraday effect

Farming

BT: Industries

RT: Agricultural engineering
Agricultural products
Agriculture
Crop yield
Food products
Precision agriculture

Fascia

BT: Musculoskeletal system

Fashion industry

USE: Clothing industry

Fast charging

UF: DC fast charging

BT: Charging stations

RT: Electric vehicles

Fast Fourier transforms

BT: Fourier transforms

RT: Digital signal processing
Harmonic analysis

Fast light

BT: Light sources

Fastbus

BT: Data acquisition

Fasteners

UF: Bolts
Hinges
Nuts (fasteners)
Screws
Zip fasteners

BT: Control equipment
Mechanical products

RT: Belts
Couplings
Joining processes
Welding

Fastening

USE: Joining processes



JULY 2025 IEEE Thesaurus

Fatigue

BT: Mechanical factors
RT: Failure analysis
Life estimation

Fats

BT: Chemical products
Food products
RT: Biological materials
Lipidomics
Oils

Fault current limiters

BT: Current limiters

Fault currents

BT: Current
RT: Electric breakdown
Grounding
Leakage currents
NT: Fault protection

Fault detection

BT: System analysis and design

Fault diagnosis

BT: Reliability
RT: Cause effect analysis
Diagnostic expert systems
Failure analysis
Maintenance engineering
Testing
NT: Dissolved gas analysis
Fault location

Fault location

BT: Fault diagnosis
RT: Cables
Communication cables
Fault trees
Insulation testing

Fault protection

BT: Electrical safety
Fault currents

Fault tolerance

UF: System resilience
BT: Reliability
NT: Fault tolerant computer

networks

Fault tolerant computing
Fault tolerant control
Redundancy

Fault tolerant computer networks

BT: Computer network reliability
Fault tolerance
RT: Fault tolerant computing
Fault tolerant control
Fault tolerant systems

Fault tolerant computing

BT: Fault tolerance
RT: Fault tolerant computer

networks

Fault tolerant control
Fault tolerant systems

Fault tolerant control

BT: Control systems
Fault tolerance
RT: Fault tolerant computer

networks

Fault tolerant computing

Fault tolerant systems

BT: System analysis and design
RT: Fault tolerant computer

networks

Fault tolerant computing

Fault trees

BT: Risk analysis
RT: Boolean functions
Failure analysis
Fault location

Fauna

BT: Plants (biology)

FBAR

USE: Film bulk acoustic resonators

FBARs

USE: Film bulk acoustic resonators

FBT

USE: Flyback transformers

FCC

UF: Federal Communications Commission

BT: US Government agencies

FDA

UF: Food and Drug Administration



JULY 2025 IEEE Thesaurus

	BT:	US Government agencies		License plate recognition
FDDI				Mixture models
	UF:	Fiber distributed data		Motion capture
interface				Pattern classification
	BT:	Communication systems		Pattern recognition
		Optical fiber communication	analysis	Principal component
	RT:	Communication standards		Saliency detection
		Local area networks		Signal processing
				Speech recognition
<i>FDM</i>				
	USE:	Frequency division	<i>Feature learning</i>	
multiplexing			USE:	Representation learning
<i>FDMA</i>				
	USE:	Frequency division	<i>Feature selection</i>	
multiaccess			USE:	Feature extraction
<i>FDTD</i>			<i>Federal Aviation Administration</i>	
	USE:	Finite difference methods	USE:	FAA
AND				
		Time-domain analysis	<i>Federal Communications Commission</i>	
			USE:	FCC
<i>FDX</i>			Federated identity	
	USE:	Full-duplex system	UF:	FIM
			BT:	Identity management
<i>Fe</i>			systems	
	USE:	Iron	RT:	Authentication
				Blockchains
Feathers				Token networks
	BT:	Animal structures		Tokenization
Feature detection			Federated learning	
	BT:	Computer vision	UF:	Collaborative learning
		Image processing		Collaborative networking
	RT:	Feature extraction		Collaborative problem
		Normalized difference	solving	
vegetation index				Collaborative work
		Normalized difference		Cooperative work
water index				Federated-learning
		Saliency detection	BT:	Machine learning
			RT:	Collaborative software
				Communication
Feature extraction			effectiveness	
	UF:	Feature selection		
	BT:	Image processing		Multimedia computing
	RT:	Blob detection		Professional
		Conditional random fields	communication	
		Deep learning	NT:	Collaborative intelligence
		Feature detection		Cooperative communication
		Graph neural networks		Crowdsourcing
		Image annotation		Social computing
		Image edge detection		
		Image recognition	<i>Federated search</i>	
		Independent component	USE:	Metasearch
analysis				



JULY 2025 IEEE Thesaurus

Federated searching

USE: Metasearch

Federated-learning

USE: Federated learning

Feed in tariff

UF: Advanced renewable tariff
FIT
Feed-in-tariff
Renewable energy

payments

BT: Government policies
Tariffs
RT: Electricity supply industry
Energy conservation
Power generation
Pricing
Renewable energy sources

Feed-forward neural networks

USE: Feedforward neural networks

Feed-in-tariff

USE: Feed in tariff

Feedback

UF: Saturation detection
BT: Circuits
Control systems
RT: Control design
Positive train control
SIMO
Scrum (Software

development)

NT: System dynamics
Time invariant systems
Feedback circuits
Negative feedback
Neurofeedback

Feedback amplifiers

UF: NFB
Negative feedback amplifier
BT: Operational amplifiers

Feedback circuits

UF: Circuit feedback
BT: Feedback
RT: Control theory
Distributed feedback

devices

NT: Feedback communications
Output feedback

Feedback communications

BT: Telecommunications
RT: Feedback circuits
NT: Automatic repeat request
Feedback control
Feedback loop

Feedback control

BT: Feedback communications
NT: Windup

Feedback linearization

BT: Control nonlinearities
Control systems

Feedback loop

BT: Feedback communications
NT: Negative feedback loops

Feedforward neural nets

USE: Feedforward neural networks

Feedforward neural networks

UF: Feed-forward neural networks
BT: Feedforward neural nets
Neural networks
RT: Artificial intelligence
Pattern recognition
Self-organizing feature
maps
NT: Support vector machines
Extreme learning machines
Multilayer perceptrons

Feedforward systems

BT: Intelligent control
RT: Forward error correction
Open loop systems

Feeds

BT: Antennas
NT: Antenna feeds

FeFETs

UF: Ferroelectric FETs
BT: Field effect transistors

Felines

USE: Cats

FEM

USE: Finite element analysis



JULY 2025 IEEE Thesaurus

Femtocell networks

UF: Access point base station
BT: Cellular networks
RT: Base stations

Femtocells

BT: Base stations

Fermentation

BT: Chemical processes
RT: Alcoholic beverages
Dairy products
Pickling
Sewage treatment

Fermi energy

USE: Fermi level AND
Quasi-Fermi level

Fermi level

UF: Fermi energy
Fermi-level
BT: Energy states
Thermodynamics
RT: Quasi-Fermi level

Fermi-level

USE: Fermi level

Ferrimagnetic films

BT: Ferrimagnetic materials
Films
Magnetic films
Magnetic materials

Ferrimagnetic materials

BT: Magnetic materials
NT: Ferrimagnetic films
Ferrite films
Ferrites
Garnet films
Garnets

Ferrite devices

BT: Magnetic devices
RT: Ferrites
Flyback transformers
Gyrators
NT: Circulators

Ferrite films

BT: Ferrimagnetic materials
Ferrites
Films
Magnetic films

Magnetic materials

Ferrites

BT: Ferrimagnetic materials
Magnetic materials
RT: Ferrite devices
Gyromagnetism
NT: Ferrite films

Ferroelectric devices

BT: Dielectric devices
RT: Ferroelectric materials

Ferroelectric FETs

USE: FeFETs

Ferroelectric films

BT: Ferroelectric materials
RT: Magnetic field induced

strain

Ferroelectric materials

BT: Ultrasonics, ferroelectrics,
and frequency control

RT: Dielectric materials
Ferroelectric devices
Magnetic field induced

strain

NT: Pyroelectricity
Ferroelectric films
Lead zirconate titanate
Relaxor ferroelectrics

Ferrofluid

UF: LiquiFerrofluid
BT: Fluids
Magnetic materials

Ferromagnetic materials

BT: Magnetic materials

Ferromagnetic resonance

BT: Magnetic resonance

Ferroresonance

BT: Power engineering
Resonance
RT: Magnetic resonance
Nonlinear magnetics

Fertilisers

USE: Fertilizers

Fertilizers

UF: Fertilisers



JULY 2025 IEEE Thesaurus

BT:	Agrochemicals	<i>Fiber Bragg gratings</i>	
RT:	Boron	USE:	Bragg gratings
	Composting		
	Crops	<i>Fiber distributed data interface</i>	
		USE:	FDDI
FET circuits		Fiber gratings	
BT:	Solid state circuits	UF:	Fibre gratings
RT:	Nuclear electronics	BT:	Bragg gratings
	Operational amplifiers		
NT:	FET integrated circuits	Fiber lasers	
	JFET circuits	UF:	Fibre lasers
	MESFET circuits	BT:	Ring lasers
	MODFET circuits	NT:	Erbium-doped fiber lasers
	MOSFET circuits		High power fiber lasers
FET integrated circuits		Fiber nonlinear optics	
BT:	FET circuits	BT:	Fiber optics
	Integrated circuits		Nonlinear optics
RT:	Field effect transistors		
NT:	Field effect MMIC	<i>Fiber optic sensors</i>	
	MESFET integrated circuits	USE:	Optical fiber sensors
Fetal heart		Fiber optics	
BT:	Heart	UF:	Fibre optics
Fetal heart rate		BT:	Optics
BT:	Heart rate	NT:	Fiber nonlinear optics
			Optical fibers
<i>FETs</i>		Fiber reinforced plastics	
USE:	Field effect transistors	UF:	Fibre reinforced plastics
Fetus		BT:	Plastics
BT:	Embryonic structures	RT:	Plastic insulators
Few shot learning		<i>Fiber-Bragg gratings</i>	
UF:	Few-shot learning	USE:	Bragg gratings
BT:	Deep learning		
	Machine learning	<i>Fiber-in-the-loop</i>	
RT:	Artificial intelligence	USE:	Optical fiber subscriber
	One shot learning	loops	
	Training data	<i>Fibers</i>	
<i>Few-shot learning</i>		USE:	Textile fibers
USE:	Few shot learning	<i>Fibre gratings</i>	
<i>FFF</i>		USE:	Fiber gratings
USE:	Field-flow fractionation	<i>Fibre lasers</i>	
<i>FFP2</i>		USE:	Fiber lasers
USE:	Face masks	<i>Fibre optic sensors</i>	
<i>FGIR</i>		USE:	Optical fiber sensors
USE:	Fine-grained image	<i>Fibre optics</i>	
recognition		USE:	Fiber optics



JULY 2025 IEEE Thesaurus

Fibre reinforced plastics

USE: Fiber reinforced plastics

Fibrillation

BT: Medical treatment

RT: Defibrillation

NT: Atrial fibrillation

Fibroblasts

BT: Biological cells

Fiducial markers

UF: Imagimarkers

BT: Image processing

RT: Microfabrication

Semiconductor device

manufacture

Field assisted sintering

USE: Spark Plasma sintering

Field buses

UF: Instrumentation buses

BT: Computer interfaces

RT: Industrial control

Local area networks

Field effect MMIC

BT: FET integrated circuits

Field effect transistors

UF: FETs

BT: Transistors

RT: FET integrated circuits

Graphene devices

Semiconductor devices

NT: CNTFETs

Double-gate FETs

FeFETs

HEMTs

JFETs

MESFETs

MISFETs

MODFETs

MOSFET

MOSHFETs

OFETs

Schottky gate field effect

transistors

TFETs

Thin film transistors

Field electron emission

USE: Electron emission

Field emitter arrays

BT: Electron tubes

RT: Vacuum technology

Field flow fractionation

USE: Field-flow fractionation

Field ion emission

USE: Ion emission

Field multiplication

USE: Galois fields

Field programmable analog arrays

UF: FPAA

Field programmable

analogue arrays

BT: Analog integrated circuits

Programmable circuits

RT: Application specific

integrated circuits

Field programmable gate

arrays

Space technology

Field programmable analogue arrays

USE: Field programmable analog

arrays

Field programmable gate arrays

UF: FPGA

Field-programmable gate

arrays

BT: Integrated circuits

RT: AI accelerators

Field programmable analog

arrays

Reconfigurable devices

VHDL

Field robots

BT: Mobile robots

RT: Assistive robots

Autonomous robots

Collaborative robots

Humanoid robots

Service robots

Field-flow fractionation

UF: EFFF

FFF

Field flow fractionation

BT: Fractionation



JULY 2025 IEEE Thesaurus

Field-programmable gate arrays

USE: Field programmable gate arrays

Fifth Industrial Revolution

UF: 5IR
IR 5.0
Industrial Revolution 5.0
Industry 5.0
BT: Automation
Digital transformation
RT: Brain-computer interfaces
Fourth Industrial Revolution
Human computer

interaction
Internet of Things

Filament lamps

BT: Lamps
RT: Lighting

File servers

BT: Computers and information processing
RT: Computer networks
Data communication
Local area networks

File sharing

USE: Peer-to-peer computing

File system permissions

USE: Permission

File systems

BT: System software
RT: Audio databases
Data structures
Database systems
Information systems

Fill factor (solar cell)

BT: Photovoltaic systems

Filler metals

BT: Joining materials
RT: Metals

Filling

BT: Freight handling
RT: Containers
Loading
Packaging

Film bulk acoustic resonators

UF: FBAR
FBARs
BT: Acoustic devices
Thin film devices
RT: Bulk acoustic wave devices
Cellular radio
Mobile communication
Radio communication
Resonance
Telecommunications

Films

BT: Materials
RT: Chemical vapor deposition
Coatings
Entertainment industry
Human image synthesis
Sputtering
NT: Conductive films
Dielectric films
Epitaxial layers
Ferrimagnetic films
Ferrite films
Garnet films
Magnetic films
Optical films
Piezoelectric films
Plastic films
Polymer films
Semiconductor films
Thick films
Thin films

Films (Motion pictures)

USE: Motion pictures

Filter banks

UF: Filterbank
BT: Band-pass filters

Filter-theory

USE: Filtering theory

Filterbank

USE: Filter banks

Filtering

BT: Circuits and systems
RT: Noise cancellation
NT: Filters
Information filtering



JULY 2025 IEEE Thesaurus

Filtering algorithms

UF: Loop-filtering algorithm
Post-filtering algorithm
BT: Algorithms

Filtering theory

UF: Filter-theory
BT: Filters
RT: Estimation
Line enhancers
Matched filters
Maximum likelihood

detection

NT: Transversal filters
Collaborative filtering
Image filtering

Filters

BT: Filtering
Signal processing
RT: Passive filters
Signal to noise ratio
NT: Active filters
Anisotropic
Bragg gratings
Channel bank filters
Comb filters
Digital filters
Equalizers
Filtering theory
Gabor filters
Harmonic filters
IIR filters
Kalman filters
Low-pass filters
Matched filters
Microstrip filters
Nonlinear filters
Notch filters
Particle filters
Power filters
Resonator filters
Spatial filters
Superconducting filters
Transversal filters

Filtration

UF: Nanofiltration
BT: Materials science and

technology

RT: Sieving
NT: Microfiltration

FIM

USE: Federated identity

Finance

UF: Taxes
BT: Financial management
RT: Banking
Bitcoin
Business
Cryptocurrency
Economics
Open banking
NT: Bankruptcy
Crowdfunding
Currencies

Finance sector

USE: Financial industry

Financial industry

UF: Finance sector
BT: Industries
NT: Banking
Financial services

Financial management

UF: Financial planning
Money management
BT: Management
RT: Electronic commerce
Profitability
Public finance
NT: Costing
Credit cards
Finance
Insurance
Investment
Loans and mortgages
Management accounting
Mutual funds
Pricing
Venture capital

Financial planning

USE: Financial management

Financial services

BT: Financial industry
NT: Automated teller machine
Fintech
Micropayments

Financial technology

USE: Fintech

Fine-grained image recognition

UF: FGIR
BT: Image recognition



JULY 2025 IEEE Thesaurus

RT: Computer vision
Deep learning
Object detection

NT: Materials processing
Planing
Surface finishing

FinFETs

BT: MOSFET

Fingerprint identification

USE: Fingerprint recognition

Fingerprint images

USE: Image matching

Fingerprint indexing

USE: Fingerprint recognition

Fingerprint matching

USE: Fingerprint recognition

Fingerprint modality

USE: Fingerprint recognition

Fingerprint recognition

UF: Fingerprint identification
Fingerprint indexing
Fingerprint matching
Fingerprint modality
Fingerprint sensing
Fingerprint sensors
Fingerprint verification
Fingerprinting

BT: Biometrics
Identification of persons
Pattern recognition

RT: Image matching

Fingerprint sensing

USE: Fingerprint recognition

Fingerprint sensors

USE: Fingerprint recognition

Fingerprint verification

USE: Fingerprint recognition

Fingerprinting

USE: Fingerprint recognition

Fingers

BT: Extremities

NT: Thumb

Finishing

BT: Surface treatment

RT: Machining

Finite difference methods

UF: FDTD
Finite difference time

domain analysis

Finite difference time

domain methods

Finite-difference methods

Finite-difference time-

domain methods

BT: Mathematics

Numerical analysis

RT: Computational

electromagnetics

Perfectly matched layers

Finite difference time domain analysis

USE: Finite difference methods

Finite difference time domain methods

USE: Finite difference methods

Finite element analysis

UF: Discrete element method
FEM
Finite element methods
Finite element modeling
Finite element modelling
Finite-element analysis
Finite-element methods
Finite-element modeling
Finite-element modelling

BT: Mathematics

Numerical analysis

RT: Eddy current testing

Perfectly matched layers

Finite element methods

USE: Finite element analysis

Finite element modeling

USE: Finite element analysis

Finite element modelling

USE: Finite element analysis

Finite fields

USE: Galois fields

Finite impulse response filters

UF: FIR
FIR filters



JULY 2025 IEEE Thesaurus

BT: Digital filters
RT: Discrete wavelet transforms
Frequency response

Finite state machines

USE: Automata

Finite volume methods

UF: Finite-volume method
BT: Numerical analysis
RT: Navier-Stokes equations

Finite wordlength effects

UF: Overflow oscillations
Truncation errors
BT: Error analysis
RT: Quantization (signal)
NT: Roundoff errors

Finite-difference methods

USE: Finite difference methods

Finite-difference time-domain methods

USE: Finite difference methods

Finite-element analysis

USE: Finite element analysis

Finite-element methods

USE: Finite element analysis

Finite-element modeling

USE: Finite element analysis

Finite-element modelling

USE: Finite element analysis

Finite-volume method

USE: Finite volume methods

Finline

BT: Planar transmission lines

Fintech

UF: Financial technology
BT: Financial services
Technology
RT: Cryptocurrency
Investment
Mobile applications
Online banking
Smart phones

FIR

USE: Finite impulse response filters

FIR filters

USE: Finite impulse response filters

Fire extinguishers

BT: Safety devices
RT: Fire safety

Fire retardants

USE: Flame retardants

Fire safety

BT: Safety
RT: Fire extinguishers

Fireproofing

USE: Flame retardants

Fires

UF: Flames
BT: Hazards
RT: Accidents
Emergency services
Flammability
Hazardous areas
Safety
Smoke detectors
NT: Wildfires

Firewalls (computing)

BT: Computer security
RT: Computer networks
Hardware
Software

FireWire

USE: Firewire

Firewire

UF: FireWire
BT: Computer interfaces
RT: Computer peripherals
Consumer electronics
Data communication
Home computing
IEEE 1394 Standard
Video signal processing

Fireworks algorithm

BT: Optimization methods
RT: Particle swarm optimization



JULY 2025 IEEE Thesaurus

Firing

BT: Materials preparation
RT: Ceramics
Heat treatment
Kilns

Firmware

USE: Microprogramming

Fish

BT: Organisms
NT: Fisheries
Sharks

Fish schooling

USE: Fish schools

Fish schools

UF: Fish schooling
BT: Collective intelligence
Ensemble learning
RT: Algorithm design and
analysis
Artificial neural networks
Behavioral sciences
Clustering methods
Computational modeling
Computer simulation
Decision making
Neural networks
Neuroscience
Particle swarm optimization
Predictive models
Random forests
Training data

Fishbone diagrams

USE: Cause effect analysis

Fisheries

UF: Fishery
BT: Aquaculture
Fish

Fishery

USE: Fisheries

Fission reactors

UF: Nuclear fission
Nuclear reactors (fission)
BT: Nuclear power generation
RT: Pressure vessels
Radiation protection

FIT

USE: Feed in tariff

Fitbit

USE: Wearable Health Monitoring

Systems

Fitting

BT: Assembly
RT: Assembly systems

Fixed point arithmetic

USE: Fixed-point arithmetic

Fixed-point arithmetic

UF: Fixed point arithmetic
BT: Arithmetic

Fixtures

UF: Fixturing
Jigs
BT: Production equipment
RT: Machine tools

Fixturing

USE: Fixtures

Flame retardants

UF: Fire retardants
Fireproofing
BT: Retardants
RT: Bromine compounds
Flammability
Materials preparation

Flames

USE: Fires

Flammability

UF: Inflammability
BT: Hazards
RT: Explosion protection
Explosions
Fires
Flame retardants
Hazardous materials

Flanges

BT: Mechanical products
RT: Rails
Structural plates
Wheels



JULY 2025 IEEE Thesaurus

Flash memories

UF: NAND flash
BT: Memory
RT: Automation
Computer peripherals
Solid state drives
NT: Flash memory cells

control

Mechanical variables
Soft robotics
Structural engineering

Flicker

USE: Fluctuations

Flash memory cells

BT: Flash memories
NT: Split gate flash memory

cells

Flight control

USE: Aerospace control

Flight dynamics

BT: Aerospace engineering
RT: Aerodynamics

Flight recorder

USE: Flight recording

Flashover

BT: Dielectric breakdown

Flat panel displays

UF: Plasma display panel
BT: Displays
RT: Consumer electronics
TV

Flight recording

UF: Black box
Flight recorder
BT: Recording

Flex

USE: Flexible printed circuits

Flight simulation

USE: Aerospace simulation

Flexible AC transmission systems

UF: FACTS
BT: AC power transmission
Power transmission

Flip chip

USE: Flip-chip devices

Flexible electronics

BT: Assembly systems
RT: Graphene devices
Soft electronics
NT: Electronic skin

Flip chip solder joints

UF: Castellations
BT: Soldering
RT: Flip-chip devices

Flexible fuel vehicles

USE: Land vehicles

Flip-chip

USE: Flip-chip devices

Flexible manufacturing systems

BT: Manufacturing automation
RT: Agile manufacturing
Cellular manufacturing
Computer applications

Flip-chip devices

UF: Flip chip
Flip-chip
BT: Semiconductor device
manufacture
Semiconductor devices
RT: Flip chip solder joints
Microassembly
Microprocessor chips
Microprocessors

Flexible printed circuits

UF: Flex
BT: Printed circuits

Flip-flops

BT: Pulse circuits
RT: Logic circuits

Flexible structures

UF: Deployable structures
BT: Buildings
Structural shapes
RT: Control systems
Decentralized control

FLL

USE: Frequency locked loops



JULY 2025 IEEE Thesaurus

<i>Floating point arithmetic</i>		BT:	Manufacturing systems
USE:	Floating-point arithmetic	RT:	System dynamics
		NT:	Continuous production
Floating-point arithmetic			
UF:	Floating point arithmetic	Flowcharts	
BT:	Arithmetic	BT:	Engineering drawings
		RT:	Programming
Floods			System analysis and design
BT:	Hazards		
	Hydrology	Flower pollination algorithm	
RT:	Land use planning	BT:	Algorithm design and
	Rain	theory	
	Rivers	Flowering plants	
	Stormwater	UF:	Angiosperms
	Structural engineering	BT:	Plants (biology)
		NT:	Bamboo
Floors			Pollination (plants)
BT:	Building materials		
RT:	Construction industry	Flowmeters	
	Tiles	UF:	Flow meters
		BT:	Meters
Floppy disks		RT:	Automatic meter reading
BT:	Magnetic memory		Fluid flow
			Velocity measurement
Flora			
BT:	Plants (biology)	Fluctuations	
		UF:	Flicker
<i>Flotation devices</i>		BT:	Reliability
USE:	Underwater equipment		
<i>Flow</i>		<i>Flue ash</i>	
USE:	Fluid flow	USE:	Fly ash
<i>Flow batteries</i>		Flue gases	
USE:	Batteries	BT:	Gases
		RT:	Air pollution
<i>Flow control</i>			Effluents
USE:	Flow production systems		Exhaust gases
Flow graphs		Fluid dynamics	
UF:	Data flow graphs	BT:	Fluid flow
	Signal flow graphs		Fluids
BT:	Programmable control	RT:	Hydrodynamics
RT:	Circuits		Lattice Boltzmann methods
<i>Flow meters</i>		NT:	Buoyancy
USE:	Flowmeters		Computational fluid
<i>Flow modeling</i>		dynamics	
USE:	Flow production systems		Drag
			Navier-Stokes equations
Flow production systems			Rheology
UF:	Flow control	Fluid flow	
	Flow modeling	UF:	Flow
	Sequential production		Gas flow
			Liquid flow



JULY 2025 IEEE Thesaurus

hydrodynamics	Smoothed particle	Gases
BT:	Physics	Hydraulic fluids
RT:	Electrohydraulics	Liquids
	Flowmeters	Viscosity
	Fluid flow measurement	
	Fluidics	Fluids and secretions
	Hydraulic systems	BT: Anatomy
	Hydrodynamics	NT: Amniotic fluid
	Magnetohydrodynamics	Cerebrospinal fluid
NT:	Fluid dynamics	
	Hydraulic diameter	Fluorescence
	Hydrology	BT: Luminescence
	Pipelines	Optics
	Supersonic flow	RT: Fluorescent lamps
	Valves	Judd-Ofelt theory
		NT: Immunofluorescence
Fluid flow control		
BT:	Control systems	Fluorescent lamps
RT:	Valves	BT: Lamps
		RT: Fluorescence
		Lighting
Fluid flow measurement		
UF:	Anemometers	Fluorine
BT:	Measurement	BT: Chemical elements
RT:	Fluid flow	NT: Fluorine compounds
	Hydrologic measurements	
	Pressure gauges	Fluorine compounds
		BT: Fluorine
Fluidic microsystems		NT: Chlorofluorocarbons
BT:	Micromechanical devices	Hydrogen fluoride
RT:	Microfluidics	
Fluidics		Flux pinning
BT:	Control systems	BT: Magnetic flux
RT:	Fluid flow	Superconductivity
	Nanotechnology	RT: Type II superconductors
	Pneumatic systems	
NT:	Microfluidics	<i>Fluxtronics</i>
	Nanofluidics	USE: Spintronics
<i>Fluidisation</i>		Fly ash
USE:	Fluidization	UF: Coal ash
		Flue ash
Fluidization		Fly-ash
UF:	Fluidisation	BT: Ash
BT:	Chemical technology	RT: Slag
RT:	Fluids	<i>Fly-ash</i>
		USE: Fly ash
Fluids		Flyback transformers
BT:	Materials	UF: FBT
RT:	Buoyancy	LOPT
	Fluidization	Line output transformer
	Oils	BT: Transformers
NT:	Ferrofluid	RT: Cathode ray tubes
	Fluid dynamics	



JULY 2025 IEEE Thesaurus

	Electron beam applications	RT:	Consumer products
	Electron beams		Food preservation
	Ferrite devices		Food products
<i>Flying robots</i>			Food technology
USE:	Drones	NT:	Food waste
			Food packaging
Flywheels		Food packaging	
BT:	Energy storage	BT:	Food manufacturing
			Packaging
<i>FM</i>		RT:	Food products
USE:	Frequency modulation		Food technology
			Food waste
<i>fMRI</i>		Food preservation	
USE:	Functional magnetic	UF:	Food preservatives
resonance imaging		BT:	Food technology
<i>fnirs</i>		RT:	Food industry
USE:	Functional near-infrared		Food manufacturing
spectroscopy			Food products
Focusing		<i>Food preservatives</i>	
BT:	Imaging	USE:	Food preservation
RT:	Lenses		
<i>Fog computing</i>		Food processing	
USE:	Edge computing	BT:	Food industry
<i>Food and Drug Administration</i>		<i>Food production</i>	
USE:	FDA	USE:	Food manufacturing
<i>Food hygiene</i>		Food products	
USE:	Food safety	BT:	Manufactured products
			Production
Food industry		RT:	Agricultural products
BT:	Manufacturing industries		Consumer products
RT:	Beverage industry		Farming
	Consumer products		Food industry
	Food preservation		Food manufacturing
	Food products		Food packaging
	Food safety		Food preservation
	Food technology		Food safety
	Smart agriculture		Seeds (agriculture)
	Sugar industry		Smart agriculture
	Sugar refining		Sugar industry
NT:	Food manufacturing		Sugar refining
	Food processing		Vegetable oils
<i>Food loss</i>		NT:	Dairy products
USE:	Food waste		Fats
			Food security
Food manufacturing			Food waste
UF:	Food production		Nutrients
BT:	Food industry		Sugar
	Manufacturing systems		



JULY 2025 IEEE Thesaurus

Food safety

UF: Food hygiene
BT: Safety
RT: Food industry
Food products

Food security

BT: Food products
Security
RT: Agricultural products
Economics
Emergency services
Environmental factors
Measurement
Social factors
Supply chain management
Sustainable development

Food technology

BT: Industry applications
RT: Food industry
Food manufacturing
Food packaging
Smart agriculture
Sugar refining
NT: Food preservation

Food waste

UF: Food loss
BT: Food products
Waste materials
RT: Agriculture
Biofuels
Consumer behavior
Food manufacturing
Food packaging
Government policies
Recycling

Foot

BT: Extremities
RT: Ankle

Football

USE: Sports

Footprinting

USE: Network reconnaissance

Footwear

UF: Shoes
BT: Clothing
RT: Clothing industry
Footwear industry

Footwear industry

UF: Shoe manufacture
BT: Manufacturing industries
RT: Clothing industry
Consumer products
Footwear

Force

BT: Mechanical factors
RT: Dynamics
Force control
Magnetic forces
NT: Gravity

Force control

BT: Mechanical variables
control
RT: Control systems
Force
Robot control

Force feedback

BT: Haptic interfaces

Force measurement

BT: Mechanical variables
measurement
RT: Gravity
Pressure gauges
NT: Dynamometers
Gravity measurement

Force sensors

BT: Sensors

Forebrain

UF: Prosencephalon
BT: Brain
RT: Hindbrain
Midbrain
NT: Olfactory bulb

Forecast uncertainty

BT: Forecasting
Uncertainty

Forecasting

BT: Probability
RT: Hindcasting
Prediction methods
NT: Demand forecasting
Economic forecasting
Forecast uncertainty
Technology forecasting



JULY 2025 IEEE Thesaurus

Forehead

BT: Head

Forensic photography

USE: Image forensics

Forensics

BT: Law
NT: Digital forensics
Image forensics

Forest clearance

USE: Deforestation

Forest clearing

USE: Deforestation

Forestry

BT: Geoscience
RT: Agribusiness
Pulp and paper industry
Rainforests
Resource management
Vegetation
Vegetation mapping
Wood industry
NT: Deforestation
Forests
Reforestation

Forests

BT: Forestry
Vegetation

Forgery

UF: Imposter signature
BT: Handwriting recognition

Forging

UF: Cogging
BT: Manufacturing systems

Formal concept analysis

BT: Mathematical analysis
RT: Classification tree analysis
Data analysis
Knowledge representation
Unsupervised learning

Formal languages

BT: Computer science
NT: Computer languages
Runtime library

Formal logic

USE: Logic

Formal specifications

BT: Standardization
RT: Service-oriented systems
engineering

Formal verification

BT: Software engineering
RT: Circuits and systems
Model checking

Formaldehyde

BT: Organic compounds

Formation control

BT: Motion control
RT: Multi-agent systems
Robot control

Forward contracts

BT: Contracts

Forward error correction

BT: Error correction
RT: Feedforward systems

Fossil fuels

BT: Fuels
RT: Air pollution
NT: Natural gas

Foundation models

UF: Large AI models
BT: Artificial intelligence
Modeling
RT: Chatbots
Machine learning

Foundries

BT: Production facilities
RT: Casting
Furnaces
Heat treatment
Materials processing

Four wave mixing

USE: Four-wave mixing

Four-wave mixing

UF: Four wave mixing
BT: Distortion
Optics
RT: Multiwave mixing



JULY 2025 IEEE Thesaurus

Fourier series

BT: Mathematics
RT: Data compression
Signal processing
Spectroscopy

Fourier transform infrared spectra

USE: Fourier transform infrared spectroscopy

Fourier transform infrared spectroscopy

UF: Fourier transform infrared spectra
BT: Fourier transforms
Spectroscopy

Fourier transforms

BT: Transforms
RT: Acoustics
Cepstrum
Diffraction
Harmonic analysis
Optics
Partial differential equations
Probability
Statistics
Time-frequency analysis
NT: Discrete Fourier transforms
Fast Fourier transforms
Fourier transform infrared spectroscopy

Fourth Industrial Revolution

UF: Industrial Revolution 4.0
Industry 4.0
BT: Automation
Digital transformation
Manufacturing
RT: Fifth Industrial Revolution
Internet of Things
Machine-to-machine

communications

Smart devices
Smart manufacturing

FPAA

USE: Field programmable analog arrays

FPGA

USE: Field programmable gate arrays

Fracking

USE: Fracking

Fracking

UF: Fracking
Hydraulic fracking
BT: Hydrological techniques
RT: Mining industry
Natural gas

Fractal antennas

BT: Antennas

Fractal art

BT: Art

Fractals

BT: Computational geometry
RT: Antennas
Chaos
Computer graphics
Econophysics

Fractional brownian motion

USE: Brownian motion

Fractional calculus

BT: Mathematical analysis

Fractionation

BT: Separation processes
RT: Chemical analysis
Oils
Petroleum industry
NT: Field-flow fractionation

Frame relay

BT: Communication switching
Packet switching
RT: B-ISDN
Computer networks
ISDN
Protocols
Wide area networks

Franchises

USE: Franchising

Franchising

UF: Franchises
BT: Business

Franz-Keldysh effect

USE: Electro-absorption modulators



JULY 2025 IEEE Thesaurus

Fraud

BT: Law
NT: Identity theft

Free economic territories

USE: Free economic zones

Free economic zones

UF: Free economic territories
Free zones
BT: Commerce and trade
Economics
RT: International trade
Tariffs
Trade agreements
NT: Freeports

Free electron lasers

UF: Cerenkov lasers
BT: Lasers
RT: Electron beams
Relativistic effects
Undulators

Free ports

USE: Freeports

Free trade

USE: Trade agreements

Free zones

USE: Free economic zones

Free-space optical communication

BT: Optical fiber communication
RT: NOMA

Freeports

UF: Free ports
Free economic zones
BT: Airports
Economics
International trade
Seaports
Trade agreements

Freeware

UF: WhatsApp
BT: Software

Freight containers

BT: Containers
RT: Freight handling
Transportation

Freight handling

UF: Cargo handling
BT: Materials handling
RT: Freight containers
Lifting equipment
Pulleys
Transmission line

discontinuities

NT: Filling
Loading

Frequency

BT: Electromagnetic radiation
Band-pass filters
Electric variables
Transmission line theory
NT: Bandwidth
Frequency dependence
Frequency diversity
Frequency synchronization
Resonant frequency

Frequency allocation

USE: Radio spectrum
management

Frequency control

UF: Frequency regulation
BT: Ultrasonics, ferroelectrics,
and frequency control
RT: Electric variables control
Frequency locked loops
Mechanical variables

control

Optical variables control
Ring oscillators
Tuners
NT: Automatic frequency control
Tunable circuits and

devices

Tuning

Frequency conversion

UF: Frequency division
Frequency multiplication
Harmonic generation
BT: Converters
RT: Image converters
Image intensifiers
NT: Mixers
Optical frequency

conversion



JULY 2025 IEEE Thesaurus

Frequency dependence

UF: Frequency dependent
BT: Frequency

Frequency dependent

USE: Frequency dependence

Frequency diversity

BT: Frequency

Frequency division

USE: Frequency conversion

Frequency division multiaccess

UF: FDMA
BT: Multiaccess communication
RT: Broadband communication

Frequency division multiplexing

UF: FDM
Frequency multiplexing
BT: Multiplexing
RT: Layered division

multiplexing

Frequency domain

USE: Frequency-domain analysis

Frequency domain analysis

USE: Frequency-domain analysis

Frequency estimation

BT: Frequency measurement
Parameter estimation
RT: Spectral analysis
Speech analysis

Frequency hop communication

USE: Spread spectrum
communication

Frequency hop radar

USE: Spread spectrum radar

Frequency locked loops

UF: FLL
BT: Linear feedback control

systems

RT: Signal processing
Frequency control
Frequency synthesizers
Phase locked loops
Synchronization

Frequency measurement

BT: Measurement
RT: Acoustic measurements
Atomic clocks
Doppler measurement
Electric variables

measurement

Electromagnetic

measurements

Frequency response
Mechanical variables

measurement

Optical variables

measurement

Phase frequency detectors
Time-frequency analysis
Wavelength measurement
Frequency estimation
Frequency-domain analysis

NT:

Frequency modulation

UF: FM
BT: Modulation
Radio broadcasting
RT: Demodulation
NT: Frequency shift keying

Frequency multiplexing

USE: Frequency division
multiplexing

Frequency multiplication

USE: Frequency conversion

Frequency regulation

USE: Frequency control

Frequency response

BT: Testing
RT: Amplifiers
Channel impulse response
Digital filters
Finite impulse response

filters

Frequency measurement
Impulse testing

Frequency selective surfaces

BT: Antenna theory

Frequency shift keying

UF: FSK
Frequency-shift modulation
Frequency-shift signaling
BT: Frequency modulation



JULY 2025 IEEE Thesaurus

Frequency synchronization

BT: Frequency
NT: Frequency synthesizers

Frequency synthesizers

BT: Frequency synchronization
RT: Frequency locked loops
Tuners

Frequency-domain analysis

UF: Frequency domain
Frequency domain analysis
BT: Frequency measurement
RT: Circuit analysis
Functional analysis
Signal analysis
NT: Time-frequency analysis

Frequency-hop communication

USE: Spread spectrum
communication

Frequency-selective fading channels

BT: Fading channels

Frequency-shift modulation

USE: Frequency shift keying

Frequency-shift signaling

USE: Frequency shift keying

Freshwater

BT: Water

Fresnel integral

USE: Fresnel reflection

Fresnel lenses

USE: Fresnel reflection

Fresnel reflection

UF: Fresnel integral
Fresnel lenses
Fresnel zones
BT: Reflection

Fresnel zones

USE: Fresnel reflection

Friction

BT: Mechanical factors
RT: Drag
Dynamics
Lubrication
NT: Mechanical bearings

Friction stir processing

USE: Strain control

Frittage

USE: Sintering

Frontal lobe

UF: BrainLobe
BT: Brain

Froth flotation

USE: Manufacturing processes

FSK

USE: Frequency shift keying

FTTH

USE: Optical fiber subscriber
loops

Fuel additives

USE: Additives

Fuel cell vehicles

BT: Electric vehicles
RT: Energy storage
Fuel cells
Traction motors
Vehicle-to-grid

Fuel cells

UF: Enzymatic fuel cells
Microbial eletrolysis cells
Microbial fuel cells
Solid oxide electrolyzer
cells
BT: Electrochemical devices
Energy conversion
Energy storage
RT: Fuel cell vehicles
Fuel storage
Power generation

Fuel economy

BT: Economics
Fuels

Fuel processing industries

UF: Coal tar
BT: Manufacturing industries
RT: Fuel storage
Fuels
Mining industry
Oil drilling
Oils



JULY 2025 IEEE Thesaurus

Fuel pumps
 BT: Pumps
 RT: Engines
 Fuels

Fuel storage
 UF: Fuel tanks
 Oil tanks
 BT: Material storage
 RT: Containers
 Energy storage
 Fuel cells
 Fuel processing industries
 Fuels

Fuel tanks
 USE: Fuel storage

Fuels
 BT: Energy resources
 Manufactured products
 RT: Coal gas
 Fuel processing industries
 Fuel pumps
 Fuel storage
 Methanol
 Petrochemicals
 Waste materials
 NT: Biofuels
 Coal
 Fossil fuels
 Fuel economy
 Petroleum
 Synthetic fuels

Full duplex system
 USE: Full-duplex system

Full stack
 UF: Software stack
 Solution stack
 BT: Software engineering

Full virtualization VM
 USE: System virtual machines

Full-duplex system
 UF: FDX
 Full duplex system
 BT: Duplex communication

systems

Fullerenes
 UF: Buckeyballs
 Buckminsterfullerene
 Buckyballs
 Buckytubes
 CarboFullerene
 Fullerites
 BT: Carbon

Fullerites
 USE: Fullerenes

Function approximation
 BT: Approximation methods
 RT: Computer science

Function generators
 USE: Signal generators

Functional analysis
 BT: Mathematics
 RT: Eigenvalues and
 eigenfunctions
 Frequency-domain analysis
 Functional data analysis
 Inverse problems
 Lyapunov methods
 Wave functions

Functional connectivity
 BT: Neuroscience

Functional data analysis
 BT: Data analysis
 Statistical analysis
 RT: Functional analysis

Functional electrical stimulation
 USE: Neuromuscular stimulation

Functional magnetic resonance imaging
 UF: fMRI
 BT: Magnetic resonance
 imaging
 RT: Biomedical image
 processing

Functional near-infrared spectroscopy
 UF: fnirs
 BT: Functional neuroimaging
 Spectroscopy
 RT: Infrared imaging
 Infrared spectra
 Neuroimaging



JULY 2025 IEEE Thesaurus

Functional neuroimaging

BT: Neuroimaging
NT: Functional near-infrared spectroscopy

Functional point analysis

BT: Estimation
Size measurement
RT: Cost benefit analysis
Software engineering

Functional programming

BT: Programming
RT: Python

Fungi

BT: Microorganisms

Furnaces

BT: Machinery
RT: Building services
Foundries
Gas appliances
Heating systems
NT: Blast furnaces
Kilns

Further education

USE: Continuing education

Fuses

BT: Electronic components
RT: Interrupters
Power system protection
Protection
Switchgear

Fusion power generation

BT: Nuclear and plasma sciences
RT: Nuclear power generation
Fusion reactors
Magnetic confinement

Fusion reactor design

BT: Fusion reactors

Fusion reactors

UF: Nuclear reactors (fusion)
Thermonuclear fusion
BT: Nuclear and plasma sciences
RT: Fusion power generation
NT: Fusion reactor design
Tokamaks

Fusion splicing

USE: Splicing

Futurism

USE: Technology forecasting

Fuzz testing

USE: Fuzzing

Fuzzing

UF: Fuzz testing
BT: Software testing

Fuzzy cognitive maps

BT: Directed graphs
Knowledge representation
RT: Cognitive systems
Decision making
Fuzzy logic
Fuzzy reasoning
Fuzzy set theory
Fuzzy systems
Inference mechanisms
Learning (artificial intelligence)
Neural networks

Fuzzy control

BT: Fuzzy systems
RT: Fuzzy logic
Fuzzy sets
Takagi-Sugeno model

Fuzzy inference

USE: Fuzzy logic

Fuzzy logic

UF: Fuzzy inference
Logic
BT: Fuzzy cognitive maps
Fuzzy control
Fuzzy reasoning
Fuzzy sets
Fuzzy systems
Possibility theory
NT: Takagi-Sugeno model

Fuzzy neural nets

USE: Fuzzy neural networks

Fuzzy neural networks

UF: Fuzzy neural nets
Neuro fuzzy networks
Neuro-fuzzy networks
BT: Fuzzy systems



JULY 2025 IEEE Thesaurus

Fuzzy reasoning

BT: Inference mechanisms
RT: Fuzzy cognitive maps
Fuzzy logic

Fuzzy set theory

BT: Set theory
RT: Fuzzy cognitive maps
Fuzzy sets
Fuzzy systems
Power system faults
TOPSIS

Fuzzy sets

BT: Set theory
RT: Fuzzy control
Fuzzy logic
Fuzzy set theory
Fuzzy systems
Nonlinear dynamical

systems

Uncertainty

Fuzzy systems

BT: Computational intelligence
RT: Fuzzy cognitive maps
Fuzzy logic
Fuzzy set theory
Fuzzy sets
Large-scale systems
Soft sensors
Takagi-Sugeno model
NT: Fuzzy control
Fuzzy neural networks
Hybrid intelligent systems

Ga

USE: Gallium

GaAs

USE: Gallium arsenide

Gabor filters

BT: Filters
RT: Image processing

Gadolinium

BT: Chemical elements
NT: Gadolinium oxide

Gadolinium oxide

BT: Gadolinium

Gain

BT: Electric variables

Gain analysis

USE: Gain measurement

Gain control

UF: Automatic gain control
BT: Electric variables control

Gain measurement

UF: Gain analysis
BT: Measurement
RT: Electric variables
measurement
Refractive index

Gait analysis

USE: Gait recognition

Gait assessment

USE: Legged locomotion

Gait control

USE: Legged locomotion

Gait disorders

USE: Legged locomotion

Gait recognition

UF: Gait analysis
BT: Biometrics
RT: Computer vision
Motion capture

Galerkin method

USE: Method of moments

Gallbladder

BT: Digestive system

Gallium

UF: Ga
BT: Metals
Semiconductor materials
RT: Epitaxial growth
Gallium compounds
Molecular beam epitaxial

growth

NT: Semiconductor thin films
Gallium alloys

Gallium alloys

BT: Gallium
RT: Alloying
Wide band gap

semiconductors



JULY 2025 IEEE Thesaurus

Gallium arsenide

UF: GaAs
Gallium-arsenide
Gallium-arsenide (GaAs)
BT: Gallium compounds
Semiconductor materials

RT: Control systems
Games
Minimax techniques
Multi-armed bandit problem
Oligopoly
Optimal control
Predator prey systems

Gallium compounds

UF: Gallium devices
Gallium materials
BT: Compounds
RT: Alloying
Gallium
NT: Aluminum gallium nitride
Gallium arsenide
Gallium nitride
Gallium oxide
Indium gallium arsenide
Indium gallium nitride

NT: Branching factor
Differential games
Mechanism design
Nash equilibrium

Gallium devices

USE: Gallium compounds

Gallium materials

USE: Gallium compounds

Gallium nitride

BT: Gallium compounds

Gallium oxide

BT: Gallium compounds

Gallium-arsenide

USE: Gallium arsenide

Gallium-arsenide (GaAs)

USE: Gallium arsenide

Galois fields

UF: Field multiplication
Finite fields
BT: Abstract algebra

Galvanising

USE: Galvanizing

Galvanizing

UF: Galvanising
BT: Surface treatment
RT: Corrosion
Corrosion inhibitors
Protection

Game theory

BT: Decision making

Games

BT: Consumer products
RT: Entertainment industry
Game theory
Metaverse
Sports
NT: Cloud gaming
Procedural generation
Serious games

Gaming on demand

USE: Cloud gaming

Gamma distribution

BT: Statistics
RT: Probability

Gamma phase iron

USE: Austenite

Gamma radiation detectors

USE: Gamma-ray detectors

Gamma ray bursters

USE: Gamma-ray bursts

Gamma ray bursts

USE: Gamma-ray bursts

Gamma ray detection

USE: Gamma-ray detection

Gamma ray detectors

USE: Gamma-ray detectors

Gamma ray effects

USE: Gamma-ray effects

Gamma ray telescopes

USE: Gamma-ray telescopes

Gamma rays

USE: Gamma-rays



JULY 2025 IEEE Thesaurus

Gamma-ray bursts

UF: Cosmic gamma ray bursts
Gamma ray bursters
Gamma ray bursts
BT: Gamma-rays

Gamma-ray detection

UF: Gamma ray detection
BT: Gamma-rays

Gamma-ray detectors

UF: Gamma radiation detectors
Gamma ray detectors
BT: Radiation detectors
RT: Astronomy
Biomedical applications of
radiation
X-ray detectors
X-ray imaging

Gamma-ray effects

UF: Gamma ray effects
BT: Gamma-rays
Radiation effects

Gamma-ray imaging

USE: Nuclear imaging

Gamma-ray telescopes

UF: Gamma ray telescopes
BT: Telescopes
RT: Aerospace electronics

Gamma-rays

UF: Gamma rays
BT: Electromagnetic radiation
Nuclear and plasma

sciences

RT: Collimators
Nuclear medicine
NT: Gamma-ray bursts
Gamma-ray detection
Gamma-ray effects

GAN

USE: Generative adversarial

networks

Ganglia

UF: Ganglion
BT: Cells (biology)
Nervous system

Ganglion

USE: Ganglia

Gap waveguide

BT: Electromagnetic
waveguides
RT: Waveguide components

Garbage collection (computers)

USE: Memory management

Garment industry

USE: Clothing industry

Garments

USE: Clothing

Garnet films

BT: Ferrimagnetic materials
Films
Garnets
Magnetic films
Magnetic materials

Garnets

BT: Ferrimagnetic materials
Magnetic materials
NT: Garnet films

Gas appliances

BT: Home appliances
RT: Furnaces
Space heating

Gas chromatography

BT: Measurement

Gas detectors

UF: Gas sensors
BT: Chemical and biological

sensors

RT: Chemical transducers
NT: Amperometric sensors

Gas discharge devices

BT: Nuclear and plasma

sciences

RT: Discharges (electric)
Electrophotography
Gases
Lighting
Plasma devices
Thyratrons
NT: Glow discharge devices

Gas discharges

USE: Discharges (electric)



JULY 2025 IEEE Thesaurus

Gas flow

USE: Fluid flow

NT:

Natural gas
Argon
Carbon emissions
Coal gas
Exhaust gases
Flue gases
Greenhouse gases
Helium
Hydrogen
Nitrogen
Oxygen
Syngas
Xenon

Gas industry

BT: Industries

RT: Petroleum industry

Gas insulated switchgear

USE: Gas insulation

Gas insulated transmission lines

UF: GITL

Gas-insulated lines

Gas-insulated transmission

BT: Power transmission lines

RT: Gas insulation

Gaskets

BT: Seals

RT: Engine cylinders

Engines

Pistons

Gas insulation

UF: Gas insulated switchgear

BT: Insulation

RT: Gas insulated transmission

Gasoline

USE: Petroleum

lines

NT: Gases

Sulfur hexafluoride

Gastritis

BT: Medical conditions

RT: Stomach

Gas lasers

UF: Atomic lasers

Metal vapor lasers

BT: Lasers

RT: Atom lasers

Chemical lasers

Gases

Gastroenterologists

USE: Gastroenterology

Gastroenterology

UF: Gastroenterologists

BT: Medical specialties

Gas platforms

USE: Offshore installations

Gastrointestinal

USE: Gastrointestinal tract

Gas sensors

USE: Gas detectors

Gastrointestinal tract

UF: Gastrointestinal

BT: Digestive system

Gas-insulated lines

USE: Gas insulated transmission

lines

Gate drivers

BT: Power electronics

RT: High power amplifiers

MOSFET

Gas-insulated transmission

USE: Gas insulated transmission

lines

Gate leakage

BT: Leakage currents

Solid state circuits

Tunneling

Gases

BT: Fluids

RT: Discharges (electric)

Gas discharge devices

Gas insulation

Gas lasers

Materials science and

Gate leakage current

USE: Leakage currents

technology



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Gated recurrent units

BT: Recurrent neural networks

GATT

USE: Trade agreements

Gaussian approximation

BT: Gaussian distribution

Gaussian channels

BT: Communication channels

RT: Intersymbol interference

NT: AWGN channels

Gaussian distribution

UF: Normal distribution

BT: Statistical distributions

NT: Gaussian approximation

Gaussian mixture model

BT: Gaussian processes
Statistics

Gaussian noise

BT: Noise

RT: Additive white noise

Image denoising

Signal processing

TV interference

NT: AWGN

Gaussian processes

BT: Stochastic processes

RT: Inference mechanisms

Learning (artificial

intelligence)

Prediction methods

NT: Gaussian mixture model

Gaze tracking

BT: Control systems

Human computer

interaction

RT: Assistive technologies

Computer vision

Eyes

Face recognition

Motion measurement

Position measurement

User interfaces

Video signal processing

NT: Electrooculography

GDP

USE: Economic indicators

GDPR

USE: General Data Protection
Regulation

Ge Si

USE: Germanium silicon alloys

Gears

UF: Bevel gears

Differential gears

Helical gears

Spur gears

Worm gears

BT: Machinery

Mechanical products

RT: Automotive components

Machine components

Machine tools

Mechanical power

transmission

Mechanical splines

Mechanical systems

Production equipment

Shafts

Torque converters

NT: Magnetic gears

Gender equality

USE: Gender issues

Gender equity

BT: Equal opportunities

RT: Transgender issues

Gender issues

UF: Gender equality

Women's issues

BT: Equal opportunities

RT: Digital divide

NT: Transgender issues

Gene expression

BT: Gene therapy

Gene therapy

BT: Genetics

RT: CRISPR

Transfection

NT: Gene expression

General agreement on tariffs and trade

USE: Trade agreements



JULY 2025 IEEE Thesaurus

General Data Protection Regulation

UF: GDPR
BT: Data protection
Government policies
Legislation
RT: Data handling
Ethics
Privacy

Generation of electric power

USE: Power generation

Generation Y

USE: Millennials

Generative adversarial networks

UF: GAN
BT: Algorithm design and
analysis
RT: Artificial intelligence
Convolutional neural
networks
Machine learning
Neural networks
Unsupervised learning

Generative AI

UF: AI generated content
Generative artificial
intelligence
BT: Artificial intelligence
RT: Neural networks
Pattern analysis
NT: Prompt engineering

Generative artificial intelligence

USE: Generative AI

Generative Pre-trainer transformer

UF: GPT
BT: Large language models
Machine learning
RT: Chatbots
Deep learning
Natural language
processing
Training data

Generators

UF: Dynamo
BT: Electric machines
Rotating machines
RT: Coils
Islanding
Power generation

NT: AC generators
DC generators
Electric generators
Radioisotope thermoelectric
generators
Standby generators

Genetic algorithms

BT: Algorithms
Computational intelligence
RT: Job shop scheduling
Metaheuristics
Pareto optimization
Search methods
NT: Genetic operators

Genetic communication

BT: Genetics
Information theory
RT: Biological information
theory
Biomedical engineering
DNA

Genetic engineering

UF: Genetically modified crops
BT: Engineering in medicine
and biology
RT: Agriculture
Biomedical engineering
Biotechnology
Ethical aspects
Genetics
Molecular biophysics
Seeds (agriculture)
Tissue engineering
NT: CRISPR
Transfection

Genetic expression

BT: Genetics

Genetic mutations

BT: DNA
RT: CRISPR

Genetic operators

BT: Genetic algorithms

Genetic programming

BT: Genetics

Genetically modified crops

USE: Genetic engineering



JULY 2025 IEEE Thesaurus

Genetics

BT: Biology
 RT: Amniocentesis
 Genetic engineering
 Memetics
 Molecular biophysics
 NT: DNA
 Epigenetics
 Gene therapy
 Genetic communication
 Genetic expression
 Genetic programming
 Genomics
 Genotypes
 Optogenetics
 Phenotypes

Genital system

USE: Reproductive system

Genitourinary surgery

USE: Urology

Genomes

USE: Genomics

Genomics

UF: Genomes
 BT: Genetics
 Molecular biomarkers
 RT: High dimensional data
 NT: Codons
 Metagenomics
 Transcriptomics

Genotypes

BT: Genetics
 RT: Phenotypes

Geo tagging

USE: Location awareness

Geoacoustic inversion

BT: Sea measurements

Geochemistry

UF: Hydrochemistry
 BT: Chemistry
 Geoscience
 RT: Geophysics
 Salinity (geophysical)

Geodesy

BT: Geophysical measurements
 RT: Position measurement

Theodolites

NT: Level measurement

Geodynamics

BT: Geophysics

Geoengineering

UF: Engineering geology
 Geological engineering
 BT: Geoscience
 RT: Drilling
 Geology
 Geophysics
 Hydrological techniques
 Mining industry
 NT: Solar geoengineering

Geographic information systems

UF: GIS
 Geographical information

systems

BT: Geoscience and remote

sensing

Global communication
 Intelligent transportation

systems

RT: Cartography
 Image databases
 NT: Geospatial analysis
 Gunshot detection systems

Geographical information systems

USE: Geographic information

systems

Geography

BT: Geoscience
 RT: Environmental science
 Geospatial analysis
 NT: Cartography
 Deserts
 Rural areas
 Urban areas

Geologic measurements

BT: Measurement
 RT: Geology
 Geophysical measurements
 Hyperspectral sensors
 Remote sensing
 Terrain mapping
 Theodolites

Geologic processes

USE: Geological processes



JULY 2025 IEEE Thesaurus

Geological engineering

USE: Geoengineering

Geological processes

UF: Geologic processes

BT: Geology

NT: Sedimentation

Subduction

Weathering

Geology

BT: Geoscience

RT: Geoengineering

Geologic measurements

Geophysics

Paleontology

NT: Biogeochemistry

Continental crust

Erosion

Geological processes

Landslides

Minerals

Oceanic crust

Rocks

Stratigraphy

Tectonics

Geomagnetic disturbances

USE: Geomagnetic storms

Geomagnetic navigation

USE: Geomagnetism AND

Navigation

Geomagnetic storms

UF: Geomagnetic disturbances

BT: Geomagnetism

Storms

RT: Electromagnetic pulses

Geomagnetism

UF: Geomagnetic navigation

Geomatics

BT: Magnetic fields

RT: Electromagnetic induction

Geophysical measurements

Geophysics

Magnetosphere

NT: Geomagnetic storms

Geomatics

USE: Geomagnetism

Geometric modeling

BT: Computational geometry

Mathematical models

Geometrical optics

BT: Optics

RT: Reflectivity

NT: Ray tracing

Geometry

BT: Mathematics

RT: Layout

Lie groups

Shape

NT: Computational geometry

Elliptic curves

Elliptic design

Information geometry

Projective geometry

Surface topography

Geophysical image processing

BT: Geophysical measurement techniques

Image processing

Geophysical measurement techniques

BT: Geoscience and remote sensing

RT: Laser radar

Magneto electrical

resistivity imaging technique

Remote sensing

Theodolites

Tomography

Vegetation mapping

NT: Geophysical image

processing

Geophysical measurements

UF: Geophysical techniques

BT: Geoscience and remote

sensing

Measurement

RT: Atmospheric

measurements

Buried object detection

Depth measurement

Geologic measurements

Geomagnetism

Geophysical signal

processing

Geophysics

Gravity measurement

Pressure gauges

Remote sensing

Soil measurements



JULY 2025 IEEE Thesaurus

	NT:	Terrain mapping Geodesy Sea measurements Seismic measurements			Equator Estuaries Forestry Geochemistry Geoengineering Geography Geology Geophysics Glaciology Hydrography Ice Lakes Land surface Levee Meteorological factors Natural resources Oceanography Oceans Rivers Sediments Soil Tornadoes Tsunami Volcanoes Wetlands
Geophysical signal processing					
sensing	BT:	Geoscience and remote			
	RT:	Signal processing Geophysical measurements			
<i>Geophysical techniques</i>					
	USE:	Geophysical measurements			
Geophysics					
	BT:	Geoscience Physics			
	RT:	Earth Geochemistry Geoengineering Geology Geomagnetism Geophysical measurements Hydrologic measurements Hydrological techniques Oceans Terrestrial atmosphere			
	NT:	EMTDC Extraterrestrial phenomena Geodynamics Geophysics computing Meteorology Moisture Seismology Surface waves Well logging	Geoscience and remote sensing		
			NT:	Environmental factors Geographic information	
			systems		
			techniques	Geophysical measurement Geophysical measurements Geophysical signal	
			processing	Geoscience Land surface temperature Photometry Radiometry Remote sensing Terrain mapping Terrestrial atmosphere Vegetation mapping	
Geophysics computing					
	BT:	Geophysics			
	RT:	Computer aided analysis			
Geoscience					
sensing	UF:	Earth science			
	BT:	Geoscience and remote			
		Science - general	Geospatial analysis		
	RT:	Hydrological techniques	BT:	Geographic information	
	NT:	Antarctica Arctic Atmosphere Biosphere Continents Cyclones Earth Earthquakes	systems	RT:	Geography Software
			<i>GEOSS</i>		
			USE:	Global Earth Observation	
			System of Systems		



JULY 2025 IEEE Thesaurus

Geostationary communication satellites
USE: Geostationary satellites

Geostationary satellites

UF: Geostationary
communication satellites
Geosynchronous
communication satellites
Geosynchronous satellites
BT: Satellites
RT: Orbits

Geosynchronous communication satellites
USE: Geostationary satellites

Geosynchronous satellites
USE: Geostationary satellites

Geotechnical engineering

BT: Civil engineering
NT: Excavation

Geotechnical structures

BT: Civil engineering
NT: Dams

Geothermal energy

BT: Energy resources
RT: Geothermal power

generation
Renewable Portfolio
Standard

Geothermal power generation

BT: Power generation
RT: Geothermal energy

Geriatrics

BT: Medical treatment
RT: Assisted living
Assistive robots
Fall detection
Gerontology
Older adults

Germ warfare

USE: Biohazards AND
Biological weapons

Germanium

BT: Metals
Semiconductor materials
RT: Epitaxial growth
Semiconductor thin films
Silicon germanium

NT: Germanium alloys

Germanium alloys

BT: Germanium
RT: Alloying
NT: Germanium silicon alloys

Germanium silicon alloys

UF: Ge Si
BT: Germanium alloys
Silicon alloys

Germs

USE: Pathogens

Gerontechnology

BT: Biomedical equipment
Gerontology
RT: Assistive technologies

Gerontology

BT: Medical specialties
RT: Aging
Alzheimer's disease
Geriatrics
Older adults
NT: Gerontechnology

Gestational diabetes

BT: Diabetes
RT: Pregnancy

Gesture recognition

BT: Pattern recognition
NT: Sign language

Gettering

UF: Getters
BT: Vacuum systems
RT: Electron tubes
Integrated circuit
manufacture
Semiconductor device
manufacture
Vacuum technology

Getters

USE: Gettering

GFL

USE: Grid following

GFM

USE: Grid forming



JULY 2025 IEEE Thesaurus

GHZ transverse electromagnetic cells

USE: TEM cells

Giant magnetoresistance

BT: Magnetoresistance
RT: Hard disks
Magnetoresistive devices
Thin film devices

Girders

USE: Structural beams

GIS

USE: Geographic information systems

Github

USE: Software development management

GITL

USE: Gas insulated transmission lines

Glaciers

BT: Glaciology
Ice
RT: Snow
NT: Ice sheets

Glaciology

BT: Geoscience
NT: Glaciers

Glands

UF: Endocrine glands
Exocrine glands
BT: Biological tissues
NT: Adrenal glands
Mammary glands
Pituitary gland
Salivary glands
Sebaceous glands
Sweat glands
Thyroid

Glass

BT: Amorphous materials
Glass products
RT: Ceramics
Dielectric materials
Glass industry
Insulation
Optical materials

Glass bottles

USE: Glass products

Glass box

UF: Glass-box
White box
White-box
Whitebox
BT: Software
System analysis and design
RT: Software testing
System testing

Glass ceramics

USE: Ceramics

Glass furnaces

USE: Glass manufacturing

Glass industry

BT: Manufacturing industries
RT: Glass
Glass manufacturing
Glass products

Glass manufacturing

UF: Glass furnaces
BT: Manufacturing systems
RT: Glass industry

Glass products

UF: Glass bottles
BT: Manufactured products
RT: Bottling
Ceramic products
Ceramics
Chemical products
Glass industry
Windows
NT: Glass

Glass-box

USE: Glass box

Glaucoma

BT: Eye diseases

Glazes

BT: Coatings
RT: Ceramics
NT: Ceramic glazes

Glial cells

UF: Neuroglia
BT: Cells (biology)



JULY 2025 IEEE Thesaurus

	Nervous system	<i>Global System for Mobile Communications</i>
Global communication		USE: GSM
UF:	Global groups	<i>Global teams</i>
	Global teams	USE: Global communication
BT:	Professional	Global warming
communication		UF: Global dimming
NT:	Cross-cultural	BT: Climate change
communication		Environmental factors
	Geographic information	Temperature measurement
systems		Terrestrial atmosphere
<i>Global dimming</i>		RT: Air pollution
USE:	Global warming	Atmospheric
Global Earth Observation System of Systems		measurements
UF:	GEOSS	Carbon emissions
BT:	Earth Observing System	Carbon sequestration
		Energy informatics
<i>Global groups</i>		Environmental
USE:	Global communication	management
		Greenhouse effect
<i>Global markets</i>		Land surface temperature
USE:	Globalization	Low carbon economy
		Net zero
Global navigation satellite system		Ocean temperature
UF:	GNSS	Sea level rise
BT:	Satellite navigation systems	Thermal pollution
RT:	Global Positioning System	NT: Global warming potential
<i>Global Navigational Positioning System</i>		Global warming potential
USE:	Global Positioning System	UF: GWP
		BT: Global warming
Global Positioning System		Greenhouse gases
UF:	DGPS	<i>Globalisation</i>
	Differential GPS	USE: Globalization
	GPS	Globalization
	Global Navigational	UF: Global markets
Positioning System		Globalisation
BT:	Satellite navigation systems	BT: Social implications of
RT:	Air to ground	technology
communication		RT: Developing countries
	Air transportation	International collaboration
	Global navigation satellite	International relations
system		International trade
	Indoor navigation	Trade agreements
	Land transportation	<i>Glossaries</i>
	Marine transportation	USE: Terminology
	Military satellites	Glow discharge devices
	Road transportation	BT: Gas discharge devices
	Satellite broadcasting	
	Satellite communications	
	Telecommunications	
	Terrain mapping	

JULY 2025 IEEE Thesaurus

Glow discharges

BT: Dielectric breakdown

Glowworm swarm optimization

BT: Algorithms
Optimization methods

Glucose

BT: Sugar
NT: Continuous glucose

monitoring

Glucose sensors

BT: Sensors

Glycomics

BT: Molecular biomarkers

GNN

USE: Graph neural networks

GNP

USE: Economic indicators

GNSS

USE: Global navigation satellite

system

Goal recognition

USE: Intent recognition

Goggles

USE: Eye protection

Gold

UF: Au
BT: Metals
NT: Gold alloys

Gold alloys

BT: Gold
RT: Alloying

Goniometers

BT: Meters

Google

USE: Internet AND
Search engines

Google Chrome

USE: Browsers

GOSAT

UF: Greenhouse Gases
Observing Satellite

BT: Ibuki
Earth Observing System
Greenhouse gases
Satellites
RT: Carbon dioxide
Methane

Government

BT: Organizations
RT: Governmental factors
Leadership
Macroeconomics
Public finance
NT: Electronic government
Government policies
Legislation
Local government
US Government
Voting

Government borrowing

USE: Public finance

Government expenditure

USE: Public finance

Government policies

BT: Data governance
Government
RT: Censorship
Developing countries
Digital policy
Food waste
Open data
Public infrastructure
NT: Feed in tariff
General Data Protection

Regulation

Must-carry regulations
Public policy
Regulation

Governmental factors

BT: Management
RT: Government
Legal factors
Social factors
NT: Public finance

GPR

USE: Ground penetrating radar



JULY 2025 IEEE Thesaurus

GPS

USE: Global Positioning System

GPT

USE: Generative Pre-trainer
transformer

GPU

USE: Graphics processing units

Gradient methods

BT: Mathematics
Numerical analysis
Optimization methods
RT: Level set
Search methods

Grain alcohol

USE: Ethanol

Grain boundaries

BT: Crystals
RT: Conductivity
Corrosion
Electron backscatter

diffraction

Grain size
Thermal conductivity

Grain size

BT: Crystals
RT: Electron backscatter

diffraction

Grain boundaries

Grammar

BT: Professional
communication

Writing
RT: Syntactics

Granular computing

BT: Programming
RT: Concurrent computing
Information processing
Quantization (signal)

Granular superconductors

BT: Superconducting materials
RT: High-temperature
superconductors

Graph neural nets

USE: Graph neural networks

Graph convolutional networks

BT: Convolutional neural
networks
Graph neural networks

Graph drawing

BT: Data visualization
RT: Computational complexity
Graph theory
Knowledge representation
Mathematics computing
Social sciences

Graph neural networks

UF: GNN
Graph neural nets
BT: Graph theory
Neural networks
RT: Convolutional neural
networks

Data visualization
Deep learning
Feature extraction
Pattern classification
Recommender systems
Supervised learning
Graph convolutional

NT:
networks

Graph theory

BT: Combinatorial mathematics
Mathematics
RT: Ant colony optimization
Belief propagation
Circuit topology
Graph drawing
Topology
NT: Bipartite graph
Conditional random fields
Directed acyclic graph
Directed graphs
Graph neural networks
Network motifs
Optimal matching
Reachability analysis
Shortest path problem
Tree graphs

Graphene

BT: Carbon
NT: Graphene devices

Graphene devices

BT: Graphene
RT: Field effect transistors



JULY 2025 IEEE Thesaurus

Flexible electronics
Molecular electronics
Nanoelectronics

BT: Transient gratings
RT: Periodic structures
Optical devices

Graphic user interfaces

USE: Graphical user interfaces

Graphical models

BT: Modeling

Graphical user interfaces

UF: GUI
Graphic user interfaces
BT: Product development
User interfaces
NT: Avatars

Graphics

BT: Design methodology
RT: Art
Displays
Technical drawing
NT: Animation
Character generation
Computer graphics
Engineering drawings
Layout
Shape
Symbols
Virtual reality
Visualization

Graphics processing units

UF: GPU
VPU
BT: Program processors
RT: AI accelerators
Computer graphics
Hardware acceleration

Graphite

UF: Plumbago
BT: Carbon
RT: Lead

Grasping

BT: Haptic interfaces

Grasslands

UF: Prairie
Savanna
BT: Ecosystems

Gratings

UF: Optical gratings

Gravimeter

USE: Gravity measurement

Gravitational force

USE: Gravity

Gravitational waves

BT: Astronomy
Gravity

Gravimeter

USE: Gravity measurement

Gravity

UF: Gravitational force
BT: Force
RT: Force measurement
NT: Gravitational waves

Gravity measurement

UF: Gravimeter
Gravimeter
BT: Force measurement
RT: Astrophysics
Geophysical measurements

Gray codes

USE: Reflective binary codes

Gray matter

USE: Grey matter

Gray-scale

UF: Grayscale
BT: Image processing

Grayscale

USE: Gray-scale

Greedy algorithms

BT: Computation theory

Green buildings

BT: Construction
Green products
RT: Environmental factors
Green design

Green cleaning

BT: Green products



JULY 2025 IEEE Thesaurus

Green communications

UF: Green networking
BT: Communications
technology
RT: Carbon emissions
Environmental monitoring
Net zero
Renewable energy sources

Green computing

BT: Computer applications
Energy conservation
Green design
RT: Environmental factors
Sustainable development

Green design

UF: Environmental design
BT: Design methodology
RT: Energy informatics
Green buildings
NT: Ecodesign
Green computing

Green electronics

BT: Green products

Green energy

UF: Clean energy
BT: Renewable energy sources
RT: Anaerobic digestion
Environmental factors
Recycling
Sustainable development

Green function

USE: Green's function methods

Green hydrogen

BT: Hydrogen
Renewable energy sources
RT: Carbon emissions
Green manufacturing
Low carbon economy

Green manufacturing

BT: Environmental factors
Manufacturing
RT: Green hydrogen

Green networking

USE: Green communications

Green products

BT: Environmental factors

RT: Biohazards
Pollution
NT: Green buildings
Green cleaning
Green electronics

Green transportation

BT: Environmental factors
Transportation

Green's function

USE: Green's function methods

Green's function methods

UF: Green function
Green's function
Green's functions
BT: Modeling
RT: Failure analysis
Materials reliability

Green's functions

USE: Green's function methods

Greenhouse effect

BT: Infrared heating
RT: Carbon emissions
Carbon footprint
Carbon sequestration
Environmental factors
Global warming
Low carbon economy
Pollution control
NT: Greenhouse gases

Greenhouse gases

BT: Gases
Greenhouse effect
RT: Carbon dioxide
Chlorofluorocarbons
Methane
Net zero
Nitrous oxide
NT: GOSAT
Global warming potential

Greenhouse Gases Observing Satellite

USE: GOSAT

Greenhouses

BT: Agriculture
Production facilities
RT: Crops



JULY 2025 IEEE Thesaurus

Grey codes

USE: Reflective binary codes

BT: Ground-penetrating radar

Imaging

Radar

Grey matter

UF: Gray matter

BT: Central nervous system

RT: Buried object detection

Radar detection

Radar imaging

Synthetic aperture radar

Ultra wideband radar

Grid computing

UF: Grid maze

BT: Metacomputing

RT: Cloud computing

Ground source heat pumps

USE: Heat pumps

Grid following

UF: GFL

Grid-following

BT: Inverters

RT: Synchronous generators

Ground state

USE: Stationary state

Ground support

UF: Aerospace ground equipment

Aerospace ground services

BT: Aerospace control

RT: Aircraft

Military equipment

Missiles

Navigation

Rockets

Space vehicles

Grid forming

UF: GFM

Grid-forming

BT: Inverters

Power conversion

RT: Inverter-based resource

Synchronous generators

Grid maze

USE: Grid computing

Ground temperature

USE: Land surface temperature

Grid-following

USE: Grid following

Ground transportation

USE: Land transportation

Grid-forming

USE: Grid forming

Ground vehicles

USE: Land vehicles

Grinding machines

BT: Machine tools

Ground-penetrating radar

USE: Ground penetrating radar

Grippers

UF: Microgrippers

Worms

BT: Materials handling

equipment

RT: End effectors

Loading

Soft robotics

Grounding

UF: earthing

BT: Electrical safety

RT: Circuit stability

Electric shock

Fault currents

Power system protection

Protection

Gross domestic product

USE: Economic indicators

Groundwater

BT: Water

Gross national product

USE: Economic indicators

Group technology

BT: Production

RT: Product design

Production control

Ground penetrating radar

UF: GPR



JULY 2025 IEEE Thesaurus

<i>Groupware</i>	USE:	Collaborative software	<i>Gymnosperms</i>	USE:	Non-flowering plants
GSM	UF:	Global System for Mobile	<i>Gynaecology</i>	USE:	Gynecology
Communications	BT:	Cellular technology	Gynecology	UF:	Gynaecology
	RT:	Wireless communication	BT:	Medical specialties	
	RT:	Dual band			
	NT:	Roaming	Gyrators	BT:	Active circuits
	NT:	GSM-R		RT:	Active inductors
GSM-R					Ferrite devices
	UF:	GSM-Railway	<i>Gyroklystrons</i>	USE:	Klystrons
	BT:	GSM			
		Railway communication	Gyromagnetism	BT:	Magnetics
<i>GSM-Railway</i>	USE:	GSM-R		RT:	Faraday effect
<i>GTEM cells</i>	USE:	TEM cells			Ferrites
					Gyrotropism
<i>GUI</i>	USE:	Graphical user interfaces	<i>Gyros</i>	USE:	Gyroscopes
<i>Guided electromagnetic wave propagation</i>	USE:	Waveguide theory	Gyroscopes	UF:	Gyros
Guidelines	BT:	Standardization			Non-gyroscopes
	RT:	IEEE publishing			Nongyroscopes
		Publishing	BT:	Level control	
	NT:	Digital policy	RT:	Laser applications	
					Ring lasers
<i>Guideways (mechanical)</i>	USE:	Mechanical guides	Gyrotrons	BT:	Masers
				RT:	Electron beams
Gunn devices	UF:	Transferred electron	Gyrotropism	BT:	Magneto optic effects
devices	BT:	Semiconductor devices		RT:	Faraday effect
					Gyromagnetism
Guns	BT:	Weapons	H infinity control	UF:	H-infinity control
				BT:	Optimization methods
Gunshot detection systems	BT:	Geographic information		RT:	Closed loop systems
systems		Sensor systems			Control systems
					Intelligent control
<i>GWP</i>	USE:	Global warming potential			Optimal control
			<i>H-infinity control</i>	USE:	H infinity control



JULY 2025 IEEE Thesaurus

H.264

USE: MPEG 4 Standard

H2O

USE: Water

Habitat loss

BT: Environmental degradation
Environmental factors
Habitats

Habitats

BT: Ecology
NT: Habitat loss

Hackathon

BT: Collaboration
Computer hacking
RT: Agile software development

Hacker

USE: Computer hacking

Hacking

USE: Computer crime

Hacks

USE: Computer hacking

Haematology

USE: Hematology

Haemorrhaging

USE: Hemorrhaging

Hafnium

UF: Hf
BT: Chemical elements
Metals
RT: Nuclear physics
NT: Hafnium compounds

Hafnium compounds

BT: Hafnium
RT: Alloying
NT: Hafnium oxide

Hafnium oxide

BT: Hafnium compounds

Hair

BT: Integumentary system
NT: Eyebrows
Eyelashes
Hair follicle

Hair follicle

BT: Hair

Half duplex system

USE: Half-duplex system

Half-duplex system

UF: HDX
Half duplex system
Semi-duplex systems
BT: Duplex communication

systems

Half-wave plates

USE: Optical retarders

Hall effect

UF: Hall mobility
BT: Magnetoelectric effects
RT: Hall effect devices

Hall effect devices

BT: Semiconductor devices
RT: Hall effect

Hall mobility

USE: Hall effect

Ham radios

BT: Radio communication
equipment

Hamming distances

BT: Information theory

Hamming weight

BT: Information theory

HAMR

USE: Heat-assisted magnetic
recording

Hand held computers

USE: Personal digital devices

Hand tools

BT: Tools
RT: Machine tools

Handheld computers

USE: Personal digital devices

Handicapped aids

USE: Assistive technologies



JULY 2025 IEEE Thesaurus

Handover

BT: Communication switching
Data transfer
RT: Cellular networks
Communication system
signaling
Satellite communications

Hands

BT: Limbs

Handsets

USE: Telephone sets

Handwriting recognition

UF: Signature detection
Signature verification
Written character
recognition
Written characters
Written-character
recognition
BT: Identification of persons
Pattern recognition
RT: Biometrics
NT: Forgery

Haptic interfaces

UF: Haptic systems
Haptics
BT: Computer interfaces
RT: Braille
Electronic skin
Modeling
Touch sensitive screens
NT: Data gloves
Force feedback
Grasping
Tactile Internet

Haptic systems

USE: Haptic interfaces

Haptics

USE: Haptic interfaces

HAR

USE: Human activity recognition

Hard amorphous carbon

USE: Diamond-like carbon

Hard disc drives

USE: Hard disks

Hard discs

USE: Hard disks

Hard disk drives

USE: Hard disks

Hard disks

UF: Hard disc drives
Hard discs
Hard disk drives
Hard-disc drives
Hard-disk drives
BT: Magnetic memory
RT: Giant magnetoresistance

Hard-disc drives

USE: Hard disks

Hard-disk drives

USE: Hard disks

Hardsuit

USE: Wearable robots

Hardware

UF: Computer hardware
BT: Computers and information
processing
RT: Firewalls (computing)
Ports (computers)
NT: Hardware acceleration
Hardware security
Input devices
Open source hardware
Reconfigurable devices
Wireless access points

Hardware acceleration

UF: 3D accelerators
Accelerated computing
Cryptographic accelerators
Hardware accelerators
BT: Computer performance
Hardware
RT: Central Processing Unit
Graphics processing units

Hardware accelerators

USE: Hardware acceleration

Hardware description languages

USE: Hardware design
languages



JULY 2025 IEEE Thesaurus

Hardware design languages

UF: HDL
HDVL
Hardware description
languages
IEEE 1364
BT: Computer languages
RT: Design automation
NT: VHDL

Hardware security

UF: Security of hardware
BT: Hardware
Security
RT: Communication system
security
Computer crime
Computer security
Information security
Mobile security
Network security
Physical layer security
Power system security
Security management

Hardware-in-the-loop simulation

UF: HIL simulation
BT: Simulation
RT: Aerospace control
Control engineering
computing
Control system synthesis
Embedded systems
Real-time systems
Testing
Vehicle dynamics

Harmonic analysis

UF: Harmonics
BT: Mathematics
Signal analysis
RT: Fast Fourier transforms
Fourier transforms
Spectral analysis
Wavelet transforms

Harmonic distortion

BT: Nonlinear distortion
RT: Power conversion
harmonics
NT: Harmonics suppression
Total harmonic distortion

Harmonic filters

BT: Filters

Harmonic generation

USE: Frequency conversion

Harmonics

USE: Harmonic analysis

Harmonics suppression

BT: Harmonic distortion

Harmonised index of consumer prices

USE: Economic indicators

Harmonized index of consumer prices

USE: Economic indicators

Hash functions

BT: Algorithms
RT: Cryptography
Encoding
NT: Cryptographic hash
function

Hashtag

USE: Tagging

Hate speech

BT: Speech

Hazardous areas

BT: Hazards
RT: Accidents
Explosions
Fires
Hazardous materials
Industrial accidents
Protection
Radioactive pollution
Radioactive waste
Safety
Surveillance

Hazardous materials

UF: Hazmat
BT: Hazards
Materials
RT: Chemical hazards
Flammability
Hazardous areas
Radioactive waste
Toxicology

Hazards

BT: Safety
RT: Contamination
Disasters



JULY 2025 IEEE Thesaurus

	Explosion protection		Digital audio broadcasting
	Landslides		Multimedia communication
	Occupational stress		
	Pest control	HDTV	
	Rescue robots	UF:	ATV
	Soil remediation		Advanced TV
	Working environment noise		EDTV
NT:	Biohazards		Extended definition TV
	Chemical hazards		High definition television
	Explosions		High-definition TV
	Fires		IDTV
	Flammability		Improved definition TV
	Floods	BT:	Digital TV
	Hazardous areas	NT:	UHDTV
	Hazardous materials		
	Toxicology	HDVL	
<i>Hazmat</i>		USE:	Hardware design
USE:	Hazardous materials	languages	
		HDX	
HbbTV Standards		USE:	Half-duplex system
BT:	ETSI Standards		
RT:	Digital TV		
	TV	Head	
		BT:	Body regions
		RT:	Auditory system
<i>HBT</i>			Brain
USE:	Heterojunction bipolar		Otorhinolaryngology
transistors			Visual systems
		NT:	Cranium
<i>HCCI engines</i>			Ear
USE:	Internal combustion		Faces
engines			Forehead
			Lips
<i>HCI</i>			Mouth
USE:	Human computer		Nose
interaction			Scalp
			Skull
<i>HD</i>		<i>Head sets</i>	
USE:	High definition video	USE:	Headphones
<i>HD video</i>			
USE:	High definition video	Head-mounted displays	
		UF:	Head-worn displays
<i>HDL</i>			Helmet mounted displays
USE:	Hardware design	BT:	Displays
languages			Human computer
		interaction	
HDMI		Head-up displays	
UF:	High Definition Multimedia	UF:	Heads up displays
Interface		BT:	Displays
	High-Definition Multimedia		Human computer
Interface		interaction	
BT:	Audio-visual systems		
	Computer interfaces		
RT:	Audio compression		



JULY 2025 IEEE Thesaurus

Head-worn displays

USE: Head-mounted displays

Headphones

UF: Earphones
Head sets
Headsets
BT: Audio systems

Heads up displays

USE: Head-up displays

Headsets

USE: Headphones

Health (occupational)

USE: Occupational health

Health and safety

BT: Safety
RT: Environmental factors
NT: Occupational health
Occupational safety
Personal protective

equipment

Health care

USE: Medical services

Health informatics

USE: Bioinformatics

Health information management

BT: Medical services

Health physics

USE: Radiation monitoring

Healthcare

USE: Medical services

Hearing

USE: Auditory system

Hearing aids

BT: Sensory aids
RT: Auditory system
Speech enhancement

Heart

BT: Cardiovascular system
RT: Cardiac catheterization
Cardiology
NT: Cardiac function
Fetal heart

Heart rate
Heart transplantation
Heart valves
Heart ventricles

Heart arrest

USE: Cardiac arrest

Heart attack

USE: Cardiac arrest

Heart beat

UF: Heartbeat
BT: Heart rate
RT: Arrhythmia

Heart cath

USE: Cardiac catheterization

Heart failure

USE: Cardiovascular diseases

Heart rate

UF: HR
BT: Heart
NT: Bradycardia
Fetal heart rate
Heart beat
Heart rate detection
Heart rate interval
Heart rate measurement
Heart rate variability
Tachycardia

Heart rate detection

BT: Heart rate

Heart rate interval

BT: Heart rate

Heart rate measurement

BT: Heart rate
RT: Phonocardiography

Heart rate variability

UF: HRV
BT: Heart rate

Heart transplantation

UF: Cardiac transplants
Heart transplants
BT: Heart
Organ transplantation



JULY 2025 IEEE Thesaurus

Heart transplants

USE: Heart transplantation

Heart valves

UF: Aortic semilunar valves
Atrioventricular valves
Bicuspid valves
Mitral valves
Pulmonary semilunar

valves

Semilunar valves
Tricuspid valves
Heart

BT:

Heart ventricles

BT: Heart

Heartbeat

USE: Heart beat

Heat engines

BT: Engines
NT: Steam engines
Stirling engines

Heat islands

USE: Thermal pollution

Heat maps

BT: Data visualization

Heat networks

USE: District heating

Heat pipes

BT: Heating systems
RT: Cooling
Heat transfer

Heat pumps

UF: Ground source heat pumps
BT: Pumps
RT: Refrigerants

Heat recovery

UF: Industrial heat recovery
BT: Heating systems
RT: Boilers
Thermal engineering

Heat sinks

UF: Heatsinks
BT: Cooling

Heat transfer

BT: Thermal conductivity
RT: Heat pipes
NT: Convection

Heat treatment

BT: Materials processing
RT: Curing
Firing
Foundries
Kilns
Smelting
Thermal factors
Thermomechanical

processes

NT: Annealing
Calcination

Heat-assisted magnetic recording

UF: HAMR
BT: Magnetic recording

Heating systems

BT: Temperature control
RT: Entropy
Furnaces
HVAC
High-temperature

techniques

Laser applications
Rapid thermal processing
Thermal engineering
Boilers
Cogeneration
District heating
Electromagnetic heating
Heat pipes
Heat recovery
Induction heating
Infrared heating
Resistance heating
Solar heating
Space heating
Thermal energy
Trigeneration
Water heating

Heating, ventilation, and air conditioning

USE: HVAC

Heatsinks

USE: Heat sinks

Heavily tailed distribution

USE: Heavily-tailed distribution



JULY 2025 IEEE Thesaurus

Heavily-tailed distribution

UF: Heavily tailed distribution
BT: Probability distribution
RT: Kurtosis

Hebb's methods

USE: Hebbian theory

Hebb's rule

USE: Hebbian theory

Hebbian learning

USE: Hebbian theory

Hebbian principle

USE: Hebbian theory

Hebbian theory

UF: Hebb's methods
Hebb's rule
Hebbian learning
Hebbian principle
BT: Artificial neural networks

Height measurement

BT: Measurement

Helical antennas

BT: Antennas
RT: Electromagnetic

waveguides

Telecommunications
Transmission lines
VHF circuits
Waveguide components

Helical gears

USE: Gears

Helicopters

BT: Vertical takeoff and landing
aircraft
RT: Military systems
Urban air mobility
NT: Quadrotors

Helioseismology

BT: Asteroseismology
Nuclear and plasma

sciences

Helium

BT: Chemical elements
Gases

Helmet mounted displays

USE: Head-mounted displays

Helmets

BT: Personal protective
equipment
RT: Safety devices

Hematology

UF: Haematology
BT: Medical specialties
RT: Blood flow
Blood platelets
Blood vessels
Coagulation

Hemodynamics

UF: Hemorheology
BT: Blood flow

Hemorheology

USE: Hemodynamics

Hemorrhaging

UF: Bleeding
Haemorrhaging
BT: Medical conditions
RT: Blood flow

HEMTs

UF: Heterostructure FETs
High electron mobility
transistors
High electron-mobility
transistors
High-electron mobility
transistors
High-electron-mobility
transistors
BT: Field effect transistors
RT: MODFETs
NT: D-HEMTs
DH-HEMTs
PHEMTs
mHEMTs

Hepatectomy

BT: Medical treatment
Surgery

Hermetic seals

BT: Seals

Hetero-nanocrystal memory

BT: Single electron memory



JULY 2025 IEEE Thesaurus

Heterogeneous integration

USE: Multichip modules

Heterogeneous networks

BT: Computer networks

Heterojunction bipolar transistors

UF: HBT
BT: Transistors
RT: Heterojunctions
Integrated optoelectronics
Semiconductor devices
NT: Double heterojunction

bipolar transistors

Heterojunctions

BT: Junctions
RT: Heterojunction bipolar

transistors

Heterostructure FETs

USE: HEMTs AND
MODFETs

Heuristic algorithms

UF: Dynamic algorithms
BT: Algorithms
RT: Metaheuristics

HEV

USE: Hybrid electric vehicles

HEVC

USE: High efficiency video coding

Hf

USE: Hafnium

HF radar

USE: High frequency radar

HFC

USE: Hybrid fiber coaxial cables

Hg

USE: Mercury (metals)

Hidden Markov models

BT: Modeling
RT: Markov processes
Pattern recognition

Hierarchical learning

USE: Deep learning

Hierarchical systems

BT: Systems engineering and
theory

NT: Multilevel systems

High Definition Multimedia Interface

USE: HDMI

High definition television

USE: HDTV

High definition video

UF: HD
HD video
BT: Video recording
NT: Ultra-high definition video

High dimensional data

UF: High-dimensional data
BT: Data models
Machine learning
RT: Genomics
Natural language

processing

High dynamic range

UF: Expanded dynamic range
Extended dynamic range
Wide dynamic range
BT: Dynamic range
RT: Photography

High efficiency video coding

UF: HEVC
High-efficiency video
coding
BT: Video coding
RT: MPEG 4 Standard

High electron mobility transistors

USE: HEMTs

High electron-mobility transistors

USE: HEMTs

High energy physics

UF: Particle physics
BT: Physics

High energy physics instrumentation computing

BT: Computer applications
Instrumentation and

measurement



JULY 2025 IEEE Thesaurus

sciences		Nuclear and plasma
	RT:	Data acquisition
		Elementary particles
		Nuclear electronics
		Particle measurements
		Particle tracking
		Position sensitive particle
detectors		Proton effects
		Radiation effects
		Real-time systems
		Synchrotrons
	NT:	Linear particle accelerator

High frequency
BT: Radio frequency

High frequency radar

UF:	HF radar
BT:	Radar

High frequency transformers
USE: High-frequency transformers

High intensity discharge lamps

BT:	Discharge lamps
RT:	Arc discharges
	Electrical ballasts
	Emergency lighting
	Light sources
	Lighting
	Lighting control

High K USE: High-k dielectric materials

High level languages

- BT: Computer languages
- RT: Page description languages
- NT: Java
 - Linux
 - Parallel languages

High level synthesis devices	BT:	Circuit synthesis
	RT:	Programmable logic

High performance computing
UF: HPC
High-performance computing

BT:	Computers and information processing
NT:	Exascale computing

High power amplifiers

BT:	Power amplifiers
RT:	Gate drivers

High power fiber lasers	
UF:	HPFL High-power fiber lasers
BT:	Fiber lasers

High power microwave generation		
UF:	HPM generation	High-power microwave generation
BT:	Microwave generation	

High resolution imaging
USE: High-resolution imaging

High school engineering
USE: Pre-college engineering

USE: High-speed electronics

USE: High-speed integrated circuits

USE: High-speed networks

High speed networks
USE: High-speed networks

High speed optical methods
USE: High-speed optical
techniques

High speed optical techniques
USE: High-speed optical techniques

High speed rail transportation
USE: High-speed rail
transportation

High speed techniques
USE: High-speed electronics



JULY 2025 IEEE Thesaurus

High T_c superconductors

USE: High-temperature
superconductors

High T_c superconductors

USE: High-temperature
superconductors

High temperature superconductors

USE: High-temperature
superconductors

High voltage

USE: High-voltage techniques

High-Definition Multimedia Interface

USE: HDMI

High-definition TV

USE: HDTV

High-dimensional data

USE: High dimensional data

High-efficiency video coding

USE: High efficiency video coding

High-electron mobility transistors

USE: HEMTs

High-electron-mobility transistors

USE: HEMTs

High-frequency transformers

UF: High frequency
transformers
BT: Transformers

High-K

USE: High-k dielectric materials

High-k dielectric materials

UF: High K
High-K
BT: Dielectric materials
RT: Semiconductor materials

High-k gate dielectrics

BT: Dielectric constant
Semiconductor device
manufacture

High-performance computing

USE: High performance
computing

High-power fiber lasers

USE: High power fiber lasers

High-power microwave generation

USE: High power microwave
generation

High-resolution imaging

UF: High resolution imaging
BT: Image resolution

High-resolution transmission electron microscopy

UF: HRTEM
BT: Transmission electron
microscopy

High-speed electronics

UF: High speed electronics
High speed techniques
High-speed techniques
BT: Communications
technology
NT: High-speed integrated
circuits
High-speed networks
Ultrafast electronics

High-speed integrated circuits

UF: High speed integrated
circuits
BT: High-speed electronics
RT: Integrated circuit
technology
Microcontrollers

High-speed networking

USE: High-speed networks

High-speed networks

UF: High speed networking
High speed networks
High-speed networking
BT: High-speed electronics
RT: Long Term Evolution

High-speed optical methods

USE: High-speed optical
techniques

High-speed optical techniques

UF: High speed optical methods
High speed optical
techniques
High-speed optical methods



JULY 2025 IEEE Thesaurus

BT: Optical design techniques
RT: Laser pulses
Light fidelity

RT: Power electronics
Pulsed power systems

High-speed rail transportation

UF: High speed rail
transportation
BT: Rail transportation
RT: Magnetic levitation vehicles

High-speed techniques

USE: High-speed electronics

High- T_c superconductors

USE: High-temperature
superconductors

High- T_c superconductors

USE: High-temperature
superconductors

High-temperature effects

USE: Thermal factors

High-temperature superconductors

UF: HTS
High T_c superconductors
High T_c superconductors
High temperature
superconductors
High- T_c superconductors
High- T_c superconductors
Superconductors (high
temperature)
BT: Superconducting materials
RT: Ceramics
Granular superconductors
Persistent currents
Superconducting devices
Superconducting films
Superconducting transition
temperature
Surface impedance
Surface resistance
NT: Yttrium barium copper
oxide

High-temperature techniques

BT: Industry applications
RT: Heating systems
NT: Rapid thermal processing

High-voltage techniques

UF: High voltage
BT: Power engineering

Higher order statistics

BT: Statistics
RT: Differential equations

Highways

USE: Road transportation

HIL simulation

USE: Hardware-in-the-loop
simulation

Hilbert space

BT: Euclidean distance

Hilbert?Huang transforms

USE: Empirical mode
decomposition

Hindbrain

UF: Rhombencephalon
BT: Brain
RT: Forebrain
Midbrain

Hindcasting

BT: Probability
RT: Forecasting
Mathematical models
Prediction methods

Hinges

USE: Fasteners

Hip

BT: Extremities

Hip joint replacements

USE: Prosthetics

Hippocampus

BT: Temporal lobe
RT: Alzheimer's disease

Histograms

BT: Statistics

Histology

USE: Histopathology

Histopathology

UF: Histology
BT: Pathology



JULY 2025 IEEE Thesaurus

History	BT:	Humanities	BT:	Consumer products
			NT:	Gas appliances
<i>HITL</i>				Microwave ovens
	USE:	Human in the loop		Ovens
<i>HIV</i>				Refrigerators
	USE:	Human immunodeficiency		Washing machines
virus			Home automation	
Hobbing machines			UF:	Home networks
	BT:	Machining	BT:	Consumer electronics
<i>Hockey</i>			RT:	Automation
	USE:	Sports		Fall detection
<i>Hoists</i>				Service robots
	USE:	Lifting equipment	NT:	Portable media players
<i>Hole carriers</i>				Refrigerators
	USE:	Charge carrier processes		Smart homes
Holey fibers				Washing machines
	UF:	Holey fibres	Home computing	
	BT:	Photonic crystal fibers	BT:	Consumer electronics
<i>Holey fibres</i>			RT:	Computers and information
	USE:	Holey fibers		processing
Hollow waveguides				Firewire
	BT:	Electromagnetic		Microcomputers
waveguides			<i>Home networks</i>	
	NT:	Liquid waveguides	USE:	Home automation
Holmium			<i>Home phone</i>	
	BT:	Chemical elements	USE:	Landline
Holographic optical components			<i>Home shopping</i>	
	BT:	Optical devices	USE:	Electronic commerce
	RT:	Holography	Homeostasis	
Holography			BT:	Biology
	BT:	Imaging		Control systems
	RT:	Holographic optical	Homomorphic encryption	
components			BT:	Encryption
		Image reconstruction	RT:	Privacy
		Laser applications		Public key cryptography
		Photorefractive materials	Homopolar machines	
Home appliances			BT:	DC machines
	UF:	Appliances	Honey pot (computing)	
		Domestic appliances	BT:	Computer security
		Domestic induction	Honeycomb structures	
appliances			BT:	Structural shapes
		Household appliances	RT:	Lightweight structures
				Sandwich structures
				Structural panels
				Thin wall structures



JULY 2025 IEEE Thesaurus

Hopfield networks

USE: Hopfield neural networks

Hopfield neural networks

UF: Hopfield networks

BT: Recurrent neural networks

Hormones

USE: Biochemistry

Horn antennas

BT: Antennas

Horses

BT: Animals

Horticulture

BT: Industries

NT: Hydroponics

Hoses

BT: Mechanical products

RT: Automotive components

Rubber products

Hospitals

BT: Medical services

Medical treatment

RT: Biomedical engineering

Hot carrier effects

BT: Hot carriers

Hot carrier injection

UF: Hot-carrier injection

BT: Hot carriers

NT: Channel hot electron

injection

Secondary generated hot

electron injection

Substrate hot electron

injection

Hot carriers

BT: Charge carriers

RT: Semiconductor devices

NT: Hot carrier effects

Hot carrier injection

Hot-carrier injection

USE: Hot carrier injection

Household appliances

USE: Home appliances

HPC

USE: High performance computing

HPFL

USE: High power fiber lasers

HPM generation

USE: High power microwave generation

HR

USE: Heart rate

HRTEM

USE: High-resolution transmission electron microscopy

HRV

USE: Heart rate variability

HTML

BT: Markup languages

HTS

USE: High-temperature superconductors

HTTP

UF: Hypertext Transfer Protocol

BT: Hypertext systems
Protocols

RT: Data communication

Huffman coding

BT: Data compression

Entropy coding

RT: Algorithms

Communication systems

Multimedia communication

Multimedia databases

Multimedia systems

Symbols

Human action recognition

USE: Human activity recognition

Human activity recognition

UF: HAR

Human action recognition

Human motion recognition

BT: Activity recognition

RT: Biomechanics

Body area networks

Body sensor networks



JULY 2025 IEEE Thesaurus

intelligence)	Fall detection	<i>Human enhancement</i>	
	Image motion analysis	USE:	Human augmentation
	Image recognition		
	Learning (artificial	Human factors	
	Pattern recognition	UF:	Human factors engineering
		BT:	Stress (psychological)
		cybernetics	Systems, man, and
		RT:	Aerospace biophysics
Human anatomy			Affective computing
BT:	Anatomy		Androids
Human augmentation			Anthropometry
UF:	Human enhancement		Behavioral sciences
BT:	Augmented reality		Chatbots
	Human factors		Cognitive science
<i>Human cloning</i>			Digital humans
USE:	Cloning		Digital intelligence
			Ergonomics
Human computer interaction			Human computer
UF:	HCI	interaction	
	Human machine interaction		Human-machine systems
	Human-centered computing		Inclusive language
	Human-computer		Persuasive systems
interaction			Problem-solving
	Human-computer interfaces		Productivity
	Human-machine interaction		Social engineering
	User friendliness	(security)	
BT:	User interfaces		Socioeconomics
RT:	Adaptive learning		Telerobotics
	Cyber-physical systems		User experience
	Digital humans	NT:	Anthropomorphism
	Driver behavior		Human augmentation
	Fifth Industrial Revolution		Human image synthesis
	Human factors		Human intelligence
	Human vehicle systems		Livelihood
	Human-machine systems		Mental health
	Immersive audio		Pedestrians
	User experience		Technology acceptance
NT:	Affective computing	model	
	Chatbots		
	Extended reality	<i>Human factors engineering</i>	
	Gaze tracking	USE:	Ergonomics AND
	Head-mounted displays		Human factors
	Head-up displays		
	Human in the loop	Human image synthesis	
	Immersive experience	BT:	Human factors
	Spatial computing		Image synthesis
	Telepresence	RT:	Films
	Telexistence		Photorealism
<i>Human disease markers</i>		Human immunodeficiency virus	
USE:	Biomarkers	UF:	HIV
		BT:	Diseases
<i>Human engineering</i>		RT:	Acquired immune
USE:	Ergonomics	deficiency syndrome	



JULY 2025 IEEE Thesaurus

Human in the loop

UF: HITL
Human-in-the-loop
BT: Human computer
interaction
RT: Simulation
Computer simulation
Modeling

Human intelligence

BT: Cognitive science
Human factors
NT: Digital intelligence
Hyper-intelligence

Human machine interaction

USE: Human computer
interaction

Human machine interface

USE: Human-machine systems

Human motion recognition

USE: Human activity recognition

Human resource management

BT: Management
RT: Industrial psychology
NT: Appraisal
Continuing professional
development
Employee welfare
Employment
Equal opportunities
Incentive schemes
Job specification
Labor resources
Leadership
Multiskilling
Personnel
Recruitment
Remuneration
Retirement
Termination of employment
Unemployment

Human robot interaction

USE: Human-robot interaction

Human vehicle systems

UF: Human-vehicle interaction
Human-vehicle systems
BT: User interfaces
RT: Driver behavior

Human computer
interaction

Human voice

BT: Speech processing

Human-centered computing

USE: Human computer
interaction

Human-computer interaction

USE: Human computer
interaction

Human-computer interfaces

USE: Human computer
interaction

Human-in-the-loop

USE: Human in the loop

Human-machine interaction

USE: Human computer
interaction

Human-machine systems

UF: Cyborgs
Human machine interface
Man machine systems
Man-machine systems
Systems, man, and
cybernetics
BT: Androids
Cybernetics
RT: Ergonomics
Human computer
interaction
Human factors
Natural language
generation
Persuasive systems
Tactile Internet
NT: Digital intelligence
Extended reality
Interactive systems

Human-robot collaboration

USE: Human-robot interaction

Human-robot interaction

UF: Human robot interaction
Human-robot collaboration
BT: User interfaces
RT: Admittance control
Tactile Internet



JULY 2025 IEEE Thesaurus

Wearable robots
NT: Social robots
Human-vehicle interaction
USE: Human vehicle systems

Human-vehicle systems
USE: Human vehicle systems

Humanitarian activities
UF: Humanitarian aid
BT: IEEE Corporate activities

Humanitarian aid
USE: Humanitarian activities

Humanities
UF: Dance
Drama
Humanities data processing
BT: Education
RT: Anthropology
Computer applications
Journalism
Museums
Philosophical
considerations
NT: Archeology
Art
History
Music
Natural languages
Social sciences

Humanities data processing
USE: Humanities

Humanoid robotics
USE: Humanoid robots

Humanoid robots
UF: Humanoid robotics
Humanoids
BT: Robots
RT: Field robots
Mobile robots
Social robots

Humanoids
USE: Humanoid robots

HumanXR
USE: Extended reality

Humidity
BT: Meteorology
RT: Humidity control
Humidity measurement
Trees - insulation
NT: Humidity effects

Humidity control
BT: Moisture control
RT: Humidity
Humidity effects

Humidity effects
BT: Humidity
RT: Humidity control
Moisture control

Humidity measurement
BT: Moisture measurement
RT: Humidity

Hurricanes
BT: Cyclones

HVAC
UF: Heating, ventilation, and air
conditioning
BT: Thermal variables control
RT: Air conditioning
Cooling
Heating systems
Ventilation

HVDC transmission
BT: Power transmission
RT: DC distribution systems
Voltage-source converters

Hybrid automobiles
USE: Hybrid electric vehicles

Hybrid cars
USE: Hybrid electric vehicles

Hybrid electric vehicles
UF: HEV
Hybrid automobiles
Hybrid cars
BT: Electric vehicles
RT: Battery powered vehicles
Charging stations
Energy storage
Internal combustion

engines
Traction motors



JULY 2025 IEEE Thesaurus

vehicles
NT: Vehicle-to-grid
Plug-in hybrid electric

Hybrid fiber coaxial cables

UF: HFC
Hybrid fibre coaxial cables
BT: Coaxial cables

Hybrid fibre coaxial cables

USE: Hybrid fiber coaxial cables

Hybrid integrated circuits

BT: Circuits
Integrated circuits
RT: Thick film circuits
Thin film circuits

Hybrid intelligent systems

BT: Fuzzy systems
RT: Intelligent systems

Hybrid junctions

BT: Junctions
RT: Directional couplers

Hybrid learning

UF: Blended learning
Distributed learning
BT: Computer aided instruction
Learning systems
RT: Courseware
Distance learning
Education
Educational courses
Educational institutions
Internet
Mobile learning

Hybrid office

USE: Remote working

Hybrid power systems

BT: Power systems
RT: Distributed power

generation

Photovoltaic systems

Hybrid working

USE: Remote working

Hydraulic actuators

BT: Actuators
RT: Hydraulic drives

Hydraulic diameter

BT: Fluid flow
NT: Microchannels

Hydraulic drives

BT: Drives
RT: Hydraulic actuators

Hydraulic equipment

BT: Hydraulic systems
RT: Water pumps
NT: Valves

Hydraulic fluids

UF: Hydraulic liquids
Hydraulic oils
BT: Fluids
Hydraulic systems
RT: Production materials

Hydraulic fracking

USE: Fracking

Hydraulic liquids

USE: Hydraulic fluids

Hydraulic oils

USE: Hydraulic fluids

Hydraulic systems

UF: Hydraulics
BT: Machinery
RT: Fluid flow
Irrigation
NT: Electrohydraulics
Hydraulic equipment
Hydraulic fluids

Hydraulic turbines

BT: Turbines
RT: Hydroelectric power

generation

Hydraulics

USE: Hydraulic systems

Hydrocarbon reservoirs

BT: Hydrocarbons

Hydrocarbons

UF: Oil sands
Oil shale
BT: Organic chemicals
Petroleum
RT: Natural gas



JULY 2025 IEEE Thesaurus

NT: Hydrocarbon reservoirs

Hydrocephalus

BT: Brain
Medical conditions

Hydrochemistry

USE: Geochemistry

Hydrodynamics

UF: Smoothed particle
hydrodynamics
BT: Dynamics
Mechanical factors
RT: Fluid dynamics
Fluid flow
Microfluidics
Water
NT: Electrohydrodynamics
Magnetohydrodynamics

Hydroelectric power

USE: Hydroelectric power
generation

Hydroelectric power generation

UF: Hydroelectric power
Hydroelectricity
Hydropower
Hyrdroelectric
Water energy
Water power
BT: Power generation
Renewable energy sources
RT: Dams
Hydraulic turbines
NT: Hydroelectric-thermal
power generation
Microhydro power
Picohydro power
Wave energy conversion

Hydroelectric-thermal power generation

BT: Hydroelectric power
generation

Hydroelectricity

USE: Hydroelectric power
generation

Hydrogels

BT: Polymers
RT: Drug delivery
Tissue engineering

Hydrogen

BT: Chemical elements
Gases
RT: Water splitting
NT: Deuterium
Green hydrogen

Hydrogen chloride

USE: Chlorine compounds

Hydrogen fluoride

BT: Fluorine compounds

Hydrogen powered vehicles

BT: Vehicles

Hydrogen storage

BT: Energy storage

Hydrography

BT: Geoscience
RT: Bathymetry
Oceanography

Hydrologic measurements

BT: Hydrology
RT: Fluid flow measurement
Geophysics
Hydrological techniques
Oceanographic techniques
Water

Hydrological techniques

BT: Hydrology
RT: Geoengineering
Geophysics
Geoscience
Hydrologic measurements
NT: Fracking

Hydrology

BT: Fluid flow
RT: Water
Wetlands
NT: Aquifers
Floods
Hydrologic measurements
Hydrological techniques
Ocean waves
Stormwater
Watersheds

Hydrolysis

BT: Chemical reactions
RT: Biochemistry



JULY 2025 IEEE Thesaurus

		Biotechnology	RT:	Computer networks
		Catalysis		
		Enzymes	<i>Hyperdermic needles</i>	
		Hydrophobicity	USE:	Hypodermic needles
		Solvation		
<i>Hydromagnetics</i>			<i>Hyperintelligent systems</i>	
USE:	Magnetohydrodynamics		USE:	Hyper-intelligent systems
Hydrometers			<i>Hyperledger</i>	
BT:	Density measurement		USE:	Distributed ledger
Hydrophobicity			<i>Hyperlinks</i>	
BT:	Chemical processes		USE:	Hypertext systems
	Measurement			
RT:	Hydrolysis		Hypermedia	
			BT:	Multimedia communication
Hydrophones			Hyperparameter optimization	
BT:	Microphones		BT:	Machine learning
	Underwater equipment			
RT:	Echo sounders		Hypersonic vehicles	
	Sonar detection		BT:	Vehicles
			RT:	Aerospace control
Hydroponics				Missiles
BT:	Horticulture			Space vehicles
<i>Hydropower</i>			Hyperspectral imaging	
USE:	Hydroelectric power		BT:	Hyperspectral sensors
generation				
<i>Hydrosphere</i>			Hyperspectral sensors	
USE:	Aquatic ecosystems		BT:	Remote sensing
			RT:	Geologic measurements
<i>Hyper intelligent systems</i>				Military aircraft
USE:	Hyper-intelligent systems			Military communication
				Military satellites
<i>Hyper ledger</i>				Mining industry
USE:	Distributed ledger			Submillimeter wave
			measurements	
Hyper-intelligence			NT:	Wavelength measurement
UF:	Super intelligence			Hyperspectral imaging
	Superintelligence		Hypertension	
BT:	Human intelligence		BT:	Blood pressure
				Medical conditions
Hyper-intelligent systems			RT:	Hypotension
UF:	Hyper intelligent systems			
	Hyperintelligent systems		Hypertext systems	
BT:	Intelligent systems		UF:	Hyperlinks
			BT:	Computer interfaces
Hypercomplex				Information retrieval
BT:	Mathematics		RT:	Database systems
			NT:	HTTP
Hypercubes			<i>Hypertext Transfer Protocol</i>	
BT:	Multiprocessor		USE:	HTTP
interconnection				



JULY 2025 IEEE Thesaurus

Hyperthermia

BT: Medical conditions
Medical treatment
RT: Electromagnetic heating

Hypervisors

USE: Virtual machine monitors

Hypodermic needles

UF: Hyperdermic needles
BT: Biomedical equipment

Hypotension

UF: Low blood pressure
BT: Blood pressure
RT: Hypertension

Hypothalamus

BT: Brain
RT: Central nervous system

Hypoxia

BT: Medical conditions
RT: Oxygen

Hydroelectric

USE: Hydroelectric power generation

Hysteresis

BT: Materials science and technology
RT: Damping
Magnetic hysteresis
Magnetization processes
Spin valves

Hysteresis motors

BT: AC motors
Motors
Rotating machines
Synchronous machines
Synchronous motors

I/O programs

USE: Input-output programs

IBR

USE: Inverter-based resource

Ibuki

USE: GOSAT

IC

USE: Integrated circuits

IC packaging

USE: Integrated circuit packaging

Ice

BT: Geoscience
RT: Ice accretion
Ice sheets
Meteorology
Permafrost
Snow
NT: Glaciers
Ice cap
Ice clouds
Ice shelf
Ice surface
Ice thickness
Icebergs
Sea ice

Ice accretion

BT: Meteorology
RT: Ice

Ice cap

BT: Ice

Ice clouds

BT: Colloidal crystals
Ice
NT: Contrails

Ice sheets

BT: Glaciers
RT: Ice

Ice shelf

BT: Ice
RT: Icebergs

Ice surface

BT: Ice

Ice thickness

BT: Ice

Icebergs

BT: Ice
RT: Ice shelf

ICIC

USE: Intercell interference

ICP

USE: Iterative closest point

algorithm



JULY 2025 IEEE Thesaurus

<i>ICs</i>					Identity-based cryptography
	USE:	Integrated circuits		BT:	Public key cryptography
<i>ICT</i>			<i>IDTV</i>	USE:	HDTV
	USE:	Information and communication technology	IEC	UF:	International electrotechnical commission
<i>Icterus</i>				BT:	Standards organizations
	USE:	Jaundice		RT:	Communication standards IEC Standards Standardization Standards
<i>ID-based encryption</i>				NT:	Moving Pictures Experts Group
	USE:	Identity-based encryption	<i>IEC publications</i>	USE:	IEC Standards
Identification of persons			IEC Standards	UF:	IEC publications
	UF:	Person identification Person re-identification		BT:	Standards publications
	BT:	Systems, man, and cybernetics		RT:	Common Information Model (electricity)
	RT:	Access control Palmprint recognition Security		NT:	IEC MPEG standards
	NT:	Biometric identification Biometrics Face recognition Fingerprint recognition Handwriting recognition Identity theft Speaker recognition Speech recognition	<i>IEEE 1364</i>	USE:	Hardware design languages
<i>Identity infringement</i>			IEEE 1394 Standard	UF:	P1394
	USE:	Identity theft		BT:	IEEE Standards
Identity management systems				RT:	Data buses Data communication Firewire Machine vision Video signal processing
	BT:	Computer security Information systems	IEEE 802 LAN-MAN Standards	BT:	IEEE Standards
	RT:	Decentralized identity		NT:	IEEE 802.11 Standard IEEE 802.15 Standard IEEE 802.16 Standard IEEE 802.19 Standard IEEE 802.22 Standard IEEE 802.3 Standard
	NT:	Federated identity	IEEE 802.11 Standard	UF:	802.11 P802.11 WiGig
<i>Identity piracy</i>					
	USE:	Identity theft			
Identity theft					
	UF:	Identity infringement Identity piracy			
	BT:	Fraud Identification of persons			
	RT:	Computer crime			
<i>Identity-based cryptography</i>					
	USE:	Identity-based encryption			
Identity-based encryption					
	UF:	ID-based encryption			



JULY 2025 IEEE Thesaurus

Standards BT: IEEE 802 LAN-MAN
RT: Bluetooth
Butler matrices
Computer networks
MIMO
Modulation
Protocols
Radio communication
Wireless LAN
Wireless access points
Wireless communication
Wireless fidelity
NT: IEEE 802.11ax Standard
IEEE 802.11e Standard
IEEE 802.11g Standard
IEEE 802.11n Standard
IEEE 802.11p Standard

IEEE 802.11ax Standard

UF: 802.11ax
Wi-Fi 6
BT: IEEE 802.11 Standard

IEEE 802.11e Standard

UF: 802.11e
BT: IEEE 802.11 Standard
RT: Communication channels
Protocols
Quality assurance
Quality control
Quality of service
Streaming media
Wireless LAN

IEEE 802.11g Standard

UF: 802.11g
BT: IEEE 802.11 Standard
RT: Bluetooth
Computer networks
Modulation
Protocols
Radio communication
Wireless LAN

IEEE 802.11n Standard

UF: 802.11n
BT: IEEE 802.11 Standard
RT: Antennas
Bluetooth
Communication channels
Computer networks
MIMO
Modulation
Protocols

Radio communication
Wireless LAN

IEEE 802.11p Standard

BT: IEEE 802.11 Standard
RT: Intelligent vehicles
Wireless Access in
Vehicular Environments
Wireless communication
Wireless networks

IEEE 802.15 Standard

UF: 802.15
BT: IEEE 802 LAN-MAN
Standards RT: Bluetooth
Light fidelity
Personal communication
networks

Radio communication
Wireless LAN
Zigbee

IEEE 802.16 Standard

UF: 802.16
BT: IEEE 802 LAN-MAN
Standards RT: Broadband communication
Computer networks
Cross layer design
Internet
MIMO
Metropolitan area networks
Multimedia communication
WiMAX

IEEE 802.19 Standard

BT: IEEE 802 LAN-MAN
Standards

IEEE 802.22 Standard

BT: IEEE 802 LAN-MAN
Standards RT: Regional area networks
WRAN
Wireless communication
Wireless networks

IEEE 802.3 Standard

UF: 802.3
BT: IEEE 802 LAN-MAN
Standards RT: Communication switching
Computer networks
Ethernet



JULY 2025 IEEE Thesaurus

Local area networks
Packet switching
Switches
Wide area networks

IEEE 982.1 Standard

BT: IEEE Standards

IEEE activities

BT: IEEE organization
RT: IEEE Boards
NT: IEEE Awards activities
IEEE Conference activities
IEEE Corporate activities
IEEE Educational activities
IEEE Member and

Geographic activities

IEEE Technical activities
IEEE United States

activities

IEEE professional activities
IEEE publishing

IEEE Arc Flash Standards

USE: Power and energy
standards

IEEE Associate Members

BT: IEEE members

IEEE Awards activities

BT: IEEE activities
RT: Awards
IEEE Educational activities
IEEE Foundation
IEEE Technical activities
IEEE United States

activities

NT: IEEE professional activities
IEEE Corporate awards
IEEE Society awards
IEEE Standards awards
National Society Agreement

awards

IEEE Boards

BT: IEEE entities
RT: IEEE activities

IEEE bylaws

BT: IEEE governance

IEEE Chapters

BT: IEEE entities

IEEE Committees

BT: IEEE entities

IEEE Communities

BT: IEEE entities

IEEE Conference activities

BT: IEEE activities

IEEE Constitution

BT: IEEE governance

IEEE Corporate activities

BT: IEEE activities
RT: IEEE Corporate awards
IEEE professional activities
IEEE staff
Legal factors
NT: Humanitarian activities

IEEE Corporate awards

BT: IEEE Awards activities
RT: IEEE Corporate activities
NT: IEEE Recognitions
IEEE Technical Field

awards

IEEE Corporate recognitions

BT: IEEE Recognitions

IEEE Councils

BT: IEEE entities

IEEE Educational activities

BT: IEEE activities
RT: IEEE Awards activities
IEEE Foundation
IEEE professional activities

IEEE Electric Machinery Standards

USE: Power and energy
standards

IEEE employees

USE: IEEE staff

IEEE entities

BT: IEEE organization
NT: IEEE Boards
IEEE Chapters
IEEE Committees
IEEE Communities
IEEE Councils
IEEE Foundation
IEEE History Center



JULY 2025 IEEE Thesaurus

IEEE Regions
IEEE Societies

IEEE Prize Paper awards

BT: IEEE Recognitions

IEEE Foundation

BT: IEEE entities
RT: IEEE Awards activities
IEEE Educational activities

IEEE products

BT: IEEE organization
NT: IEEE Xplore
IEEE merchandise

IEEE governance

BT: IEEE organization
NT: IEEE Constitution
IEEE bylaws
IEEE policy and procedures
IEEE staff

IEEE professional activities

UF: Non-united-states activities
BT: IEEE activities
RT: IEEE Awards activities
IEEE Corporate activities
IEEE Educational activities
IEEE Technical activities
IEEE United States

IEEE History Center

BT: IEEE entities

activities

IEEE indexing

BT: IEEE organization
NT: Awards
Book reviews
Interviews
Obituaries
Software reviews
Special issues and sections
Tutorials
Video reviews

IEEE publishing

BT: IEEE activities
RT: Guidelines

IEEE Recognitions

BT: IEEE Corporate awards
NT: IEEE Corporate
recognitions
IEEE Prize Paper awards
IEEE Service awards
IEEE Staff recognitions
IEEE Video awards

IEEE Member and Geographic activities

BT: IEEE activities

IEEE members

BT: IEEE organization
NT: IEEE Associate Members
IEEE Senior Members

IEEE Regions

BT: IEEE entities

IEEE Senior Members

BT: IEEE members

IEEE merchandise

BT: IEEE products

IEEE Service awards

BT: IEEE Recognitions

IEEE organization

NT: IEEE activities
IEEE entities
IEEE governance
IEEE indexing
IEEE members
IEEE products

IEEE Societies

BT: IEEE entities

IEEE Society awards

BT: IEEE Awards activities

IEEE staff

UF: IEEE employees
BT: IEEE governance
RT: IEEE Corporate activities

IEEE policy and procedures

BT: IEEE governance

IEEE Staff recognitions

BT: IEEE Recognitions

IEEE Power Substations Standards

USE: Power and energy
standards

IEEE Standard 1349



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

BT:	IEEE Standards		
IEEE Standards		II-VI semiconductor materials	
BT:	Standards publications	BT:	Semiconductor materials
RT:	ANSI Standards	III-V semiconductor materials	
NT:	AIEE Standards	BT:	Semiconductor materials
	IEEE 1394 Standard	RT:	Aluminum gallium nitride
	IEEE 802 LAN-MAN		
Standards		<i>I/IOT</i>	
	IEEE 982.1 Standard	USE:	Industrial Internet of Things
	IEEE Standard 1349		
	IRE Standards	IIR filters	
IEEE Standards Association		UF:	Infinite impulse response
BT:	Standards organizations	BT:	Filters
IEEE Standards awards		<i>Illumination</i>	
BT:	IEEE Awards activities	USE:	Lighting
<i>IEEE Surge Protective Devices Standards</i>		<i>Illumination control</i>	
USE:	Power and energy	USE:	Lighting control
standards		<i>Illumination gas</i>	
IEEE Technical activities		USE:	Coal gas
BT:	IEEE activities	<i>IM</i>	
RT:	IEEE Awards activities	USE:	Instant messaging
	IEEE professional activities		
IEEE Technical Field awards		Image analysis	
BT:	IEEE Corporate awards	UF:	Scene analysis
IEEE United States activities		BT:	Image processing
UF:	US activities	RT:	Image recognition
BT:	IEEE activities		Machine vision
RT:	IEEE Awards activities	NT:	Image categorization
	IEEE professional activities		Image classification
IEEE Video awards			Image motion analysis
BT:	IEEE Recognitions		Image quality
IEEE Xplore			Image sequence analysis
BT:	IEEE products		Image texture analysis
RT:	Information services		Neural radiance field
<i>IGBT</i>			Object detection
USE:	Insulated gate bipolar		Subtraction techniques
transistors		Image annotation	
Ignition		UF:	Image tagging
BT:	Chemical reactions		Linguistic indexing
	Internal combustion	BT:	Video annotation
engines		RT:	Image processing
	Nuclear physics		Feature extraction
	Plasma materials		Image classification
processing			Image retrieval
			Learning (artificial
		intelligence)	
			Metadata
			Video signal processing



JULY 2025 IEEE Thesaurus

Image augmentation

BT: Image transformation
RT: Convolutional neural networks

Data augmentation
Image classification
Machine learning

Image capture

BT: Image processing
RT: Cameras
Computer vision
Image sensors
Photography

Image categorization

BT: Image analysis

Image classification

BT: Image analysis
RT: Deep learning
Image annotation
Image augmentation
NT: Scene classification

Image coding

UF: Image compression
BT: Image processing
RT: Image communication
Image databases
Image storage
MPEG standards
Rate distortion theory
Steganography
Transcoding
Vector quantization
Video codecs
Video coding

Image color analysis

UF: Image colour analysis
BT: Image processing
RT: Color gamut
Image filtering

Image colour analysis

USE: Image color analysis

Image communication

UF: Image transmission
BT: Communications technology
RT: B-ISDN
Cable TV
ISDN

Image coding
Motion compensation
TV
Teleconferencing
Videophone systems
Visual communication
NT: Facsimile
Picture archiving and communication systems

Image compression

USE: Image coding

Image converters

BT: Imaging
RT: Frequency conversion
Image sensors
NT: Image intensifiers

Image databases

BT: Database systems
Databases
RT: Geographic information systems

Image coding
Image storage
Video sequences
NT: Image retrieval

Image de-noising

USE: Image denoising

Image deblurring

USE: Image restoration

Image decomposition

BT: Image processing

Image dehazing

BT: Image processing
RT: Deblurring

Image denoising

UF: Image de-noising
BT: Image processing
RT: Diffusion processes
Gaussian noise
Image enhancement
Image filtering
Image reconstruction
Image resolution
Image restoration

Image edge analysis

USE: Image edge detection



JULY 2025 IEEE Thesaurus

Image edge detection

UF: Edge detection
Image edge analysis
BT: Image recognition
RT: Corner detection
Feature extraction
Image segmentation
License plate recognition
Thresholding (Imaging)

Image enhancement

BT: Image processing
RT: Image denoising
Image intensifiers
Image restoration

Image filtering

BT: Filtering theory
Image processing
RT: Image color analysis
Image denoising
Image segmentation

Image forensics

UF: Forensic photography
BT: Forensics
Photography
RT: Image processing
Law enforcement
Visualization

Image fusion

BT: Image processing

Image generation

USE: Image processing AND
Image synthesis

Image intensifiers

BT: Image converters
RT: Frequency conversion
Image enhancement
Image sensors

Image matching

UF: Appearance matching
Fingerprint images
BT: Pattern matching
RT: Fingerprint recognition
Image recognition
Object detection
Object recognition
Stereo vision
Visual information retrieval
NT: Text to image

Visual place recognition

Image morphing

BT: Image transformation
Morphological operations

Image motion analysis

BT: Image analysis
RT: Fall detection
Human activity recognition
Motion capture
Motion detection
Object tracking
Robotics and automation
NT: Video tracking

Image object detection

USE: Object detection

Image object recognition

USE: Object recognition

Image pattern recognition

USE: Pattern recognition

Image preprocessing

BT: Image processing

Image processing

UF: Image generation
Picture processing
BT: Computers and information

processing

RT: Authentication
Diffusion processes
Gabor filters
Image forensics
Multidimensional signal

processing

Optical projectors
Photogrammetry
Reconstruction algorithms
Time-frequency analysis
Video sequences
Vision sensors
NT: Active shape model
Blob detection
Corner detection
Feature detection
Feature extraction
Fiducial markers
Geophysical image

processing

Gray-scale
Image analysis



JULY 2025 IEEE Thesaurus

Image annotation		Visual place recognition
Image capture	NT:	Fine-grained image
Image coding	recognition	
Image color analysis		Image edge detection
Image decomposition		
Image dehazing	Image reconstruction	
Image denoising	BT:	Image processing
Image enhancement	RT:	Holography
Image filtering		Image denoising
Image fusion		Inverse problems
Image preprocessing		Magnetic resonance
Image recognition	imaging	
Image reconstruction		Pattern clustering
Image registration		Tomography
Image representation	Image registration	
Image resolution	BT:	Image processing
Image restoration		
Image sampling	Image representation	
Image segmentation	BT:	Image processing
Image sequences	NT:	Digital representation
Image stitching		
Image synthesis	Image resolution	
Image texture	BT:	Image processing
Image transformation	RT:	Image denoising
Machine vision		Visual communication
Morphological operations	NT:	Contrast resolution
Optical feedback		High-resolution imaging
Pansharpening		Spatial resolution
Saliency detection		Superresolution
Smart pixels		
Spatial coherence	Image restoration	
Structure from motion	UF:	Image deblurring
Table lookup	BT:	Image processing
Text detection	RT:	Distortion
Thresholding (Imaging)		Image denoising
		Image enhancement
Image quality		Video restoration
BT:		Deblurring
RT:	NT:	
Image analysis		
Deblurring		
Pansharpening		
Spatial resolution	Image retrieval	
	BT:	Image databases
Image recognition	RT:	Cross modal retrieval
BT:		Image annotation
RT:		
Image processing	Image sampling	
Emotion recognition	BT:	Image processing
Face recognition		
Fall detection	Image segmentation	
Feature extraction	BT:	Image processing
Human activity recognition	RT:	Conditional random fields
Image analysis		Deep learning
Image matching		Image edge detection
License plate recognition		Image filtering
Machine vision		Mixture models
Object recognition		
Video signal processing		



JULY 2025 IEEE Thesaurus

	Object tracking		<i>Image tagging</i>	
	Text detection		USE:	Image annotation
NT:	Instance segmentation		<i>Image textural analysis</i>	
	Semantic segmentation		USE:	Image texture analysis
Image sensors			Image texture	
UF:	Sensors (image)		BT:	Image processing
BT:	Imaging			
RT:	Cameras		Image texture analysis	
	Endoscopes		UF:	Image textural analysis
	Image capture		BT:	Image analysis
	Image converters			
	Image intensifiers		Image thinning	
	Motion capture		BT:	Image transformation
	Motion detection			Morphological operations
	Night vision		RT:	Image skeletonization
	Optical sensors			
	Photodetectors		Image transformation	
	Robot vision systems		UF:	Image transforming
	Wearable sensors		BT:	Image processing
NT:	Active pixel sensors		RT:	Morphological operations
	CCD image sensors		NT:	Image augmentation
	CMOS image sensors			Image morphing
	Charge-coupled image			Image skeletonization
sensors				Image thinning
	Infrared image sensors			Neural style transfer
Image sequence analysis			<i>Image transforming</i>	
BT:	Image analysis		USE:	Image transformation
Image sequences			<i>Image transmission</i>	
BT:	Image processing		USE:	Image communication
Image skeletonization			<i>Image watermarking</i>	
BT:	Image transformation		USE:	Watermarking
RT:	Image thinning		<i>Imagimarkers</i>	
Image stitching			USE:	Fiducial markers
BT:	Image processing		Imaging	
Image storage			RT:	Color
BT:	Imaging			Motion pictures
RT:	Image coding			Radiometry
	Image databases			Remote sensing
	Photography			Robot vision systems
	Video recording		NT:	Biomedical imaging
Image synthesis				Cameras
UF:	Image generation			Focusing
BT:	Image processing			Ground penetrating radar
RT:	Rendering (computer			Holography
graphics)				Image converters
				Image sensors
NT:	Human image synthesis			Image storage
	Neural radiance field			Infrared imaging



JULY 2025 IEEE Thesaurus

imaging	Magnetic resonance	Vaccines
resistivity imaging technique	Magneto electrical	Immune system
	Microscopy	BT: Anatomy
	Microwave imaging	RT: Biological control systems
	Multispectral imaging	Biology
	Nuclear imaging	Immunology
	Optical imaging	Immunotherapy
	Photography	Lymphocytes
	Radiation imaging	Microbiome
	Radiography	Microorganisms
	Stereo vision	Rheumatology
	Terahertz wave imaging	Sepsis
	Tomography	NT: Allergies
		Antibodies
		Artificial immune systems
		Immune response
Imaging phantoms		
BT: processing	Biomedical image	
<i>IMC</i>		Immunity testing
USE: In-memory computing		BT: Electromagnetic
		compatibility
		Electronic equipment
Imitation learning		testing
BT: Machine learning		RT: Electrostatic interference
		Anechoic chambers
		Electromagnetic
Immersion cooling		interference
BT: Cooling		Open area test sites
Immersive audio		Immunofluorescence
BT: Audio systems		BT: Fluorescence
	Augmented reality	Immunology
RT: Ambisonics		Microscopy
	Human computer	RT: Antigens
interaction		
	Virtual reality	<i>Immunoglobulin</i>
		USE: Antibodies
Immersive experience		Immunology
BT: Augmented reality		BT: Medical specialties
	Human computer	RT: Immune system
interaction		NT: Antigens
	Virtual reality	Immunofluorescence
Immersive learning		Immunotherapy
BT: Learning systems		UF: Biological therapy
	Virtual reality	BT: Medical treatment
RT: Education		RT: Immune system
		Monoclonal antibodies
<i>Immune reaction</i>		
USE: Immune response		<i>Impact ionisation</i>
Immune response		USE: Impact ionization
UF: Immune reaction		
BT: Immune system		
RT: Antigens		



JULY 2025 IEEE Thesaurus

Impact ionization

UF: Impact ionisation
BT: Ionization
RT: Charge carriers
Conductivity
Electrons
Insulators

Impedance

UF: Electric impedance
BT: Electric variables
RT: Admittance
Damping
Impedance matching
Impedance measurement

Impedance matching

BT: Electric variables
RT: Circuits
Equalizers
Impedance
NT: Baluns

Impedance measurement

UF: Impedance methods
Impedance performance
BT: Electric variables
measurement
RT: Admittance measurement
Impedance
Transmission line
measurements

Impedance methods

USE: Impedance measurement

Impedance performance

USE: Impedance measurement

Impellers

BT: Machine components
RT: Blades
Propellers
Pumps

Impersonation attacks

BT: Communication system
security

Implantable biomedical devices

USE: Implants

Implantable devices

USE: Implants

Implantable electronics

USE: Implants

Implants

UF: Implantable biomedical
devices
Implantable devices
Implantable electronics
BT: Biomedical equipment
NT: Auditory implants
Brainstem implants
Cochlear implants
Microelectronic implants
Neural implants

Importance sampling

USE: Monte Carlo methods

Imposter signature generation

USE: Forgery

Improved definition TV

USE: HDTV

Impulse generation

USE: Pulse generation

Impulse measurements

USE: Pulse measurements

Impulse testing

BT: Testing
RT: Channel impulse response
Frequency response
Insulation testing

Impurities

BT: Materials science and
technology
RT: Contamination
NT: Semiconductor impurities

Imputation

BT: Statistics

Imref

USE: Quasi-Fermi level

IMT-2000

USE: 3G mobile communication

In memory computing

USE: In-memory computing



JULY 2025 IEEE Thesaurus

In memory processing

USE: In-memory computing

In vitro

BT: Medical services
NT: In vitro fertilization

In vitro fertilization

BT: In vitro

In vivo

BT: Medical services

In-memory computing

UF: CIM
Compute-in-memory
IMC
In memory computing
In memory processing
In-memory processing
BT: Memory management
RT: Buffer storage
Cache memory

In-memory processing

USE: In-memory computing

Incentive schemes

UF: Bonuses
Merit pay
Performance related pay
Profit sharing schemes
BT: Human resource

management

RT: Remuneration
Appraisal
Employee welfare
Productivity

Incineration

UF: Afterburners
Incinerators
Refuse incineration
Waste incineration
BT: Waste disposal
RT: Air pollution
Ash
Radioactive pollution
Radioactive waste
Radioactive waste disposal

Incinerators

USE: Incineration

Inclusive language

BT: Professional
communication
RT: Terminology
Cultural aspects
Human factors
Social factors

Incremental learning

BT: Machine learning

Independent component analysis

BT: Numerical analysis
RT: Artificial intelligence
Blind source separation
Computer aided analysis
Feature extraction
Principal component

analysis

Signal processing

Index of production

USE: Economic indicators

Indexes

BT: Database systems
RT: Information retrieval
Information systems
NT: Enhanced vegetation index
Indexing
Machine assisted indexing
Spatial indexes

Indexing

UF: Online indexing
BT: Indexes
Information analysis
RT: Keyword search
Machine assisted indexing
Tagging

Indian Ocean

BT: Oceans

Indirect liquid cooling

BT: Liquid cooling

Indium

BT: Metals
RT: Indium compounds

Indium compounds

BT: Compounds
RT: Alloying
Indium



JULY 2025 IEEE Thesaurus

NT: Indium gallium arsenide
Indium tin oxide

Indium gallium arsenide

UF: InGaAs
BT: Gallium compounds
Indium compounds
Semiconductor materials

Indium gallium nitride

BT: Gallium compounds

Indium gallium zinc oxide

BT: Zinc oxide

Indium phosphide

UF: InP
BT: Semiconductor materials
RT: Phonons

Indium tin oxide

BT: Indium compounds
RT: Optical materials

Indoor air quality

BT: Air quality

Indoor communication

BT: Communication systems
RT: Indoor positioning systems
Mobile communication
Optical fiber communication
Optical modulation
NT: Indoor environment

Indoor environment

BT: Indoor communication
NT: Indoor positioning systems

Indoor navigation

BT: Navigation
RT: Computer vision
Global Positioning System
Indoor positioning systems
Land mobile radio
Path planning
Radio navigation

Indoor positioning systems

BT: Indoor environment
RT: Indoor communication
Indoor navigation

Indoor radio

USE: Indoor radio communication

Indoor radio communication

UF: Indoor radio
Indoor radio
communications
BT: Radio communication

Indoor radio communications

USE: Indoor radio communication

Inductance

BT: Electric variables
RT: Coils
Inductance measurement
Inductors
Transmission line theory

Inductance measurement

BT: Electric variables
measurement
RT: Inductance

Induction (electromagnetic)

USE: Electromagnetic induction

Induction (electrostatic)

USE: Electrostatic induction

Induction generators

BT: AC generators
Induction machines
NT: Doubly fed induction
generators

Induction heating

BT: Heating systems
RT: Electromagnetic heating

Induction machines

BT: AC machines
Rotating machines
NT: Induction generators
Induction motors

Induction motor drives

BT: Induction motors

Induction motors

UF: Asynchronous machines
BT: AC motors
Induction machines
Motors
Rotating machines
RT: Sensorless control
NT: Induction motor drives



JULY 2025 IEEE Thesaurus

Inductive charging

UF: Wireless charging
BT: Energy exchange
Power supplies
RT: Wireless communication

Inductive coupling

BT: Circuit theory
Mutual coupling

Inductive energy transfer

USE: Inductive power
transmission

Inductive power transmission

UF: Inductive energy transfer
BT: Electromagnetic induction
Power transmission
RT: Inductors
Sensorless control
Transformers

Inductive transducers

BT: Transducers

Inductors

UF: Chokes
Reactors
BT: Electronic components
RT: Coils
Electrical ballasts
Inductance
Inductive power

transmission

devices

NT: Active inductors
Thick film inductors
Thin film inductors

Industrial accidents

BT: Accidents
RT: Hazardous areas
Occupational safety

Industrial communication

UF: Organizational
communication
BT: Communication networks
Industrial engineering
RT: Business
Organizational aspects

Industrial control

BT: Industrial electronics
RT: Assembly systems
Computer numerical control
Control system security
Field buses
Industrial engineering
Industrial plants
Manipulators
Manufacturing automation
Mobile robots
Motor drives
Programmable control
Robots
NT: Process control
Production control

Industrial democracy

USE: Industrial relations

Industrial economics

UF: Manufacturing economics
Production economics
BT: Microeconomics
RT: Economies of scale
Privatization

Industrial electronics

NT: Assembly systems
Computer aided

manufacturing

systems

Cryogenic electronics
Industrial control
Integrated manufacturing

Machine control
Manufacturing automation
Testing

Industrial engineering

BT: Industry applications
RT: Design methodology
Industrial control
Industrial plants
Industrial training
Precision engineering
Production engineering
Production management
Research and development
NT: Industrial communication

Industrial facilities

BT: Production facilities
RT: Industrial plants
Manufacturing systems
NT: Seaports



JULY 2025 IEEE Thesaurus

Industrial heat recovery

USE: Heat recovery

BT: Business

RT: Equal opportunities

Industrial Internet of Things

UF: IIOT
Industrial IoT

BT: Internet of Things

RT: Machine-to-machine

communications

Robotics and automation

Industrial IoT

USE: Industrial Internet of Things

Industrial plants

UF: Plants (industrial)
BT: Production facilities
RT: Industrial control
Industrial engineering
Industrial facilities
Industrial power systems
Industries
Manufacturing
Paper mills
Production systems

Industrial pollution

BT: Pollution
RT: Air pollution
Industrial waste
Land pollution
Radioactive pollution
Thermal pollution
Water pollution

Industrial power systems

UF: Commercial power systems
BT: Power systems
RT: Buildings
Cogeneration
Industrial plants
Power distribution

Industrial psychology

BT: Psychology
RT: Employee welfare
Human resource

management

Productivity
Psychometric testing

Industrial relations

UF: Collective bargaining
Industrial democracy
Trade unions

Industrial Revolution 4.0

USE: Fourth Industrial Revolution

Industrial Revolution 5.0

USE: Fifth Industrial Revolution

Industrial robots

BT: Robots

RT: Manufacturing automation

Industrial training

BT: Training
RT: Industrial engineering
Multiskilling
On the job training
Vocational training

Industrial waste

BT: Waste materials
RT: Effluents
Industrial pollution
Slurries
Waste heat
Wastewater
NT: Ash
Slag

Industries

BT: Industry applications
RT: Business
Industrial plants
Agriculture
Airline industry
Architecture
Beverage industry
Chemical industry
Coal industry
Communication industry
Computer industry
Construction
Construction industry
Defense industry
Electrical engineering

industry

Entertainment industry
Farming
Financial industry
Gas industry
Horticulture
Information industry
Lumber industry
Manufacturing industries



JULY 2025 IEEE Thesaurus

Metals industry
Mining industry
Natural gas industry
Petroleum industry
Pharmaceutical industry
Power industry
Real estate industry
Steel industry
Sugar industry
Textile technology
Tourism industry
Toy industry
Transportation industry
Wood industry

Industry 4.0

USE: Fourth Industrial Revolution

Industry 5.0

USE: Fifth Industrial Revolution

Industry applications

NT: Accident prevention
Chemical technology
Cryogenics
Electrochemical devices
Electrochemical processes
Electromechanical systems
Electrostatic devices
Electrostatic precipitators
Electrostatic processes
Engines
Environmental

management

Food technology
High-temperature

techniques

Industrial engineering
Industries
Inspection
Machinery
Manufacturing
Packaging
Paper technology
Production
Safety
Security
Wine industry

Inertial confinement

BT: Plasma confinement

Inertial navigation

BT: Navigation

Inertial sensors

BT: Sensors

Infant

USE: Pediatrics

Infants

USE: Pediatrics

Infectious diseases

UF: Communicable disease
Transmissible disease
BT: Diseases
RT: Contact tracing
NT: Measles

Inference algorithms

BT: Algorithms
RT: Model compression

Inference mechanisms

UF: Model-based reasoning
BT: Knowledge engineering
RT: Cognitive science
Fuzzy cognitive maps
Gaussian processes
Intent recognition
Learning systems
NT: Belief propagation
Fuzzy reasoning

Inferential statistics

BT: Statistical analysis
RT: Descriptive statistics

Infertility

BT: Medical conditions
RT: Pregnancy

Infinite horizon

BT: Optimal control
RT: Markov processes
Optimization methods

Infinite impulse response filters

USE: IIR filters

Inflammability

USE: Flammability

Inflammatory bowel disease

BT: Medical conditions
RT: Digestive system
NT: Crohn's disease
Ulcerative colitis



JULY 2025 IEEE Thesaurus

Influenza

BT: Diseases
Viruses (medical)
RT: Epidemics
Pandemics

Social networking (online)
RT: Fake news
Information sharing
Knowledge transfer
Privacy

Informatics

BT: Information processing
Information systems
RT: Computational materials
science
NT: Bioinformatics
Cognitive informatics
Energy informatics
Neuroinformatics

Information entropy

BT: Information theory

Information exchange

BT: Data processing
Information processing
RT: Border Gateway Protocol
Common Information Model
(computing)
Common Information Model
(electricity)
Information leakage
Information management
Information sharing
Ports (computers)
Tactile Internet
NT: Information diffusion

Information age

UF: AOI
Age of information
Digital age
New media age
BT: Information technology

Information analysis

BT: Professional
communication
RT: Big Data applications
Sentiment analysis
NT: Decision analysis
Indexing

Information extraction

USE: Information retrieval

Information filtering

BT: Filtering
Information retrieval
NT: Information filters
Recommender systems

Information and communication technology

UF: ICT
BT: Communications
technology
Information technology
RT: Energy informatics
NT: Ambient assisted living

Information filters

UF: Web filters
BT: Information filtering
RT: Information retrieval
NT: Accesslists
Blocklists

Information architecture

BT: Information systems
RT: Database systems
NT: Enterprise architecture
management

Information geometry

BT: Geometry
RT: Probability

Information centric networking

USE: Information-centric
networking

Information industry

BT: Industries

Information centric networks

USE: Information-centric
networking

Information inequality

USE: Cramer-Rao bounds

Information integrity

UF: Information quality
BT: Professional
communication
RT: Cyber threat intelligence

Information diffusion

BT: Information exchange



JULY 2025 IEEE Thesaurus

Deepfakes
Fake news
Information leakage
Synthetic data

Information leakage

BT: Information security
RT: Eavesdropping
Encryption
Information exchange
Information integrity
Privacy
Security

Information management

BT: Information systems
Management
RT: Big Data
Data aggregation
Decentralized identity
Information exchange
Information services
Knowledge management
NT: Common Information Model
(computing)
(electricity)
Common Information Model
Competitive intelligence
Digital information
Digital preservation
Document handling
Enterprise architecture
management
Information security
Information sharing
Knowledge transfer

Information processing

BT: Information systems
RT: Big Data
Business Process
Execution Language
Business data processing
Data collection
Granular computing
Information sharing
Software as a service
Spectral efficiency
NT: Electronic healthcare
Informatics
Information exchange
Smart agriculture
Sonification

Information quality

USE: Information integrity

Information rates

UF: Throughput
(communication systems)
BT: Information retrieval

Information representation

BT: Information technology
RT: Visual analytics
NT: Digital representation

Information resources

BT: Professional
communication
RT: Information retrieval
Information systems

Information retrieval

UF: Information extraction
BT: Professional
communication
RT: Big Data
Data retrieval
Document handling
Indexes
Information filters
Information resources
Knowledge discovery
Named entity recognition
Persistent identifiers
Portals
Ranking (statistics)
Symbols
Triples (Data structure)
NT: Blogs
Content-based retrieval
Cross modal retrieval
Dimensionality reduction
Hypertext systems
Information filtering
Information rates
Music information retrieval
Online services
Search engines
Search methods
Semantic communication
Social networking (online)
Tagging
Taxonomy
Terminology
Visual information retrieval
Vocabulary
Web sites



JULY 2025 IEEE Thesaurus

Information science

BT: Professional

communication

NT: Quantum information

science

processing

CD-ROMs

Computers and information

Database machines

Digital information

Extranets

File systems

Indexes

Information resources

Information technology

Management information

Information security

BT: Information management

Security

RT: Cyber threat intelligence

Data protection

Decentralized identity

Differential privacy

Digital policy

Hardware security

Internet security

Security information and

base

Multimedia computing

Office automation

Strategic planning

Technology acceptance

event management

NT: Cyber espionage

Data breach

Information leakage

Intrusion detection

Phishing

Privacy breach

SQL injection

Social engineering

model

NT:

Data systems

Database systems

Decision support systems

Distributed information

systems

Identity management

systems

Informatics

Information architecture

Information management

Information processing

Management information

(security)

Trust management

Information services

BT: Professional

communication

RT: IEEE Xplore

Information management

Journalism

NT: Dictionaries

Document delivery

Encyclopedias

Libraries

Teletext

Videotex

systems

systems

Medical information

Information technology

BT: Professional

communication

RT: Automation

Biometrics

Computer applications

Digital economy

Information systems

NT: Bring your own device

DevOps

Information age

Information and

communication technology

Information representation

Printing

Semantic technology

Service computing

Telematics

Universal Serial Bus

Information sharing

BT: Information management

RT: Collaboration

Cyber threat intelligence

Information diffusion

Information exchange

Information processing

NT: Data dissemination

Information systems

BT: Professional

communication

RT: Big Data applications



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Information theory

UF: Coding theory
Information-theoretic
Informationtheoretic

RT: Bandwidth
Code refractoring
Communication systems
Cybernetics
Cyclic redundancy check
Econophysics
Modulation coding
Quantum communication
Statistics
Teleportation
Viterbi algorithm

NT: Audio coding
Biological information

theory

Channel coding
Codes
Communication channels
Decoding
Encoding
Error compensation
Genetic communication
Hamming distances
Hamming weight
Information entropy
Mutual information
Network coding
Rate distortion theory
Rate-distortion
Source coding
Speech coding
Technology acceptance

model

Information-centric networking

UF: Content-centric networking
Information centric

networking

Information centric

networks

Information-centric

networks

BT: Network architecture
RT: Telecommunication

computing

Information-centric networks

USE: Information-centric

networking

Information-theoretic

USE: Information theory

Informationtheoretic

USE: Information theory

Infrared communication

USE: Optical fiber communication

Infrared detectors

BT: Radiation detectors
RT: Bolometers
Infrared surveillance
Motion detection
Photodetectors
Superconducting

photodetectors

Wearable sensors

Infrared heating

BT: Heating systems
NT: Greenhouse effect

Infrared image sensors

BT: Image sensors

Infrared imaging

UF: Infrared thermography
Thermal video
BT: Imaging
RT: Biomedical optical imaging
Functional near-infrared

spectroscopy

Infrared surveillance
Optical imaging
Remote sensing
Night vision

NT:

Infrared lasers

USE: Lasers

Infrared propagation

USE: Optical propagation

Infrared sensors

BT: Sensors

Infrared spectra

UF: IR Spectra
BT: Spectral analysis
RT: Functional near-infrared

spectroscopy

Spectroscopy

Infrared surveillance

BT: Surveillance
RT: Infrared detectors
Infrared imaging



JULY 2025 IEEE Thesaurus

Infrared thermography

USE: Infrared imaging

InGaAs

USE: Indium gallium arsenide

Inhibitors

BT: Chemical products
Production materials
RT: Retardants
NT: Corrosion inhibitors

Inhomogeneous media

USE: Nonhomogeneous media

Injected beams

USE: Particle beam injection

Injection lasers

USE: Semiconductor lasers

Injection locked oscillators

USE: Injection-locked oscillators

Injection locking

USE: Injection-locked oscillators

Injection molding

UF: Injection moulding
Power injection molding
Power injection moulding
BT: Production
RT: Compression molding
Embossing

Injection moulding

USE: Injection molding

Injection-locked oscillators

UF: Injection locked oscillators
Injection locking
BT: Oscillators

Injuries

UF: Injury
BT: Medical conditions
RT: Fall detection
NT: Amputation
Brain injuries
Pain
Skin burns
Wounds

Injury

USE: Injuries

Ink

BT: Production materials
RT: Paints
Printing
NT: Ink jet printing

Ink jet printing

UF: Ink-jet printers
Ink-jet printing
Inkjet printing
BT: Ink
Printing
RT: Three-dimensional printing

Ink-jet printers

USE: Ink jet printing

Ink-jet printing

USE: Ink jet printing

Inkjet printing

USE: Ink jet printing

Innovation

USE: Technological innovation

Innovation management

UF: Management of innovation
BT: Engineering management
Research and development
management
RT: Entrepreneurship
Technology management
NT: Creativity

Inorganic chemicals

BT: Chemistry

Inorganic compounds

BT: Compounds
RT: Metals
Organic inorganic hybrid

materials

NT: Transition metal

compounds

Inorganic LEDs

USE: Inorganic light emitting

diodes

Inorganic light emitting diodes

UF: Inorganic LEDs
BT: Light emitting diodes



JULY 2025 IEEE Thesaurus

Inorganic materials

BT: Materials
RT: Soft electronics

Inorganic organic hybrid materials

USE: Organic inorganic hybrid materials

Inorganic-organic hybrid materials

USE: Organic inorganic hybrid materials

InP

USE: Indium phosphide

Input devices

BT: Computer interfaces
Hardware

Input surge current

USE: Inrush current

Input variables

UF: Variable selection
BT: Modeling

Input-output programs

UF: I/O programs
BT: Operating systems
RT: Program processors
NT: Device drivers

Inrush current

UF: Input surge current
Switch on surge
BT: Current
Surges
RT: Converters
Current measurement
Electric current control
Electric fields

Insect control

USE: Pest control

Insects

BT: Animals
RT: Apicology
Entomology

Insertion loss

BT: Propagation
RT: Attenuation

Inspection

BT: Industry applications
RT: Coordinate measuring machines
Maintenance engineering
Testing
NT: Automatic optical inspection

Instance segmentation

BT: Image segmentation
RT: Object detection
Semantic segmentation

Instant messaging

UF: IM
BT: Electronic messaging
Internet

Instanton vacuum

USE: Elementary particle vacuum

Instruction repertory

USE: Instruction sets

Instruction sets

UF: Instruction repertory
BT: Program processors
RT: Turing completeness
NT: Out of order
Prefetching
Reduced instruction set

computing

Instructional aids

USE: Educational technology

Instrument transformers

BT: Transformers
RT: Protective relaying
NT: Voltage transformers

Instrumentation and measurement

NT: Computerized instrumentation
Electric variables
High energy physics
instrumentation computing
Instruments
Measurement
Monitoring
Pulse oximetry
Testing

Instrumentation buses

USE: Field buses



JULY 2025 IEEE Thesaurus

Instruments

BT: Instrumentation and
measurement
RT: Design tools
Measurement
NT: Barometers
Compass
Medical instruments
Meters
Microscopy
Network analyzers
Odometers
Oscilloscopes
Pressure gauges
Probes
Telescopes
Theodolites
Tuners

Insulated gate bipolar transistors

UF: IGBT
BT: Bipolar transistors

Insulation

BT: Dielectrics and electrical
insulation
RT: Dielectric breakdown
Dielectric losses
Dielectric materials
Glass
Insulation life
Insulation testing
Oils
Polymer foams
Power transformer

insulation

NT: Spark gaps
Cable insulation
Ceramics
Gas insulation
Insulators
Isolation technology
Oil insulation
Plastic insulation
Solid insulation

Insulation life

BT: Insulation testing
RT: Aging
Insulation
Life estimation
Partial discharge

measurement

Trees - insulation

Insulation testing

BT: Insulator testing
RT: Fault location
Impulse testing
Insulation
Partial discharge
measurement
Pulsed electroacoustic
methods
NT: Insulation life

Insulator testing

BT: Testing
RT: Insulators
Surface discharges
NT: Insulation testing

Insulators

UF: Bushings
BT: Insulation
RT: Breakdown voltage
Ceramic products
Impact ionization
Insulator testing
Polymer foams
Temperature distribution
NT: Metal-insulator structures
Plastic insulators
Rubber
Topological insulators
Trees - insulation

Insulin

BT: Drugs

Insulin pumps

BT: Pumps
RT: Biomedical equipment
Diabetes

Insurance

BT: Financial management

Intake systems

UF: Data intake
BT: Machine components
RT: Data ingestion

Integer linear programming

BT: Programming
NT: Constraint theory
Mixed integer linear

programming



JULY 2025 IEEE Thesaurus

Integer programming

BT: Linear programming

Integral equations

UF: Antiderivatives
BT: Calculus
RT: Boundary-element methods
Deconvolution
Integrodifferential equations
Inverse problems
Method of moments
Numerical analysis
NT: Probability density function

Integrated circuit design

USE: Integrated circuit synthesis

Integrated circuit interconnections

BT: Integrated circuits

Integrated circuit layout

BT: Integrated circuit synthesis
RT: Layout
Physical design
Printed circuits

Integrated circuit manufacture

BT: Components, packaging,
and manufacturing technology
RT: Gettering
Integrated circuits
Microassembly
Micromachining
Silicon compiler
NT: Surface mount technology

Integrated circuit measurements

BT: Circuit testing
RT: Electric variables
measurement

Integrated circuit metallisation

USE: Integrated circuit
metallization

Integrated circuit metallization

UF: Integrated circuit
metallisation
BT: Metallization

Integrated circuit modeling

UF: Integrated circuit modelling
BT: Integrated circuits
Modeling
NT: Cutoff frequency

Integrated circuit modelling

USE: Integrated circuit modeling

Integrated circuit noise

BT: Integrated circuits
RT: Semiconductor device
noise
Threshold voltage
NT: Optical noise

Integrated circuit packaging

UF: IC packaging
BT: Components, packaging,
and manufacturing technology
RT: Chip scale packaging
Encapsulation
Integrated circuits
Plastic packaging
Semiconductor device
packaging
NT: Multichip modules
Plastic integrated circuit
packaging

Integrated circuit reliability

BT: Reliability
RT: Electrostatic discharge
protection
Integrated circuit testing
Thermal stability

Integrated circuit synthesis

UF: Integrated circuit design
BT: Circuit synthesis
Integrated circuits
NT: Integrated circuit layout

Integrated circuit technology

BT: Circuits and systems
RT: Electrostatic discharge
protection
High-speed integrated
circuits
NT: Beyond CMOS
CMOS technology
Moore's Law

Integrated circuit testing

BT: Testing
RT: Integrated circuit reliability
NT: Integrated circuit yield
Logic testing

Integrated circuit yield

BT: Integrated circuit testing



JULY 2025 IEEE Thesaurus

Integrated circuits

UF: IC
ICs
Microchips
BT: Circuits
RT: Active inductors
Integrated circuit
manufacture
Integrated circuit packaging
Integrated optoelectronics
Memory modules
Microelectronics
Neural network hardware
Planarization
SPICE
Semiconductor devices
Semiconductor memory
Silicon-on-insulator
VHDL
NT: Analog integrated circuits
Analog-digital integrated
circuits
Application specific
integrated circuits
CMOS integrated circuits
Chiplets
Coprocessors
Current-mode circuits
Digital integrated circuits
FET integrated circuits
Field programmable gate
arrays
Hybrid integrated circuits
Integrated circuit
interconnections
Integrated circuit modeling
Integrated circuit noise
Integrated circuit synthesis
Large scale integration
MESFET integrated circuits
Microprocessors
Microwave integrated
circuits
Millimeter wave integrated
circuits
Monolithic integrated
circuits
Photonic integrated circuits
Power integrated circuits
Radiofrequency integrated
circuits
SIM card
integrated circuits
Submillimeter wave

circuits
Superconducting integrated
Thick film circuits
Thin film circuits
Three-dimensional
integrated circuits
Through-silicon vias
UHF integrated circuits
Ultra large scale integration
Very high speed integrated
circuits
Very large scale integration
Wafer scale integration
Integrated circuits industry
USE: Electronics industry
Integrated control
USE: Centralized control
Integrated design
BT: Design methodology
Systems engineering and
theory
Integrated manufacturing systems
BT: Industrial electronics
Manufacturing systems
RT: CAD/CAM
Computer aided
manufacturing
System integration
Integrated memory circuits
BT: Digital integrated circuits
Semiconductor memory
RT: Solid state drives
Integrated optics
BT: Optics
RT: Arrayed waveguide gratings
Distributed Bragg reflectors
Electro-optic modulators
Integrated optoelectronics
Microoptics
Nanoantennas
Optical films
Optical waveguides
Synapses
Thermo-optical devices
Integrated optoelectronics
BT: Optoelectronic devices
RT: Heterojunction bipolar
transistors



JULY 2025 IEEE Thesaurus

Integrated circuits
Integrated optics
Liquid crystal on silicon
Microoptics
Microwave photonics
Nanoantennas
Smart pixels

Integrated sensing and communication

UF: ISAC
BT: Communication systems
Sensors

Integrated services digital networks

USE: ISDN

Integrated services networks

USE: Intserv networks

Integrodifferential equations

BT: Equations
RT: Differential equations
Integral equations

Integumentary system

BT: Anatomy
NT: Hair
Nails
Skin

Intellectual capital

USE: Knowledge management

Intellectual property

UF: IP rights
IPR
BT: Copyright protection
RT: Cyberethics
Patents
Software protection
NT: Digital rights management

Intelligent actuators

UF: Smart actuators
BT: Actuators

Intelligent agents

BT: Software agents

Intelligent agriculture

USE: Smart agriculture

Intelligent automation

UF: Robotic process automation
BT: Automation

Intelligent systems
RT: Intelligent robots

Intelligent control

BT: Cybernetics
RT: Context awareness
H infinity control
Mechatronics
NT: Feedforward systems
Neurocontrollers

Intelligent databases

USE: Deductive databases

Intelligent manufacturing systems

BT: Manufacturing systems
Production systems
RT: Smart manufacturing

Intelligent materials

BT: Materials
RT: Biomimetics
Composite materials
Intelligent structures
Polymer gels
Smart materials

Intelligent networks

BT: Telecommunication
network topology
RT: Software defined
networking

Intelligent reconfigurable surface

USE: Reconfigurable intelligent
surfaces

Intelligent robots

BT: Intelligent systems
Robots
RT: Autonomous robots
Intelligent automation
Robot vision systems

Intelligent sensors

UF: Smart sensors
BT: Sensors
RT: Electronic noses
Mechatronics
Soft sensors

Intelligent structures

UF: Smart structures
BT: Buildings
RT: Intelligent materials



JULY 2025 IEEE Thesaurus

	Intelligent systems	Intensity modulation	
	Structural engineering	BT:	Optical modulation
NT:	Smart cities	RT:	Amplitude modulation
			Electro-optic modulators
Intelligent systems		<i>Intent classification</i>	
BT:	Artificial intelligence	USE:	Intent recognition
RT:	Ambient intelligence		
	Artificial general intelligence	Intent recognition	
	Automata	UF:	Goal recognition
	Collaborative intelligence		Intent classification
	Context awareness	BT:	User interfaces
	Controller area networks	RT:	Behavioral sciences
	Expert systems		Inference mechanisms
	Hybrid intelligent systems		
	Intelligent structures	<i>Inter Planetary File System</i>	
	Knowledge based systems	USE:	InterPlanetary File System
	Massive machine type		
communications		<i>Inter-cell interference</i>	
	Mobile agents	USE:	Intercell interference
	Software agents		
NT:	Autonomous systems	<i>Inter-cell interference coordination</i>	
	Collective intelligence	USE:	Intercell interference
	Hyper-intelligent systems		
	Intelligent automation	Interactive systems	
	Intelligent robots	BT:	Human-machine systems
Intelligent transportation systems		RT:	Affordances
RT:	Advanced driver assistance		Authentication
systems			Spatial computing
	Automotive control	NT:	External stimuli
	Smart transportation		
NT:	Automated highways	<i>Intercalibration</i>	
	Geographic information	USE:	Calibration
systems		Intercell interference	
	Intelligent vehicles	UF:	ICIC
	Navigation		Inter-cell interference
	Transportation		Inter-cell interference
Intelligent vehicles		coordination	
BT:	Intelligent transportation	BT:	Network resource
systems		management	
	Vehicles		Radiofrequency
RT:	Advanced driver assistance	interference	
systems		RT:	Cellular radio
	Connected vehicles		Fading channels
	Dedicated short range		Location awareness
communication			Radio communication
	IEEE 802.11p Standard	Interchannel interference	
	Smart transportation	UF:	Adjacent channel
	Vehicle routing	interference	
	Vehicular automation		Co-channel interference
	Wireless Access in		Cochannel interference
Vehicular Environments			Intersystem interference
NT:	Autonomous vehicles	BT:	Interference
	Vehicle-to-everything		



JULY 2025 IEEE Thesaurus

RT: Crosstalk

Interconnected systems

UF: Composite systems
BT: System analysis and design
RT: Control systems
NT: Botnet

Interconnection networks

USE: Multiprocessor

interconnection

Intercultural competence

USE: Cultural competence

Interest point detection

BT: Computer vision

Interest rates

USE: Economic indicators

Interface management

BT: Management
Systems engineering and

theory

RT: Computer interfaces
Network interfaces

Interface phenomena

BT: Computer interfaces
RT: Adsorption
NT: Network interfaces

Interface states

BT: Computer interfaces
MOSFET
RT: Silicon-on-insulator

Interference

UF: Interference (signal)
BT: Electromagnetic

compatibility and interference

RT: Coherence
Distortion
Diversity schemes
Noise
NT: Clutter
Crosstalk
Diffraction
Echo interference
Electromagnetic

interference

Electromagnetic radiative

interference

Electrostatic interference

Interchannel interference
Interference cancellation
Interference channels
Interference constraints
Interference elimination
Interference suppression
Intersymbol interference
Rain fading
TV interference
Terrain factors

Interference (signal)

USE: Interference

Interference cancellation

BT: Interference

Interference channels

BT: Interference

Interference constraints

BT: Interference

Interference elimination

BT: Interference

Interference suppression

BT: Interference

Interferometers

UF: Etalons
BT: Interferometry
NT: Mach-Zehnder

interferometers

Interferometric lithography

BT: Lithography

Interferometry

BT: Measurement
RT: Micrometers
Talbot effect
NT: Fabry-Perot
Interferometers
Optical interferometry
Phase shifting
interferometry
Radar interferometry
Radio interferometry
Sagnac interferometers

Interleaved codes

UF: Bit interleaved coded
Bit-interleaved coded
BT: Modulation coding



JULY 2025 IEEE Thesaurus

Intermetallic

BT: Alloying

USE: ISO

Intermodulation distortion

BT: Nonlinear distortion

International System of Units

BT: Measurement units

Internal combustion engines

UF: HCCI engines
BT: Engines
RT: Automotive components
Exhaust gases
Hybrid electric vehicles
NT: Diesel engines
Ignition

International Telecommunications Union

USE: ITU

Internal stresses

BT: Stress
RT: Surface stress

International trade

UF: Trade (international)
BT: Economics
RT: Business
Developing countries
Exchange rates
Free economic zones
Freeports
Globalization
International collaboration
Macroeconomics
Trade agreements

International Atomic Time

UF: TAI
BT: Standards categories
RT: Atomic clocks

Internet

UF: Google
BT: Communication systems
Computer networks
Digital systems
Distributed computing
RT: ARPANET
Blogs
Crowdfunding
Cyberspace
Diffserv networks
Digital economy
Electronic commerce
Electronic learning
Energy Internet
Extranets
Hybrid learning
IEEE 802.16 Standard
IP networks
IPTV
Internetworking
Intserv networks
Multicast protocols
Multiprotocol label

International collaboration

UF: Joint ventures
BT: Management
RT: Environmental factors
Environmental

management

Globalization
International relations
International trade
Research and development
Social factors
Standards
Trade agreements

International electrotechnical commission

USE: IEC

International organization for standardization

USE: ISO

International relations

BT: Social implications of
technology
RT: Globalization
International collaboration
Social factors

switching

communications

International Space Station

BT: Space stations

Next generation networking
Online services
Open data
Point-to-multipoint
Routing protocols
Service level agreements
Smart TV
Social networking (online)

International standards organization



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

	Streaming media		Smart healthcare
	TCPIP		Wearable devices
	Virtual enterprises		
	Virtual private networks		
	Web sites		
	World Wide Web		
NT:	Bot (Internet)	Internet of Things	
	Botnet	UF:	IOT
	Cloud computing		Internet of Everything
	Crowdsourcing	BT:	Internet
	Dark Web	RT:	Aerial computing
	Instant messaging		Ambient intelligence
	Internet of Things		Bar codes
	Internet privacy		Cloud computing
	Internet security		Cyber-physical systems
	Internet telephony		Digital economy
	Internet topology		Digital transformation
	Linked data		Digital twins
	Middleboxes		Edge computing
	Semantic Web		Energy Internet
	Social computing		Fifth Industrial Revolution
	Web 2.0		Fourth Industrial Revolution
	Web conferencing		Machine-to-machine
	Web services		
<i>Internet banking</i>		communications	
USE:	Online banking		Middleware
<i>Internet bullying</i>			Object detection
USE:	Cyberbullying		Precision agriculture
<i>Internet governance</i>			Protocols
USE:	Digital policy		Radiofrequency
<i>Internet neutrality</i>			
USE:	Network neutrality	identification	Simultaneous wireless
<i>Internet of Energy</i>			information and power transfer
USE:	Energy Internet		Tagging
<i>Internet of Everything</i>			Virtual environments
USE:	Internet of Things		Watermarking
<i>Internet of Health Things</i>			Wireless sensor networks
USE:	Internet of Medical Things		NT: Agriculture Internet of
Internet of Medical Things		Things	
UF:	Internet of Health Things		Industrial Internet of Things
	IoHT		Internet of Medical Things
BT:	Internet of Things		Internet of Vehicles
	Medical services		Social Internet of Things
RT:	Biomedical monitoring		Tactile Internet
	Emergency services		
	Medical treatment		
	Remote monitoring		
		Internet of Vehicles	
		UF:	IOV
			Internet-of-Vehicles
		BT:	Internet of Things
			Vehicles
		RT:	Vehicular ad hoc networks
		Internet privacy	
		BT:	Internet
			Privacy
		RT:	Internet security
		<i>Internet Protocol networks</i>	
		USE:	IP networks



JULY 2025 IEEE Thesaurus

Internet protocol television

USE: IPTV

BT: Space exploration

RT: Space missions

Internet security

BT: Computer security
Internet

RT: Information security
Internet privacy

InterPlanetary File System

UF: IPFS
Inter Planetary File System

BT: Peer-to-peer computing
Protocols

RT: World Wide Web

Internet services

USE: Web and internet services

Interpolating

USE: Interpolation

Internet telephony

UF: IP telephony
VOIP
Voice over IP
Voice over Internet protocol
Voice-over-Internet protocol
WhatsApp

BT: Internet
RT: Call admission control
Point-to-multipoint

Interpolation

UF: Interpolating
BT: Approximation methods
RT: Curve fitting
Digital-analog conversion
Radial basis function

communications

networks

Statistics
Surface fitting

Internet topology

BT: Internet

Interpreters (program)

USE: Program processors

Internet-of-Vehicles

USE: Internet of Vehicles

Interrupters

UF: Interruption
BT: Switchgear
RT: Circuit breakers
Fuses

Internetworking

BT: Telecommunication

computing

RT: Computer networks
Internet
Local area networks
Metropolitan area networks
Open systems
Wide area networks
NT: Interoperability
LAN interconnection

Interruption

USE: Interrupters

Interoperability

UF: Service composability
BT: Internetworking
RT: Collaboration
Common Information Model

(electricity)

Open systems

Interstellar chemistry

BT: Chemistry
RT: Extraterrestrial

measurements

Intersymbol interference

BT: Interference
RT: AWGN channels
Equalizers
Gaussian channels

Intersystem interference

USE: Interchannel interference

Interplanetary exploration

UF: Emirates Mars Mission
Mars Express
Mars Odyssey
Tianwen-1

Interviews

BT: IEEE indexing

Intestines

BT: Digestive system



JULY 2025 IEEE Thesaurus

Intracranial pressure sensors

BT: Biomedical equipment
Sensors
RT: Brain
Neural engineering

Intracranial system

BT: Cranial pressure

Intrusion detection

BT: Information security
RT: Network function

virtualization

NT: Network intrusion detection

Intserv networks

UF: Integrated services
networks
BT: Computer networks
RT: Internet
Multimedia communication
NT: Space-air-ground
integrated networks

Intubation

UF: Tracheal intubation
BT: Medical treatment
RT: Respiratory system
Ventilators

Invasive software

USE: Privacy-invasive software

Invasive species

BT: Organisms

Invention

USE: Technological innovation

Inventory control

BT: Operations research
RT: Control systems
Production control
Production management

Inventory management

BT: Production management
RT: Bar codes
Production engineering
NT: Bills of materials

Inverse design

BT: Design methodology
RT: Reverse engineering

Inverse distortion

USE: Predistortion

Inverse method

USE: Inverse problems

Inverse methods

USE: Inverse problems

Inverse modeling

USE: Inverse problems

Inverse problem

USE: Inverse problems

Inverse problems

UF: Inverse method
Inverse methods
Inverse modeling
Inverse problem
Inverse scattering
BT: Modeling
RT: Functional analysis
Image reconstruction
Integral equations
Numerical analysis
Signal reconstruction
NT: Deconvolution

Inverse scattering

USE: Inverse problems

Inverse synthetic aperture radar

BT: Synthetic aperture radar

Inverse transforms

USE: Laplace equations

Inverted classroom

USE: Education AND
Online services

Inverter-based resource

UF: IBR
BT: Inverters
Power conversion
RT: Grid forming

Inverters

BT: Power electronics
RT: Maximum power point
trackers
Zero current switching
Zero voltage switching
NT: Grid following



JULY 2025 IEEE Thesaurus

	Grid forming Inverter-based resource Microinverters Multilevel inverters Pulse inverters Resonant inverters Voltage source inverters	RT:	Electrodynamics Ion accelerators Ion beam applications Ion emission Ion sources Ions
		NT:	Ion beam effects
Investment		Ion emission	
BT:	Financial management	UF:	Field ion emission Secondary ion emission
RT:	Crowdfunding Developing countries Fintech Open banking	BT:	Nuclear imaging
		RT:	Ion beam effects Ion beams Ion sources Ions Thermionic emission
<i>Iodides</i>			
USE:	Iodine compounds		
Iodine		Ion implantation	
BT:	Chemical elements	BT:	Ion beam applications Materials preparation
NT:	Iodine compounds	RT:	Plasma sources Semiconductor device
Iodine compounds		manufacture	
UF:	Iodides Iodine monofluoride	NT:	Plasma immersion ion
BT:	Iodine	implantation	
<i>Iodine monofluoride</i>		<i>Ion optics</i>	
USE:	Iodine compounds	USE:	Particle beam optics
<i>IoHT</i>		Ion radiation effects	
USE:	Internet of Medical Things	BT:	Radiation effects
		RT:	Ionizing radiation Proton radiation effects
Ion accelerators		Ion sources	
BT:	Particle accelerators	BT:	Ions Nuclear physics
RT:	Ion beam effects Ion beams Ion sources Ions Proton accelerators	RT:	Ion accelerators Ion beams Ion emission Plasma sources
Ion beam applications		<i>Ion trapping</i>	
BT:	Nuclear and plasma	USE:	Trapped ions
sciences		<i>Ionisation</i>	
RT:	Ion beams	USE:	Ionization
NT:	Ion implantation	<i>Ionisation chambers</i>	
Ion beam effects		USE:	Ionization chambers
BT:	Ion beams	<i>Ionising radiation</i>	
RT:	Aerospace safety Ion accelerators Ion emission	USE:	Ionizing radiation
Ion beams			
BT:	Particle beams		



JULY 2025 IEEE Thesaurus

Ionization

UF: Ionisation
Photoionisation
Photoionization
BT: Ions
RT: Discharges (electric)
Plasmas
Space radiation
NT: Impact ionization
Ionization chambers
Ionizing radiation
Single event transients
Single event upsets

Protons
Storage rings
NT: Ion sources
Ionization
Trapped ions

IOT

USE: Internet of Things

IOV

USE: Internet of Vehicles

IP

USE: IP networks

Ionization chambers

UF: Ionisation chambers
BT: Ionization
RT: Ionizing radiation
Smoke detectors

IP networks

UF: IP
IP-networks
Internet Protocol networks
BT: Communication systems
Computer networks
Telecommunications
RT: IPTV
Internet
Machine-to-machine

Ionized jet deposition

USE: Physical vapor deposition

Ionizing radiation

UF: Ionising radiation
BT: Ionization
RT: Ion radiation effects
Ionization chambers
Radiation hardening

communications

(electronics)

Silicon radiation detectors

Next generation networking
Quality of service
Transport protocols
TCP/IP
NT:

Ionizing radiation sensors

BT: Sensors
NT: Position sensitive particle
detectors
Radiation detectors
X-ray detectors

IP rights

USE: Intellectual property

IP telephony

USE: Internet telephony

IP-networks

USE: IP networks

Ionomeric polymer-metal composite actuators

USE: Actuators

IPFS

USE: InterPlanetary File System

Ionosphere

BT: Terrestrial atmosphere
RT: Meteorology
Plasmas

iPOD

USE: Portable media players

IPR

USE: Intellectual property

Ions

BT: Elementary particles
RT: Alpha particles
Elementary particle
exchange interactions
Ion accelerators
Ion beams
Ion emission

IPTV

UF: Internet protocol television
BT: Digital TV
RT: Broadband communication
Computer networks
IP networks



JULY 2025 IEEE Thesaurus

	Internet	<i>ISAC</i>	
	Local area networks	USE:	Integrated sensing and
	Protocols	communication	
	Streaming media		
<i>IR 5.0</i>		Ischemic pain	
USE:	Fifth Industrial Revolution	BT:	Pain
<i>IR Spectra</i>		ISDN	
USE:	Infrared spectra	UF:	Integrated services digital
IRE Standards		networks	
BT:	IEEE Standards	BT:	Communication systems
Iridium			Digital communication
BT:	Chemical elements		Digital systems
Iris			Asynchronous transfer
BT:	Eyes		
RT:	Ophthalmology		Data communication
Iris recognition			Frame relay
BT:	Biometrics		Image communication
<i>Irises</i>			Multimedia communication
USE:	Waveguide discontinuities	NT:	B-ISDN
Iron		<i>Ishikawa diagrams</i>	
UF:	Fe	USE:	Cause effect analysis
BT:	Metals	Islanding	
NT:	Cast iron	BT:	Power supplies
	Iron alloys	RT:	Electrical safety
	Iron oxide		Generators
Iron alloys		ISO	
BT:	Iron	UF:	International organization
RT:	Alloying	for standardization	
	Metallurgy	organization	International standards
NT:	Austenite	BT:	Standards organizations
Iron oxide		RT:	Communication standards
BT:	Iron		ISO Standards
<i>Irradiation</i>			Measurement standards
USE:	Radiation effects		Software standards
Irrigation			Standardization
BT:	Agriculture		Standards
RT:	Agricultural products		Moving Pictures Experts
	Crops	NT:	
	Hydraulic systems	Group	
	Water pumps	<i>ISO 9000</i>	
<i>Irtran 5</i>		USE:	Quality management
USE:	Magnesium oxide	ISO Standards	
		BT:	Standards publications
		RT:	ANSI Standards
			Communication standards
			ISO
			Quality management
			Software standards
			Standardization



JULY 2025 IEEE Thesaurus

NT:	X3D MPEG standards	NT:	Expectation-maximization algorithms
Isobaric processes			Iterative algorithms Iterative learning control
BT:	Thermodynamics	ITU	
Isolation technology		UF:	International Telecommunications Union
BT:	Insulation	BT:	Standards organizations
RT:	Vibration control	ITU Standards	
Isolators		BT:	Standards publications
BT:	Circuits	RT:	UHDTV
Isosurfaces		<i>J2EE</i>	
BT:	Data visualization	USE:	Java
RT:	Biomedical imaging Computational fluid dynamics	<i>Jacks</i>	
Isothermal processes		USE:	Lifting equipment
BT:	Thermodynamics	Jacobian matrices	
Isotopes		UF:	Jacobian matrix
BT:	Chemical elements Nuclear physics	BT:	Matrices
RT:	Radioactive materials	<i>Jacobian matrix</i>	
Itemsets		USE:	Jacobian matrices
BT:	Data analysis Transaction databases	<i>Jakarta EE</i>	
Iterative algorithms		USE:	Java
BT:	Iterative methods	Jamming	
NT:	Iterative closest point algorithm	BT:	Electronic warfare
	Sum product algorithm	RT:	Electronic countermeasures Radar clutter Radar countermeasures Radio communication
Iterative closest point algorithm		countermeasures	
UF:	ICP	Jaundice	
BT:	Iterative algorithms	UF:	Icterus
Iterative decoding		BT:	Medical conditions
BT:	Parity check codes	RT:	Liver diseases
Iterative learning control		Java	
BT:	Control theory Iterative methods	UF:	J2EE Jakarta EE
RT:	Adaptive control Learning systems Tracking	BT:	High level languages
Iterative methods		RT:	Webassembly
BT:	Mathematics Numerical analysis	Jellyfish	
RT:	Belief propagation	UF:	Sea jellies
		BT:	Marine animals



JULY 2025 IEEE Thesaurus

Jet engines

BT: Engines
RT: Aircraft propulsion
Exhaust gases
Fans

JFET circuits

BT: FET circuits
NT: JFET integrated circuits

JFET integrated circuit technology

USE: JFET integrated circuits

JFET integrated circuits

UF: JFET integrated circuit
technology
BT: JFET circuits
RT: JFETs

JFETs

UF: Junction FETs
BT: Field effect transistors
RT: JFET integrated circuits

Jigs

USE: Fixtures

Jitter

BT: Distortion
RT: Circuit stability
Quality of transmission
Ring oscillators
NT: Timing jitter

Job design

BT: Ergonomics

Job production systems

UF: Bespoke production
BT: Manufacturing systems

Job rotation

USE: Multiskilling

Job shop scheduling

BT: Scheduling
RT: Genetic algorithms

Job specification

BT: Human resource
management
RT: Multiskilling
Recruitment

Jobs listings

BT: Career development
RT: Employment

Johnson Nyquist noise

USE: Thermal noise

Joining materials

BT: Production materials
RT: Joining processes
Soldering equipment
NT: Filler metals
Sealing materials

Joining processes

UF: Connecting
Coupling (process)
Fastening
Linking
BT: Manufacturing systems
Materials processing
RT: Couplings
Fasteners
Joining materials
Plasma welding
Soldering equipment
NT: Bonding processes
Crimping
Soldering
Splicing
Welding

Joint ventures

USE: International collaboration

Joints

BT: Skeleton
NT: Ankle

Josephson devices

USE: Superconducting devices

Josephson effect

BT: Tunneling
RT: Josephson junctions

Josephson junctions

UF: Josephson logic
Superconducting junction
devices
BT: Superconducting devices
RT: Josephson effect

Josephson logic

USE: Josephson junctions



JULY 2025 IEEE Thesaurus

Journalism

BT: Publishing
RT: Broadcasting
Electronic publishing
Humanities
Information services
Multimedia communication
Radio broadcasting
Social networking (online)

JPEG

USE: Transform coding

JPEG2000

USE: Transform coding

Judd-Ofelt theory

BT: Spectral analysis
RT: Fluorescence
Photoluminescence

Junction detectors

USE: Semiconductor counters

Junction FETs

USE: JFETs

Junction lasers

USE: Semiconductor lasers

Junctionless nanowire transistors

BT: MOSFET
Nanoelectronics
RT: Nanowires
Silicon-on-insulator

Junctions

BT: Semiconductor devices
NT: Heterojunctions
Hybrid junctions
P-n junctions
Waveguide junctions

Junk e-mail

USE: Unsolicited e-mail

Junk email

USE: Unsolicited e-mail

Jupiter

BT: Planets

k neighbor methods

USE: Nearest neighbor methods

k neighbour methods

USE: Nearest neighbor methods

K-armed bandit problem

USE: Multi-armed bandit problem

K-band

BT: Microwave bands

K-nearest neighbor

USE: Nearest neighbor methods

K-NN methods

USE: Nearest neighbor methods

Ka band

USE: Ka-band

Ka-band

UF: Ka band
BT: Microwave bands

Kaizen

USE: Continuous improvement

Kalman filtering

USE: Kalman filters

Kalman filters

UF: Kalman filtering
BT: Filters
RT: Estimation
Nonlinear dynamical

systems

Prediction methods
Sensor fusion
Soft sensors

Kaons

USE: Mesons

Karhunen-Loeve transforms

BT: Transforms

KBO

USE: Kuiper belt

Kelvin

BT: Temperature measurement

Kernel

BT: Mathematics
Operating systems
NT: Null space
System kernels



JULY 2025 IEEE Thesaurus

Kernel machines

BT: Machine learning
algorithms
RT: Pattern analysis
Support vector machines

RT: Calcination
Curing
Firing
Heat treatment

Kerr effect

BT: Electro-optic effects
RT: Cross-phase modulation
Magnetooptic effects

Kindle

USE: Consumer electronics AND
Electronic publishing

Key performance indicator

UF: KPI
BT: Measurement
Performance evaluation

Kinematic analysis

USE: Kinematics

Kinematic faults

USE: Kinematics

Kinematic model

USE: Kinematics

Kinematic noise

USE: Kinematics

Keyboards

BT: Computer peripherals
RT: Ergonomics

Keystroke dynamics

BT: Biometrics

Kinematics

UF: Kinematic analysis
Kinematic faults
Kinematic model
Kinematic noise
BT: Mechanical factors
RT: Medical robotics
NT: Motion capture
Motor coordination

Keyways

BT: Plugs

Keyword search

UF: Keyword searches
Keyword searching
BT: Search methods
RT: Indexing

Kinetic energy

BT: Kinetic theory
RT: Mechanical energy
Potential energy
Thermal energy

Keyword searches

USE: Keyword search

Keyword searching

USE: Keyword search

Kinetic molecular theory

USE: Kinetic theory

Kidney

BT: Urogenital system
RT: Nephrology
NT: Chronic kidney disease
Kidney stones

Kinetic theory

UF: Collision theory
Kinetic molecular theory
Kinetic-molecular theory
Kinetics
BT: Motion control
Physics
NT: Kinetic energy

Kidney stones

UF: Nephrolithiasis
Renal calculi
Urinary calculosis
BT: Kidney
Medical conditions
RT: Lithotripsy
Nephrology

Kinetic-molecular theory

USE: Kinetic theory

Kinetics

USE: Kinetic theory

Kilns

BT: Furnaces



JULY 2025 IEEE Thesaurus

Kirchhoff approximation

USE: Kirchhoff's Law

Kirchhoff current law

USE: Kirchhoff's Law

Kirchhoff law

USE: Kirchhoff's Law

Kirchhoff scattering

USE: Kirchhoff's Law

Kirchhoff's Law

UF: Kirchhoff approximation
Kirchhoff current law
Kirchhoff law
Kirchhoff scattering
BT: Spectroscopy

Kirk effect

USE: Kirk field collapse effect

Kirk field collapse effect

UF: Kirk effect
BT: Bipolar transistors

Klystrons

UF: Gyroklystrons
BT: Electron tubes
RT: Amplifiers
Cavity resonators
Colliding beam accelerators
Oscillators
Relativistic effects
Ring oscillators

Knee

BT: Extremities

Knee arthroplasty

USE: Knee replacement

Knee joint replacements

USE: Prosthetics

Knee replacement

UF: Knee arthroplasty
BT: Prosthetics

Knitted fabric composites

USE: Fabrics

KNN methods

USE: Nearest neighbor methods

Knowledge acquisition

BT: Knowledge engineering
RT: Context awareness
Econophysics
Expert systems
Knowledge based systems
Self-organizing feature
maps
NT: Subject matter experts

Knowledge based systems

UF: Knowledge systems
Knowledge-based systems
Rule based systems
BT: Artificial intelligence
RT: Decision support systems
Deductive databases
Intelligent systems
Knowledge acquisition
Knowledge representation
Linked data
Software agents
NT: Expert systems
Mobile agents

Knowledge discovery

BT: Knowledge engineering
RT: Data mining
Data science
Information retrieval
Knowledge management
NSL-KDD
Subject matter experts

Knowledge engineering

BT: Artificial intelligence
RT: Knowledge management
NT: Inference mechanisms
Knowledge acquisition
Knowledge discovery
Knowledge representation

Knowledge graphs

BT: Knowledge representation

Knowledge management

UF: Intellectual capital
BT: Computer applications
Management
RT: Competitive intelligence
Information management
Knowledge discovery
Knowledge engineering
Management information

systems



JULY 2025 IEEE Thesaurus

NT:	Semantic Web Knowledge transfer	BT:	Microwave bands
Knowledge representation		Kuiper belt	
BT:	Knowledge engineering	UF:	KBO Kuiper belt objects Kuiper belts
RT:	Answer set programming Expert systems Formal concept analysis Graph drawing Knowledge based systems Lexicon Linked data OWL	BT:	Solar system
NT:	Description logic Fuzzy cognitive maps Knowledge graphs Ontologies Thesauri	<i>Kuiper belt objects</i>	
		USE:	Kuiper belt
		<i>Kuiper belts</i>	
		USE:	Kuiper belt
<i>Knowledge systems</i>		Kurtosis	
USE:	Knowledge based systems	BT:	Probability distribution
Knowledge transfer		RT:	Heavily-tailed distribution
BT:	Information management Knowledge management	L-band	
RT:	Information diffusion	BT:	Microwave bands
<i>Knowledge-based systems</i>		Lab-on-a-chip	
USE:	Knowledge based systems	UF:	Lab-on-chip
<i>Kohonen maps</i>		BT:	System-on-chip
USE:	Self-organizing feature	<i>Lab-on-chip</i>	
maps		USE:	Lab-on-a-chip
<i>KPI</i>		<i>Label swapping</i>	
USE:	Key performance indicator	USE:	Multiprotocol label switching
Krill herd algorithm		Labeling	
UF:	Krill Herd optimization	UF:	Labelling
algorithm		BT:	Packaging
BT:	Algorithms Optimization	RT:	Applicators Packaging machines
RT:	Particle swarm optimization	<i>Labelling</i>	
<i>Krill Herd optimization algorithm</i>		USE:	Labeling
USE:	Krill herd algorithm	<i>Labor productivity</i>	
Krypton		USE:	Productivity
BT:	Chemical elements	Labor resources	
<i>Ku band</i>		UF:	Labor supply Labour resources Labour supply Manpower planning Human resource
USE:	Ku-band	BT:	Human resource
Ku-band		management	
UF:	Ku band	RT:	Personnel Equal opportunities Recruitment



JULY 2025 IEEE Thesaurus

Labor supply

USE: Labor resources

Laboratories

BT: Test facilities
RT: Engineering education
Research and development
Student experiments
NT: Remote laboratories

Labour productivity

USE: Productivity

Labour resources

USE: Labor resources

Labour supply

USE: Labor resources

Lacquers

BT: Chemical products
Coatings
Materials
RT: Paints

Lagrange duality

USE: Lagrangian functions

Lagrange functions

USE: Lagrangian functions

Lagrange relaxation

USE: Lagrangian functions

Lagrangian functions

UF: Lagrange duality
Lagrange functions
Lagrange relaxation
BT: Optimization methods
RT: Quantum mechanics

Lakes

BT: Geoscience
RT: Aquatic ecosystems
Reservoirs
Rivers
Sediments
Water
Water pollution
Water resources
Water storage
Wetlands

Laminates

BT: Materials

RT: Lamination

Lamination

BT: Materials processing
RT: Laminates

Lamps

BT: Lighting
RT: Light sources
Lighting control
Ultraviolet sources
NT: Discharge lamps
Electrodeless lamps
Filament lamps
Fluorescent lamps
LED lamps

LAN

USE: Local area networks

LAN emulation

UF: Local area network
emulation
BT: Optical fiber networks

LAN interconnection

BT: Internetworking
RT: Computer networks
Local area networks
Metropolitan area networks
Wide area networks
Wireless LAN

Land cover

USE: Land surface

Land development

USE: Land use planning

Land impacts

USE: Land use planning

Land mine detection

USE: Landmine detection

Land mines

USE: Landmine detection

Land mobile radio

UF: Land mobile radio service
Land-mobile radio
Mobile radio
BT: Mobile communication
Radio communication
RT: 5G mobile communication



JULY 2025 IEEE Thesaurus

equipment	NT:	Ad hoc networks	sensing	BT:	Geoscience and remote
		Bluetooth		RT:	Global warming
		Channel estimation			Land surface
		Indoor navigation			Ocean temperature
		Land mobile radio			Remote sensing
		Location awareness			
		Mobile antennas			
		Mobile handsets			
		Multiuser detection			
		Personal area networks			
Land mobile radio equipment	NT:	Radio access networks	Land use management	USE:	Land surface temperature
		Routing protocols			
		Software radio			
		Cellular radio			
Land mobile radio equipment	NT:	Cellular radio	Land use planning		
Land mobile radio networks	NT:	Cellular technology	Land use management		
Land mobile radio service	USE:	Land mobile radio	Land vehicles		
Land pollution	NT:	Pollution	Land-mobile radio	USE:	Land mobile radio
		Industrial pollution			
		Land use planning			
		Oil pollution			
		Pesticides			
		Radioactive pollution			
		Soil pollution			
Land surface	NT:	Land cover	Land-mobile radio cellular systems	USE:	Cellular radio
		Geoscience			
		Land surface temperature			
		Watersheds			
Land surface temperature	UF:	Ground temperature	Land-mobile radio equipment	USE:	Land mobile radio
		Land temperature			



JULY 2025 IEEE Thesaurus

Landfills	RT: Minimally invasive surgery
BT: Waste disposal	
Landline	<i>Laparoscopic surgery</i>
UF: Home phone	USE: Minimally invasive surgery
Landline telephone	
Main line	
POTS	
BT: Telephone equipment	Laplace equations
	UF: Inverse transforms
	Laplace operator
	Laplace transform
	Laplacian
<i>Landline telephone</i>	BT: Mathematics
USE: Landline	
Landmine detection	<i>Laplace operator</i>
UF: Land mine detection	USE: Laplace equations
Land mines	
Landmines	<i>Laplace transform</i>
BT: Buried object detection	USE: Laplace equations
RT: Military equipment	
Radar imaging	<i>Laplacian</i>
Remote sensing	USE: Laplace equations
<i>Landmines</i>	Lapping
USE: Landmine detection	BT: Machining
	RT: Surface finishing
Landsat	<i>Laptops</i>
BT: Earth Observing System	USE: Microcomputers AND
RT: NASA	Portable computers
Landslides	<i>Large AI models</i>
BT: Geology	USE: Foundation models
RT: Hazards	
Lane departure warning systems	Large Hadron Collider
BT: Road safety	UF: LHC
Vehicle safety	BT: Test facilities
RT: Collision avoidance	RT: Particle accelerators
Lane detection	
Lane detection	Large language models
BT: Vehicle safety	UF: LLM
RT: Collision avoidance	BT: Artificial intelligence
Lane departure warning	Text recognition
systems	RT: Artificial neural networks
Road safety	Deep learning
	Neural networks
	Prompt engineering
	Recurrent neural networks
	Self-supervised learning
	Semisupervised learning
Lanthanum	NT: Generative Pre-trainer
BT: Metals	transformer
NT: Lanthanum compounds	
Lanthanum compounds	Large scale integration
BT: Lanthanum	UF: LSI
Laparoscopes	Large-scale integration
BT: Surgical instruments	BT: Circuits



JULY 2025 IEEE Thesaurus

NT:	Integrated circuits Ultra large scale integration Very large scale integration Wafer scale integration	RT:	Machining Laser beam cutting
Large screen displays		Laser beams	
UF:	Large-screen displays	UF:	Laser guide stars
BT:	TV equipment	BT:	Beams
		RT:	Bragg gratings Electro-absorption
<i>Large-scale integration</i>		modulators	
USE:	Large scale integration		Electro-optic modulators Laser theory Lasers Optical beams Optical vortices Refractive index Supercontinuum generation Thermal lensing
Large-scale systems		NT:	Laser cooling Laser pulses
BT:	System analysis and design		
RT:	Complex systems Fuzzy systems		
<i>Large-screen displays</i>			
USE:	Large screen displays		
Larynx		Laser cavity resonators	
UF:	Voice tract	BT:	Cavity resonators
BT:	Respiratory system	RT:	Optical resonators Surface emitting lasers
Laser ablation		Laser cladding	
BT:	Laser applications	BT:	Claddings
Laser applications		RT:	Pulsed laser deposition
BT:	Lasers	Laser cooling	
RT:	CD recording Endoscopes Gyroscopes Heating systems Holography Measurement by laser	BT:	Cooling Laser beams
beam		RT:	Trapped ions Ultracold atoms
	Optical recording Photoacoustic effects Stereolithography	<i>Laser deposition</i>	
NT:	Dark states Distributed feedback	USE:	Pulsed laser deposition
devices		<i>Laser diodes</i>	
	Laser ablation Laser beam cutting Laser beam machining Laser fusion Laser theory Magnetooptic recording	USE:	Diode lasers AND Semiconductor lasers
Laser beam cutting		Laser excitation	
BT:	Laser applications	UF:	Electron beam pumping Excitation of lasers Pumping of lasers
RT:	Laser beam machining	BT:	Lasers
Laser beam machining		NT:	Optical pumping
BT:	Laser applications	Laser feedback	
		BT:	Laser noise
		Laser fusion	
		BT:	Laser applications



JULY 2025 IEEE Thesaurus

Laser guide stars

USE: Laser beams

Laser materials processing

BT: Materials processing

Laser mode locking

BT: Laser modes

Laser modes

BT: Lasers

NT: Laser mode locking

Laser noise

BT: Noise
Optical signal processing

RT: Lasers and electrooptics

NT: Laser feedback

Laser physics

USE: Laser theory

Laser printers

BT: Printers

Laser pulses

UF: Laser pulsing

Pulsed lasers

BT: Laser beams

RT: High-speed optical

techniques

Lasers

Laser pulsing

USE: Laser pulses

Laser radar

UF: Lidar

Optical radar

BT: Radar

RT: Geophysical measurement

techniques

Optical scattering

Laser science

USE: Laser theory

Laser sintering

UF: Selective laser sintering

BT: Materials preparation

RT: Design automation

Prototypes

Stereolithography

Laser stability

BT: Lasers

RT: Stability analysis

Laser surgery

BT: Surgery

Laser theory

UF: Laser physics

Laser science

BT: Laser applications

RT: Laser beams

Lasers

Optical beams

Optical design

Optics

Particle beams

Quantum mechanics

Laser transitions

BT: Lasers

Laser tuning

BT: Semiconductor lasers

Tuning

RT: Optical tuning

Laser velocimetry

BT: Measurement by laser

beam

Lasers

UF: Infrared lasers

BT: Lasers and electrooptics

RT: Laser beams

Laser pulses

Laser theory

Light sources

Nanobiophotonics

Optical distortion

Oscillators

Stereolithography

Stimulated emission

Superluminescent diodes

Threshold current

Ultraviolet sources

Waveguide lasers

NT: Atom lasers

Chemical lasers

Diode lasers

Free electron lasers

Gas lasers

Laser applications

Laser excitation

Laser modes



JULY 2025 IEEE Thesaurus

Laser stability
Laser transitions
Power lasers
Pump lasers
Quantum well lasers
Ring lasers
Semiconductor lasers
Solid lasers
Surface emitting lasers
X-ray lasers

Consumer protection
Contract law
Criminal law
Employment law
Forensics
Fraud
Law enforcement
Patent law
Trademarks

Lasers and electrooptics

RT: Erbium
Laser noise
NT: Electro-optic devices
Electro-optic effects
Lasers
Optics
Optoelectronic devices
Photonics

Latches

BT: Bistable circuits

Lattice Boltzmann

USE: Lattice Boltzmann methods

Lattice Boltzmann methods

UF: Lattice Boltzmann
BT: Boltzmann distribution
Lattices
RT: Fluid dynamics

Lattices

UF: Optical lattices
BT: Mathematics
NT: Lattice Boltzmann methods

Launching (electromagnetic)

USE: Electromagnetic launching

Launching (electrothermal)

USE: Electrothermal launching

Lava

BT: Rocks
Volcanoes
RT: Magma
Volcanic ash

Law

UF: Legal aspects
BT: Legal factors
NT: Censorship
Commercial law

Law enforcement

UF: Police
BT: Law
RT: Censorship
Digital forensics
Image forensics
Legal factors
Threat assessment

Layered division multiplexing

UF: LDM
Layered-division-multiplexing
BT: Multiplexing
RT: Frequency division
multiplexing

Layered manufacturing

BT: Manufacturing systems
RT: Computational geometry
Stereolithography

Layered media

USE: Nonhomogeneous media

Layered-division-multiplexing

USE: Layered division
multiplexing

Layout

BT: Graphics
RT: Art
Geometry
Integrated circuit layout
Wiring

LCA

USE: Life cycle assessment

LCD

USE: Liquid crystal displays

LCDs

USE: Liquid crystal displays



JULY 2025 IEEE Thesaurus

LCOE

USE: Levelized cost of energy

Lcos

USE: Liquid crystal on silicon

LDM

USE: Layered division multiplexing

LDPA

USE: Log-periodic dipole antennas

LDPC

USE: Parity check codes

Ldpc codes

USE: Parity check codes

Leaching

BT: Chemical processes

Lead

UF: Pb
BT: Metals
RT: Graphite
Lead compounds
NT: Lead isotopes

Lead acid batteries

UF: Lead-acid batteries
BT: Batteries

Lead compounds

BT: Compounds
RT: Lead

Lead isotopes

BT: Lead

Lead time reduction

BT: Production management
RT: Production planning
Project management

Lead zirconate titanate

UF: Lead zirconium titanate
PZT
BT: Ferroelectric materials
Piezoelectric materials

Lead zirconium titanate

USE: Lead zirconate titanate

Lead-acid batteries

USE: Lead acid batteries

Leadership

BT: Human resource management
RT: Business
Government
Organizations

Leak detection

BT: Sensor systems and applications
RT: Packaging
Testing
Vacuum systems

Leakage currents

UF: Gate leakage current
BT: Current
RT: Electron traps
Fault currents
NT: Gate leakage

Leaky wave antennas

UF: Leaky-wave antennas
BT: Antennas

Leaky-wave antennas

USE: Leaky wave antennas

Lean production

BT: Manufacturing systems
Production systems
RT: Production management

Learning (artificial intelligence)

BT: Artificial intelligence
RT: AI accelerators
Conditional random fields
Data augmentation
Electronic learning
Fuzzy cognitive maps
Gaussian processes
Human activity recognition
Image annotation
Logistic regression
Manifold learning
Soft sensors
NT: Distance learning
Naive Bayes methods
Nearest neighbor methods



JULY 2025 IEEE Thesaurus

Learning automata

UF: Learning automaton
BT: Learning systems

Learning automaton

USE: Learning automata

Learning management systems

BT: Computer aided instruction
Learning systems
RT: Computer applications
Electronic learning
Management
Training

Learning mechanisms

USE: Learning systems

Learning methods

USE: Learning systems

Learning systems

UF: Learning mechanisms
Learning methods
Learning-based method
BT: Artificial intelligence
RT: Adaptive systems
Context awareness
Cybernetics
Deep learning
Dyslexia
Inference mechanisms
Iterative learning control
Mobile agents
Pattern recognition
Software agents
White matter
NT: Active learning
Backpropagation
Cognitive systems
Collective learning
Electronic learning
Hybrid learning
Immersive learning
Learning automata
Learning management

systems

Self-supervised learning
Semisupervised learning
Stability plasticity
Supervised learning
Unsupervised learning
Weak supervision

Learning-based method

USE: Learning systems

Least mean squares methods

BT: Least squares
approximations
Mean square error methods

Least squares approximations

UF: Least-squares
approximations
BT: Numerical analysis
RT: Approximation methods
Curve fitting
Mean square error methods
Optimization
Recursive estimation
NT: Least mean squares
methods

Least-squares approximations

USE: Least squares
approximations

LED

USE: Light emitting diodes

LED lamps

UF: AC light emitting diode
lamps
AC-LED lamps
Light emitting diode lamps
BT: Lamps
Light emitting diodes
RT: Light sources

LEDs

USE: Light emitting diodes

Left handed materials

USE: Metamaterials

Left-handed materials

USE: Metamaterials

Legal aspects

USE: Law

Legal factors

BT: Engineering management
RT: Censorship
Ethical aspects
Governmental factors
IEEE Corporate activities
Law enforcement



JULY 2025 IEEE Thesaurus

NT: Copyright protection
Law
Patents
Product liability
Software protection
Trademarks

Legged locomotion

UF: Biped locomotion
Gait assessment
Gait control
Gait disorders
Walking
BT: Mobile robots
RT: Biological control systems
Control systems
Motion control
Pedestrians
Stairs

Legislation

BT: Government
NT: General Data Protection

Regulation

Legs

BT: Limbs
RT: Ankle

Length measurement

BT: Measurement
RT: Micrometers
Size measurement

Lens

USE: Lenses

Lenses

UF: Lens
BT: Optical devices
RT: Focusing
Optical materials

LEO

USE: Low earth orbit satellites

Lesions

BT: Tumors
NT: Tissue damage

Leukemia

BT: Cancer
RT: Blood
White blood cells

Levee

UF: Dike
Levee system
BT: Geoscience

Levee system

USE: Levee

Level control

UF: Liquid level control
BT: Mechanical variables

control

NT: Gyroscopes

Level measurement

UF: Liquid level measurement
BT: Geodesy

Level set

BT: Calculus
RT: Gradient methods

Levelized cost of electricity

USE: Levelized cost of energy

Levelized cost of energy

UF: LCOE
Levelized Energy Cost
Levelized cost of electricity
BT: Power system
measurements
RT: Costs
Power generation

Levelized Energy Cost

USE: Levelized cost of energy

Levels, energy

USE: Energy states

Levitation

BT: Physics
NT: Electrostatic levitation
Magnetic levitation

Lexicon

BT: Natural languages
RT: Knowledge representation
NT: Vocabulary

LF noise

USE: Low frequency noise

LHC

USE: Large Hadron Collider



JULY 2025 IEEE Thesaurus

Li

USE: Lithium

li-fi

USE: Light fidelity

Li-ion batteries

USE: Lithium-ion batteries

Li-S batteries

USE: Lithium-sulfur batteries

Libraries

BT: Information services

NT: Software libraries

License plate detection

USE: License plate recognition

License plate recognition

UF: ANPR

Automatic number plate

recognition

Automatic-number plate

recognition

Car plate recognition

LPD

LPR

License plate detection

Number plate recognition

VLPR

Vehicle license plate

recognition

Vehicle plate detection

BT: Optical character

recognition

Vehicle detection

RT: Character recognition

Feature extraction

Image edge detection

Image recognition

Licenses

UF: Licensing

BT: Contracts

RT: Must-carry regulations

Licensing

USE: Licenses

Licensing (nuclear facilities)

USE: Nuclear facility regulation

Lidar

USE: Laser radar

Lie groups

BT: Mathematics

RT: Algebra

Geometry

Life cycle analysis

USE: Life cycle assessment

Life cycle assessment

UF: LCA

Life cycle analysis

BT: Environmental factors

Product lifecycle

management

Life estimation

UF: Accelerated testing

BT: Estimation

RT: Aging

Failure analysis

Fatigue

Insulation life

Life long learning

USE: Continuing professional development

Life sciences

UF: Computational life sciences

BT: Science - general

RT: Animals

Biology

Plants (biology)

Life sciences computing

USE: Computational modeling

Life testing

BT: Testing

RT: Reliability

Lifetime estimation

UF: Lifetime management

Lifetime measurement

Lifetime tests

BT: Measurement

Lifetime management

USE: Lifetime estimation

Lifetime measurement

USE: Lifetime estimation

Lifetime tests

USE: Lifetime estimation



JULY 2025 IEEE Thesaurus

<i>lifi</i>	USE:	Light fidelity	Optical fiber networks Radio frequency Visible light communication Wireless communication Wireless fidelity
Lifting equipment	UF:	Hoists Jacks	
	BT:	Materials handling	Light fields
equipment	RT:	Freight handling Materials handling Pulleys Winches	BT: Optics
	NT:	Cranes	<i>Light interferometry</i>
Ligaments			USE: Optical interferometry
	BT:	Musculoskeletal system	<i>Light polarisation</i>
<i>Light attenuation</i>			USE: Optical polarization
USE:	Attenuation		<i>Light polarization</i>
Light deflectors			USE: Optical polarization
	BT:	Optical devices	<i>Light pollution</i>
<i>Light emitters</i>			USE: Artificial light
USE:	Light emitting diodes		Light rail systems
<i>Light emitting diode lamps</i>			UF: Light railways Streetcars
USE:	LED lamps		BT: Rail transportation RT: Public transportation
Light emitting diodes			<i>Light railways</i>
UF:	LED LEDs Light emitters Light-emitting diodes		USE: Light rail systems
	BT:	Diodes Optoelectronic devices	Light scattering
	RT:	Microcavities Molecular beam	BT: Scattering RT: Optical scattering Resonance light scattering Turbidity
applications		P-n junctions Visible light communication	Light sources
	NT:	Inorganic light emitting	BT: Optics RT: Arc discharges Color gamut High intensity discharge
diodes		LED lamps Organic light emitting	lamps
		Superluminescent diodes	LED lamps Lamps Lasers Lighting Lighting control Photometry Supercontinuum generation Synchrotron radiation
Light fidelity			NT: Electroluminescent devices Fast light Luminescent devices Phosphors Slow light
UF:	li-fi lifi		
	BT:	Wireless LAN	
	RT:	High-speed optical	
techniques		IEEE 802.15 Standard	



JULY 2025 IEEE Thesaurus

	Stray light		Lightly-tailed distribution
	Superluminescent diodes	UF:	Light tailed distribution
	Ultraviolet sources		Light-tailed distribution
<i>Light tailed distribution</i>		BT:	Lightly tailed distribution
USE:	Lightly-tailed distribution		Probability distribution
Light trapping		Lightning	
UF:	Plasmonic solar cells	BT:	Meteorology
BT:	Photovoltaic cells	RT:	Dielectric breakdown
RT:	Reflectivity		Electrostatic processes
			Storms
<i>Light-emitting diodes</i>		NT:	Lightning protection
USE:	Light emitting diodes	Lightning protection	
<i>Light-tailed distribution</i>		BT:	Lightning
USE:	Lightly-tailed distribution		Protection
Lighting		Lightweight structures	
UF:	Arc lamps	BT:	Structural shapes
	Illumination	RT:	Aerospace engineering
BT:	Optical devices		Aerospace industry
RT:	Building services		Aerospace materials
	Buildings		Honeycomb structures
	Filament lamps		Metal foam
	Fluorescent lamps		Sandwich structures
	Gas discharge devices		Thin wall structures
	High intensity discharge	Limbic system	
lamps		BT:	Brain
	Light sources	Limbs	
	Lighting control	BT:	Extremities
	Photometry	RT:	Artificial limbs
	Quantum radar	NT:	Arms
	Visible light communication		Hands
NT:	Artificial light		Legs
	Daylighting	<i>Limit cycle</i>	
	Electrical ballasts	USE:	Limit-cycles
	Emergency lighting	<i>Limit-cycle</i>	
	Lamps	USE:	Limit-cycles
	Lumen	Limit-cycles	
	Smart lighting	UF:	Limit cycle
	Solid state lighting		Limit-cycle
Lighting control		BT:	Mathematics
UF:	Illumination control	Limiting	
BT:	Optical control	BT:	Signal processing
RT:	High intensity discharge	RT:	Nonlinear distortion
lamps			Voltage control
	Lamps	<i>Linac</i>	
	Light sources	USE:	Linear particle accelerator
	Lighting		
<i>Lightly tailed distribution</i>			
USE:	Lightly-tailed distribution		



JULY 2025 IEEE Thesaurus

LINACS

USE: Linear accelerators

Line enhancers

BT: Adaptive systems

RT: Digital filters
Filtering theory

Line output transformer

USE: Flyback transformers

Line-of-sight propagation

BT: Electromagnetic radiation

Linear accelerators

UF: LINACS

BT: Particle accelerators

RT: Collimators

Linear algebra

UF: Linear systems (algebraic)

BT: Algebra

RT: Eigenvalues and

eigenfunctions

NT: Linear programming

Matrices

Vectors

Linear antenna arrays

BT: Antenna arrays

Linear approximation

BT: Approximation methods

RT: Nonlinear equations

Nonlinear systems

Linear circuits

BT: Circuits

RT: Ohmic contacts

Linear codes

BT: Block codes

RT: Error correction

NT: Polar codes

Linear discriminant analysis

UF: Linear discriminant

classification

BT: Statistics

RT: Machine learning

Linear discriminant classification

USE: Linear discriminant analysis

Linear feedback control systems

BT: Control systems

Cybernetics

RT: Linear systems

NT: Frequency locked loops

Phase locked loops

State feedback

Tracking loops

Linear feedback shift registers

BT: Shift registers

Linear filtering

USE: Maximum likelihood

detection

Linear frequency modulation

USE: Chirp modulation

Linear integrated circuits

USE: Analog integrated circuits

Linear matrix inequalities

BT: Mathematics

RT: Linear systems

Uncertain systems

Linear parameter varying systems

USE: Linear systems

Linear particle accelerator

UF: Linac

Particle accelerator

BT: High energy physics

instrumentation computing

Linear predictive coding

BT: Prediction methods

Linear programming

UF: Linear-programming

BT: Linear algebra

RT: Algorithms

Microeconomics

Operations research

Optimization methods

NT: Data envelopment analysis

Integer programming

Linear regression

BT: Regression analysis

NT: Maximum likelihood linear

regression



JULY 2025 IEEE Thesaurus

Linear systems

UF: Linear parameter varying
systems
BT: Mathematics
RT: Control systems
Linear feedback control
systems
Linear matrix inequalities
Principal component
analysis
Time invariant systems
Transfer functions
NT: Sparse approximation

Linear systems (algebraic)

USE: Linear algebra

Linear-programming

USE: Linear programming

Linearisation techniques

USE: Linearization techniques

Linearity

BT: Electromagnetic
measurements

Linearization techniques

UF: Linearisation techniques
BT: Mathematics
RT: Control system synthesis
Control systems
MOSFET circuits
Modulation
Operational amplifiers
Transmitters

Linguistic indexing

USE: Image annotation

Linguistics

BT: Natural languages
RT: Anthropology
Cultural competence
Semiotics
Translation
NT: Multilingual
Phonetics
Pragmatics

Link aggregation

BT: Telecommunication
network topology

Linkages

USE: Couplings

Linked data

BT: Internet
RT: Big Data
Database systems
Knowledge based systems
Knowledge representation
Metadata
NoSQL databases
Ontologies
Open data
Query processing
Semantic Web

Linkedin

USE: Social networking (online)

Linking

USE: Joining processes

Linux

BT: High level languages

Lipid bilayers

USE: Lipidomics

Lipidomics

UF: Lipid bilayers
Lipids
BT: Molecular biomarkers
RT: Fats

Lipids

USE: Lipidomics

Lips

BT: Head
RT: Stomatognathic system

Liquefied natural gas

UF: LNG
BT: Natural gas

Liquid cooling

BT: Cooling
NT: Indirect liquid cooling

Liquid crystal devices

UF: Liquid-crystal devices
BT: Displays
RT: Electro-optic devices
Liquid crystals
Microdisplays



JULY 2025 IEEE Thesaurus

Thin film transistors
NT: Liquid crystal displays
Liquid crystal on silicon

Liquid crystal displays

UF: LCD
LCDs
Liquid-crystal displays
BT: Liquid crystal devices
NT: Active matrix liquid crystal

displays

Liquid crystal on silicon

UF: Lcos
BT: Liquid crystal devices
RT: Integrated optoelectronics
Microdisplays

Liquid crystal polymers

UF: Liquid-crystal polymers
BT: Polymers

Liquid crystals

BT: Crystals
RT: Liquid crystal devices

Liquid flow

USE: Fluid flow

Liquid insulation

USE: Dielectric liquids

Liquid level control

USE: Level control

Liquid level measurement

USE: Level measurement

Liquid nitrogen

BT: Cryogenics
Refrigerants

Liquid waveguides

BT: Hollow waveguides

Liquid-crystal devices

USE: Liquid crystal devices

Liquid-crystal displays

USE: Liquid crystal displays

Liquid-crystal polymers

USE: Liquid crystal polymers

Liquids

BT: Fluids
RT: Aerosols
Electrohydraulics
Materials science and

technology

NT: Spraying
Evaporation
Water

LiquiFerrofluid

USE: Ferrofluid

Literature review

USE: Systematic literature review

Lithium

UF: Li
BT: Metals
RT: Alloying
Batteries
NT: Lithium compounds

Lithium batteries

BT: Batteries
Lithium compounds

Lithium compounds

BT: Lithium
RT: Alloying
Batteries
NT: Lithium batteries
Lithium niobate

Lithium ion batteries

USE: Lithium-ion batteries

Lithium niobate

BT: Lithium compounds

Lithium-ion batteries

UF: Li-ion batteries
Lithium ion batteries
BT: Batteries

Lithium-sulfur batteries

UF: Li-S batteries
BT: Batteries

Lithography

UF: Photolithography
BT: Manufacturing
RT: Nanotechnology
Printing
Proximity effects



JULY 2025 IEEE Thesaurus

NT: Colloidal lithography
Extreme ultraviolet
lithography
Interferometric lithography
Nanolithography
Soft lithography
Stereolithography
X-ray lithography

Lithotripsy

BT: Medical treatment
RT: Kidney stones
Lithotriptors

Lithotriptors

BT: Biomedical equipment
RT: Lithotripsy

Livelihood

BT: Employment
Human factors
Social factors

Liver

BT: Digestive system
NT: Liver diseases

Liver cancer

BT: Cancer

Liver diseases

BT: Liver
RT: Jaundice

Liver neoplasms

BT: Neoplasms

Livestock

BT: Animals
RT: Agriculture

LLM

USE: Large language models

LNG

USE: Liquefied natural gas

Load balancing

USE: Load management

Load compensation

USE: Load management

Load composition

USE: Load management

Load flow

UF: Power flow
BT: Power system management
NT: Load flow analysis

Load flow analysis

UF: Power flow analysis
BT: Load flow
RT: Power system security
Power transmission

Load flow control

UF: Power flow control
BT: Power system control
NT: Power factor correction

Load forecasting

BT: Power demand
RT: Load management
Load monitoring

Load management

UF: Load balancing
Load compensation
Load composition
Load variations
BT: Energy management
RT: Energy storage
Load forecasting
Pallets
Power demand
Vehicle-to-grid
NT: Load monitoring
Load shedding

Load modeling

BT: Modeling
Power system modeling
RT: Power demand

Load monitoring

BT: Load management
Monitoring
RT: Energy consumption
Load forecasting
Power system control
Power system

measurements

SCADA systems

Load shedding

BT: Load management
RT: Power distribution



JULY 2025 IEEE Thesaurus

Load tap changers

USE: On load tap changers

Load variations

USE: Load management

Loaded antennas

BT: Antennas

Loaded waveguides

BT: Electromagnetic

waveguides

RT: Dielectric materials
Waveguide discontinuities

Loading

BT: Freight handling
RT: Containers
Filling
Grippers
Pulleys

Loans and mortgages

UF: Mortgages
BT: Financial management

Local area network emulation

USE: LAN emulation

Local area networks

UF: LAN
BT: Communication systems
Digital systems
RT: Distributed computing
Ethernet
FDDI
Field buses
File servers
IEEE 802.3 Standard
IPTV
Internetworking
LAN interconnection
Media Access Control
Multiprocessor

interconnection

Office automation
Open systems
Protocols
Regional area networks
Storage area networks
Token networks
Virtual private networks
NT: Virtual LAN
Wireless LAN

Local authorities

USE: Local government

Local field potentials

BT: Extracellular
Signal processing
RT: Synapses

Local government

UF: Local authorities
BT: Government

Local oscillators

BT: Oscillators

Localization

USE: Location awareness

Location awareness

UF: Geo tagging
Localization
Location based services
Location metadata
Mobile location

management

Mobile radio mobility

management

BT: Mobile communication
RT: Cellular radio
Inter-cell interference
Land mobile radio
Mobile computing
Navigation
Odometry
Personal communication

networks

Position measurement
Visual place recognition
Wireless communication
NT: Network location

awareness

Location based services

USE: Location awareness

Location metadata

USE: Location awareness

Log normal distribution

USE: Log-normal distribution

Log periodic antennas

BT: Antenna arrays



JULY 2025 IEEE Thesaurus

Log-normal distribution

UF: Log normal distribution
BT: Probability distribution

Log-periodic dipole antennas

UF: LDPA
BT: Antennas

Logic

UF: Formal logic
BT: Computational and artificial intelligence

RT: Boolean algebra
Cognitive science
Computer science
Logic circuits
Logic functions
NT: Fuzzy logic
Multivalued logic
Probabilistic logic
Sufficient conditions

Logic arrays

BT: Circuits
Logic circuits
NT: Programmable logic arrays

Logic CAD

USE: Logic design

Logic circuit testing

USE: Logic testing

Logic circuits

BT: Circuits
Switching circuits
RT: Adders
Computers and information

processing

Counting circuits
Digital circuits
Digital integrated circuits
Flip-flops
Logic
Logic design
Logic devices
Logic functions
Multiplying circuits
Pulse inverters
Shift registers
NT: Combinational circuits
Logic arrays
Programmable logic arrays
Superconducting logic

circuits

Logic design

UF: Circuit design (logic)
Logic CAD
BT: Design automation
RT: Circuit synthesis
Design for testability
Design methodology
Engineering education
Logic circuits
Timing
NT: Reconfigurable logic

Logic devices

BT: Circuits and systems
RT: Logic circuits
NT: Logic gates
Programmable logic

devices

Logic functions

BT: Boolean functions
RT: Logic
Logic circuits
Multivalued logic

Logic gates

BT: Logic devices
RT: Boolean algebra
Ring oscillators

Logic inverters

USE: Pulse inverters

Logic programming

BT: Programming
NT: Constraint handling

Logic test

USE: Logic testing

Logic testing

UF: Logic circuit testing
Logic test
BT: Integrated circuit testing
RT: Design for testability

Logical decomposition

USE: System analysis and design

Logistic regression

UF: Logit models
Ordered logit models
BT: Regression analysis
RT: Learning (artificial

intelligence)



JULY 2025 IEEE Thesaurus

	Pattern classification	<i>LOPT</i>	
	Support vector machines	USE:	Flyback transformers
Logistics		LoRa	
UF:	Physical distribution	UF:	Long range
management		BT:	Data communication
BT:	Production management		Radio communication
RT:	Procurement	RT:	Wide area networks
NT:	Reverse logistics	NT:	LoRaWAN
	Supply chains		
<i>Logit models</i>		<i>Loran</i>	
USE:	Logistic regression	USE:	Radio navigation
<i>Long range</i>		LoRaWAN	
USE:	LoRa	UF:	Long range WAN
		BT:	LoRa
<i>Long range WAN</i>			Protocols
USE:	LoRaWAN		
Long short term memory		Lorentz covariance	
UF:	LSTM	UF:	Lorentz force
	Long short-term memory		Lorentz invariance
BT:	Artificial neural networks	BT:	Physics
RT:	Machine learning	<i>Lorentz force</i>	
NT:	Bidirectional long short term	USE:	Lorentz covariance
memory		<i>Lorentz invariance</i>	
<i>Long short-term memory</i>		USE:	Lorentz covariance
USE:	Long short term memory		
Long Term Evolution		Loss measurement	
UF:	LTE	BT:	Measurement
	LTE advanced	RT:	Attenuation measurement
BT:	3GPP Standards		Magnetic losses
	Communication standards		Optical losses
RT:	4G mobile communication	NT:	Packet loss
	High-speed networks		
	Mobile communication	Lot sizing	
	Mobile handsets	BT:	Production control
	Wireless communication	RT:	Materials requirements
<i>Look-up table</i>		planning	
USE:	Table lookup	Loudspeakers	
<i>Lookup table</i>		BT:	Audio systems
USE:	Table lookup	RT:	Acoustic distortion
Loop antennas		<i>Low blood pressure</i>	
BT:	Antennas	USE:	Hypotension
<i>Loop-filtering algorithm</i>		Low carbon economy	
USE:	Filtering algorithms	UF:	Decarbonisation
			Decarbonised economy
			Decarbonization
			Decarbonized economy
			Low fossile fuel economy
			Low-carbon economy



JULY 2025 IEEE Thesaurus

BT:	Power system economics	<i>Low-carbon economy</i>	
RT:	Carbon	USE:	Low carbon economy
	Ecosystems		
	Electrification	<i>Low-earth-orbit</i>	
	Environmental	USE:	Low earth orbit satellites
management			
	Global warming	<i>Low-frequency noise</i>	
	Green hydrogen	USE:	Low frequency noise
	Greenhouse effect		
	Renewable energy sources	<i>Low-latency communication</i>	
		USE:	Low latency communication
<i>Low density parity check codes</i>			
USE:	Parity check codes		
Low earth orbit satellites		Low-noise amplifiers	
UF:	LEO	UF:	Low noise amplifiers
	Low-earth-orbit	BT:	Amplifiers
BT:	Artificial satellites		
<i>Low fossile fuel economy</i>		Low-pass filters	
USE:	Low carbon economy	UF:	Low pass filters
			Lowpass filters
		BT:	Filters
Low frequency noise		<i>Low-power electronics</i>	
UF:	LF noise	USE:	Low power electronics
	Low-frequency noise		
BT:	Noise	Low-power wide area networks	
		UF:	LPWAN
Low latency communication		BT:	Wide area networks
UF:	Low-latency communication	Low-temperature plasmas	
BT:	Communication systems	UF:	Low temperature plasmas
NT:	Ultra reliable low latency	BT:	Plasmas
communication		RT:	Plasma applications
<i>Low noise amplifiers</i>		<i>Low-voltage</i>	
USE:	Low-noise amplifiers	USE:	Low voltage
<i>Low pass filters</i>		Lower bound	
USE:	Low-pass filters	BT:	Boundary conditions
		RT:	Upper bound
Low power electronics		<i>Lowpass filters</i>	
UF:	Low-power electronics	USE:	Low-pass filters
	Ultra low power*		
	Ultra-low power*	<i>LPD</i>	
BT:	Consumer electronics	USE:	License plate recognition
RT:	Electronic equipment		
	Nanogenerators	<i>LPR</i>	
	Simultaneous wireless	USE:	License plate recognition
information and power transfer			
<i>Low temperature plasmas</i>		<i>LPWAN</i>	
USE:	Low-temperature plasmas	USE:	Low-power wide area networks
Low voltage			
UF:	Low-voltage	<i>LSI</i>	
BT:	Voltage measurement	USE:	Large scale integration



JULY 2025 IEEE Thesaurus

LSTM

USE: Long short term memory

LTE

USE: Long Term Evolution

LTE advanced

USE: Long Term Evolution

Lubricants

UF: Cutting fluids
BT: Production materials
RT: Lubrication

Lubricating oils

UF: Oil filters
Oiling (lubrication)
BT: Oils

Lubrication

BT: Mechanical factors
RT: Friction
Lubricants
Mechanical bearings

Lumber industry

UF: Timber industry
BT: Industries

Lumen

BT: Lighting
Measurement

Luminescence

BT: Optics
RT: Luminescent devices
Muon colliders
Scintillators
NT: Chemiluminescence
Electroluminescence
Fluorescence
Phosphorescence
Photoluminescence
Thermoluminescence

Luminescent devices

BT: Light sources
Optical devices
RT: Luminescence
Muon colliders
NT: Electroluminescent devices

Lunar

USE: Moon

Lung cancer

BT: Cancer

Lung diseases

USE: Pulmonary diseases

Lung neoplasms

BT: Neoplasms

Lungs

BT: Respiratory system
RT: Acute respiratory distress
syndrome
Pulmonary diseases
Pulmonology
Spirometry

LUT

USE: Table lookup

Lutecium

USE: Lutetium

Lutetium

UF: Lutecium
BT: Chemical elements

Lyapunov function

USE: Lyapunov methods

Lyapunov methods

UF: Lyapunov function
Lyapunov stability
BT: System analysis and design
RT: Control design
Functional analysis
Stability

Lyapunov stability

USE: Lyapunov methods

Lymph nodes

BT: Lymphatic system

Lymphatic system

BT: Anatomy
NT: Lymph nodes
Spleen

Lymphocytes

UF: B-cells
T-cells
BT: White blood cells
RT: Immune system



JULY 2025 IEEE Thesaurus

M2M

USE: Machine-to-machine communications

MaaS

USE: Mobility as a service

MAC

USE: Media Access Control

MAC protocol

USE: Media Access Control

Mach-Zehnder interferometers

UF: Mach-Zehnder modulation

BT: Interferometers

Mach-Zehnder modulation

USE: Mach-Zehnder interferometers

Machine added indexing

USE: Machine assisted indexing

Machine aided indexing

USE: Machine assisted indexing

Machine assisted indexing

UF: Automated indexing
Automatic indexing
MAI
Machine added indexing
Machine aided indexing
Machine indexing
Machine-added indexing
Machine-aided indexing
Machine-assisted indexing

BT: Indexes

RT: Indexing

Machine components

BT: Machinery
Mechanical products

RT: Couplings
Engines
Gears
Turbomachinery
Wheels

NT: Air cleaners
Belts
Cams
Engine cylinders
Exhaust systems
Impellers
Intake systems

Manifolds

Mechanical splines

Pistons

Rotors

Shafts

Valves

Machine control

BT: Industrial electronics

NT: Machine vector control

Machine ethics

UF: Computational ethics
Computational morality
Machine morality
BT: Ethics
Technology
RT: Artificial intelligence
Philosophical

considerations

Machine indexing

USE: Machine assisted indexing

Machine intelligence

BT: Computational and artificial intelligence

RT: Machine-to-machine communications

NT: Pattern analysis

Machine learning

UF: Dictionary learning
Machine-learning
BT: Artificial intelligence
RT: Behavior recognition
Bio-inspired computing
Cognitive systems
Convolutional neural

networks

Data augmentation
Deep architecture
Energy informatics
Foundation models
Generative adversarial

networks

Image augmentation
Linear discriminant analysis
Long short term memory
Naive Bayes methods
Photorealistic images
Predictive analytics
Radiomics
Text detection
Text summarization



JULY 2025 IEEE Thesaurus

	Text to image		Machinery production
	Text to video	industries	
	Weak supervision		Machining
learning	NT: Adversarial machine		
	Association rule learning	Machine tool spindles	
	Attention mechanisms	UF: Spindle bearings	
learning	Automated machine	BT: Machine tools	
		RT: Mechanical splines	
	Boosting		Shafts
	Concept drift	Machine tools	
	Deep learning	BT: Production equipment	
learning	Deep reinforcement	RT: Clamps	
			Coordinate measuring
	Diffusion models	machines	
	Dimensionality reduction		Cutting tools
	Ensemble learning		Fixtures
	Explainable AI		Gears
	Federated learning		Hand tools
	Few shot learning		Machine shops
transformer	Generative Pre-trainer		Machining
			Manufacturing
	High dimensional data		Mechanical guides
optimization	Hyperparameter		Turning
		NT: Dies	
	Imitation learning		Drilling machines
	Incremental learning		Grinding machines
	Model compression		Machine tool spindles
	Multi-armed bandit problem		Metalworking machines
	One shot learning		Milling machines
	Random forests		Presses
	Reinforcement learning		Sawing machines
	Relevance vector machines		
	Representation learning	Machine translation	
	Robot learning	BT: Computational linguistics	
	Statistical learning		Natural language
	Tiny machine learning	processing	
	Transfer learning	RT: Translation	
		NT: Neural machine translation	
Machine learning algorithms			
	BT: Algorithms		
	NT: Kernel machines	Machine vector control	
		BT: Machine control	
Machine listening		RT: AC-DC power converters	
	UF: Audio signal processing		DC-DC power converters
	Computational auditory		
scene analysis		Machine vision	
	BT: Artificial intelligence	UF: Vision systems	
		(nonbiological)	
<i>Machine morality</i>		BT: Image processing	
	USE: Machine ethics	RT: Automatic optical inspection	
		IEEE 1394 Standard	
Machine shops		Image analysis	
	BT: Production facilities	Image recognition	
	RT: Machine tools	Manufacturing automation	
		Observers	



JULY 2025 IEEE Thesaurus

NT: Pattern recognition
Stereo vision
Visual systems
Object recognition
Object segmentation

Machine windings

BT: Windings

Machine-added indexing

USE: Machine assisted indexing

Machine-aided indexing

USE: Machine assisted indexing

Machine-assisted indexing

USE: Machine assisted indexing

Machine-learning

USE: Machine learning

Machine-to-machine communications

UF: M2M
BT: Communication systems
RT: Fourth Industrial Revolution
IP networks
Industrial Internet of Things
Internet of Things
Machine intelligence
Remote monitoring
Tactile Internet
Wireless communication
Wireless sensor networks
NT: Massive machine type
communications

Machinery

BT: Industry applications
RT: Machinery production

industries

equipment

NT: Production equipment
Agricultural machinery
Ball bearings
Belts
Drives
Electric machines
Fans
Furnaces
Gears
Hydraulic systems
Machine components
Motors

Printing machinery
Pumps
Textile machinery

Machinery production industries

BT: Manufacturing industries
RT: Machine shops
Machinery

Machining

BT: Materials processing
RT: Burnishing
Clamps
Deburring
Finishing
Machine shops
Machine tools
Machinery
Manufacturing
NT: Boring
Drilling
Electrochemical machining
Hobbing machines
Lapping
Laser beam machining
Milling
Planing
Sawing
Turning
Virtual machining

Macrocell networks

UF: Macrocells
BT: Cellular networks
RT: Rural areas

Macrocells

USE: Macrocell networks

Macroeconomics

BT: Economics
RT: Government
International trade
Public finance
NT: Privatization

Macular degeneration

BT: Eye diseases
Visual impairment

Maglev

USE: Magnetic levitation

Maglev trains

USE: Magnetic levitation vehicles



JULY 2025 IEEE Thesaurus

Maglev transportation

USE: Magnetic levitation vehicles

Maglev vehicles

USE: Magnetic levitation vehicles

Magma

BT: Rocks

RT: Lava

Magnesium

UF: Mg

BT: Metals

NT: Magnesium compounds

Magnesium compounds

BT: Magnesium

NT: Magnesium oxide

Magnesium oxide

UF: Irtran 5

MgO

BT: Magnesium compounds

RT: Ceramics

Optical materials

Magnetic analysis

BT: Magnetism

RT: Electromagnetic analysis

Magnetic fields

NT: Magnetization

Magnetic anisotropy

BT: Magnetism

NT: Magnetic domain walls

Magnetic domains

Magnetic moments

Perpendicular magnetic

anisotropy

Magnetic anomaly detection

BT: Magnetic variables

measurement

RT: Magnetic fields

Object detection

Magnetic anomaly detectors

BT: Magnetometers

RT: Magnetic fields

Military equipment

Object detection

Magnetic bearings

USE: Magnetic levitation

Magnetic circuits

BT: Circuits

RT: Coils

Magnetic devices

Windings

Magnetic communication

BT: Communication systems

RT: Electromagnetic induction

Near field communication

Magnetic confinement

BT: Plasma confinement

RT: Electromagnets

Fusion power generation

Tokamak devices

Tokamaks

Magnetic core losses

USE: Magnetic losses

Magnetic cores

BT: Magnetic devices

RT: Inductors

NT: Transformer cores

Magnetic devices

BT: Magnetism

RT: Magnetic circuits

Magnetic materials

NT: Accelerator magnets

Ferrite devices

Magnetic cores

Magnetic gears

Magnetic heads

Magnetic memory

Magnetic modulators

Magneto-optic devices

Magnetoresistive devices

Magnetostrictive devices

Solenoids

Transformer cores

Undulators

Magnetic domain walls

BT: Magnetic anisotropy

Magnetic domains

BT: Magnetic anisotropy

Magnetic field induced strain

BT: Magnetomechanical effects

RT: Ferroelectric films

Ferroelectric materials

MISFETs



JULY 2025 IEEE Thesaurus

Semiconductor diodes
Semiconductor films
Semiconductor-metal
interfaces

Magnetic field measurement
BT: Magnetic variables
measurement
RT: Magnetic fields

Magnetic fields
BT: Magnetics
RT: Biomagnetics
Compass
Electromagnetic fields
Magnetic analysis
Magnetic anomaly
detection
Magnetic anomaly
detectors
Magnetic field
measurement
Magnetic levitation vehicles
Maxwell equations
Remanence
SQUID magnetometers
Saturation magnetization
Synchrotrons
NT: Geomagnetism
Magnetic reconnection
Magnetic separation
Magnetostatics
Toroidal magnetic fields

Magnetic films
UF: Magnetic thin films
BT: Films
Magnetic materials
RT: Thin films
NT: Ferrimagnetic films
Ferrite films
Garnet films

Magnetic filters
USE: Magnetic separation

Magnetic fluids
USE: Magnetic liquids

Magnetic flux
BT: Magnetics
RT: Remanence
NT: Flux pinning
Magnetic flux density
Magnetic flux leakage

Magnetic flux density
BT: Magnetic flux

Magnetic flux leakage
BT: Magnetic flux
Nondestructive testing
RT: Corrosion
Pipelines

Magnetic force microscopy
BT: Magnetics
RT: Atomic force microscopy
Magnetic forces

Magnetic forces
BT: Magnetics
RT: Electromagnetic forces
Force
Magnetic force microscopy
Magnetic levitation
NT: Coercive force

Magnetic gears
BT: Gears
Magnetic devices
RT: Electromagnetic devices
Magnetic levitation
Permanent magnets
Power transmission
Variable speed drives

Magnetic heads
BT: Magnetic devices
RT: Magnetic recording
Magnetoresistive devices

Magnetic hysteresis
BT: Magnetics
RT: Hysteresis
Remanence

Magnetic levitation
UF: Maglev
Magnetic bearings
BT: Levitation
Magnetics
RT: Electromagnets
Magnetic forces
Magnetic gears
Rail transportation
NT: Magnetic levitation vehicles

Magnetic levitation vehicles
UF: Maglev trains
Maglev transportation



JULY 2025 IEEE Thesaurus

transportation

BT: Maglev vehicles
Magnetic levitation
Rail transportation

RT: Electromagnets
High-speed rail

Magnetic fields
Permanent magnets
Superconducting magnets

Magnetic liquids

UF: Magnetic fluids
BT: Magnetic materials

Magnetic losses

UF: Magnetic core losses
BT: Magnetism
RT: Eddy currents
Loss measurement

Magnetic materials

BT: Magnetism
Materials

RT: Biomagnetism
Boron alloys
Magnetic devices
Magnetoelasticity
Magnetostriction
Permeability

NT: Amorphous magnetic

materials

Antiferromagnetic materials
Diamagnetic materials
Ferrimagnetic films
Ferrimagnetic materials
Ferrite films
Ferrites
Ferrofluid
Ferromagnetic materials
Garnet films
Garnets
Magnetic films
Magnetic liquids
Magnetic semiconductors
Magnetic superlattices
Paramagnetic materials
Soft magnetic materials

Magnetic measurements

USE: Magnetic variables

measurement

Magnetic memory

UF: Magnetic storage
BT: Magnetic devices

Memory

RT: Magnetic recording

NT: Floppy disks
Hard disks

Magnetic modulators

BT: Magnetic devices
Modulation

Magnetic moments

BT: Magnetic anisotropy

Magnetic multilayers

BT: Magnetism
RT: Coatings

Magnetic nanoparticles

BT: Nanoparticles

Magnetic noise

BT: Magnetic recording

Magnetic particle imaging

BT: Tomography
RT: Medical diagnostic imaging

Magnetic particles

BT: Magnetism
RT: Biomagnetism
Microelectromechanical

devices

Nanomagnetism

Magnetic permeability

USE: Permeability

Magnetic properties

BT: Magnetism

Magnetic reconnection

BT: Magnetic fields

Magnetic recording

UF: Perpendicular recording
BT: Recording
RT: Magnetic heads
Magnetic memory
NT: Digital magnetic recording
Heat-assisted magnetic

recording

Magnetic noise
Magnetooptic recording
Microwave-assisted

magnetic recording



JULY 2025 IEEE Thesaurus

recording Perpendicular magnetic
recording Shingled magnetic

Magnetic resonance

BT: Resonance
Resonant frequency
RT: Ferroresonance
Magnetic resonance
imaging NT: Antiferromagnetic
resonance Ferromagnetic resonance
Nuclear magnetic
resonance Paramagnetic resonance

Magnetic resonance elastography

BT: Magnetic resonance
imaging

Magnetic resonance fingerprinting

BT: Magnetic resonance
imaging

Magnetic resonance imaging

UF: Biomedical MRI
MRI
NMR imaging
Nuclear magnetic
resonance imaging
BT: Imaging
RT: Diagnostic radiography
Image reconstruction
Magnetic resonance
NT: Diffusion tensor imaging
Functional magnetic
resonance imaging
elastography Magnetic resonance
fingerprinting Magnetic resonance
mapping Quantitative susceptibility

Magnetic semiconductors

BT: Magnetic materials
Semiconductor materials

Magnetic sensors

BT: Magnetics
Sensors
RT: Wearable sensors
NT: Spin valves

Magnetic separation

UF: Magnetic filters
BT: Magnetic fields
RT: Particle separators

Magnetic shielding

BT: Electromagnetic shielding

Magnetic stimulation

BT: Medical treatment

Magnetic storage

USE: Magnetic memory

Magnetic superlattices

BT: Magnetic materials
Superlattices

Magnetic susceptibility

BT: Magnetics

Magnetic switching

BT: Magnetics

Magnetic thin films

USE: Magnetic films

Magnetic tunnel junctions

USE: Magnetic tunneling

Magnetic tunneling

UF: Magnetic tunnel junctions
Magnetic tunnelling
Spin-dependent tunneling
Spin-dependent tunnelling
BT: Magnetoelectric effects
Tunneling
RT: Magnetoelectronics
Spin polarized transport

Magnetic tunnelling

USE: Magnetic tunneling

Magnetic variables control

BT: Control systems

Magnetic variables measurement

UF: Magnetic measurements
BT: Measurement
NT: Magnetic anomaly
detection Magnetic field
measurement Magnetometers
Permeability measurement



JULY 2025 IEEE Thesaurus

Magnetics

NT: Biomagnetics
Demagnetization
Gyromagnetism
Magnetic analysis
Magnetic anisotropy
Magnetic devices
Magnetic fields
Magnetic flux
Magnetic force microscopy
Magnetic forces
Magnetic hysteresis
Magnetic levitation
Magnetic losses
Magnetic materials
Magnetic multilayers
Magnetic particles
Magnetic properties
Magnetic sensors
Magnetic susceptibility
Magnetic switching
Magnetization processes
Magnetoacoustic effects
Magnetoelectric effects
Magnetomechanical effects
Magnetooptic effects
Magnets
Magnonics
Microwave magnetics
Nanomagnetics
Nonlinear magnetics
Remanence
Spin systems

Magnetisation

USE: Magnetization

Magnetisation processes

USE: Magnetization processes

Magnetisation reversal

USE: Magnetization reversal

Magnetization

UF: Magnetisation
BT: Magnetic analysis

Magnetization processes

UF: Magnetisation processes
BT: Magnetics
RT: Hysteresis
NT: Magnetization reversal
Saturation magnetization

Magnetization reversal

UF: Magnetisation reversal
BT: Magnetization processes

Magneto electrical resistivity imaging technique

UF: MERIT
BT: Imaging
RT: Geophysical measurement techniques

Magneto-electronics

USE: Magnetoelectronics

Magneto-optical effects

USE: Magnetooptic effects

Magnetoacoustic effects

UF: Acoustomagnetic effects
BT: Magnetics
RT: Acoustics
Magnetomechanical effects

Magnetoelasticity

BT: Magnetomechanical effects
RT: Magnetic materials
NT: Magnetostriction

Magnetoelectric effects

BT: Magnetics
NT: Hall effect
Magnetic tunneling
Magnetoelectronics
Magnetoresistance
Spintronics

Magnetoelectronic devices

USE: Magnetoelectronics

Magnetoelectronics

UF: Magneto-electronics
Magnetoelectronic devices
BT: Magnetoelectric effects
RT: Magnetic tunneling
Magnetoresistive devices
NT: Spin polarized transport

Magnetoencephalography

BT: Biomagnetics
RT: Biomedical image processing
Brain

Magnetofluid dynamics

USE: Magnetohydrodynamics



JULY 2025 IEEE Thesaurus

Magnetofluidynamics

USE: Magnetohydrodynamics

NT: Ultracold atoms
Faraday effect
Gyrotropism

Magnetohydrodynamic power generation

BT: Power generation
RT: Magnetohydrodynamics

Magnetohydrodynamics

UF: Hydromagnetics
MHD
Magnetofluid dynamics
Magnetofluidynamics
BT: Dynamics
Hydrodynamics
Mechanical factors
RT: Electrohydraulics
Fluid flow
Magnetohydrodynamic

power generation

Magnetomechanical effects

UF: Piezomagnetic effects
BT: Magnetism
RT: Magnetoacoustic effects
Mechanical factors
Stress
NT: Magnetic field induced

strain

Magnetoelasticity
Magnetostriction

Magnetometers

UF: Magnetometry
BT: Magnetic variables
NT: Magnetic anomaly

measurement

detectors

SQUID magnetometers

Magnetometry

USE: Magnetometers

Magneto optic devices

UF: Photomagnetic devices
BT: Magnetic devices
RT: Magneto optic effects

Magneto optic effects

UF: Magneto-optical effects
Photomagnetic effects
BT: Magnetism
RT: Kerr effect
Magneto optic devices
Magneto optic recording
Optics

Magneto optic recording

BT: Laser applications
Magnetic recording
RT: Magneto optic effects

Magnetoresistance

UF: Magnetoresistivity
BT: Magnetoelectric effects
RT: Magnetoresistive devices
Nanocontacts
Spin polarized transport
NT: Anisotropic

magnetoresistance

Colossal

magnetoresistance

Enhanced

magnetoresistance

Extraordinary

magnetoresistance

Giant magnetoresistance
Ordinary

magnetoresistance

Tunneling

magnetoresistance

Magnetoresistive devices

UF: Magnetoresistors
BT: Magnetic devices
RT: Giant magnetoresistance
Magnetic heads
Magnetoelectronics
Magnetoresistance
Tunneling

magnetoresistance

Magnetoresistivity

USE: Magnetoresistance

Magnetoresistors

USE: Magnetoresistive devices

Magnetosphere

UF: Magnetotail
BT: Terrestrial atmosphere
RT: Geomagnetism

Magnetostatic waves

BT: Waves
RT: Electromagnetic

propagation

Magnetostatics



JULY 2025 IEEE Thesaurus

Magnetostatics

BT: Magnetic fields
RT: Magnetostatic waves

Magnetostriction

BT: Magnetoelasticity
Magnetomechanical effects
RT: Magnetic materials
Magnetostrictive devices

Magnetostrictive devices

BT: Magnetic devices
RT: Magnetostriction
Sensors

Magnetotail

USE: Magnetosphere

Magnetrons

BT: Electron tubes
RT: Relativistic effects
Sputtering

Magnets

BT: Magnetism
RT: Cobalt
Saturation magnetization
NT: Electromagnets
Micromagnetics
Permanent magnets

Magnonics

BT: Magnetism

MAI

USE: Machine assisted indexing

Mail

USE: Postal services

Mail (electronic)

USE: Electronic mail

Main frames

USE: Mainframes

Main line

USE: Landline

main secondary

USE: Main-secondary

Main-secondary

UF: main secondary
BT: Protocols

Mainframes

UF: Main frames
BT: Digital computers
RT: Microcomputers
Time sharing computer

systems

Maintenance

BT: Reliability

Maintenance engineering

UF: Repair
BT: Engineering - general
RT: Automatic testing
Availability
Configuration management
Fault diagnosis
Inspection
Monitoring
Remaining life assessment
Testing
NT: Maintenance management
Predictive maintenance
Preventive maintenance
Systems support

Maintenance management

BT: Maintenance engineering
Technical management

Major depressive disorder

USE: Depression

Malaria

BT: Diseases

Maldistribution

BT: Reliability

Malicious software

USE: Malware

Malignancy

USE: Cancer

Malignant

USE: Cancer

Malignant tumors

BT: Tumors

Malware

UF: Malicious software
BT: Software
RT: Anti-virus software



JULY 2025 IEEE Thesaurus

	Cyber espionage		Contingency management
	Phishing		Contract management
	Privacy		Contracts
	Security		Customer relationship
NT:	Computer viruses	management	
	Computer worms		Dependability management
	Ransomware		Digital management
	Rootkit		Distributed management
	Trojan horses		Enterprise resource
		planning	
Mammary glands			Facilities management
BT:	Glands		Financial management
<i>Mammary neoplasms</i>			Governmental factors
USE:	Breast neoplasms	management	Human resource
Mammography			Information management
BT:	Biomedical imaging		Interface management
RT:	Medical tests		International collaboration
<i>Man machine systems</i>			Knowledge management
USE:	Human-machine systems		Marketing management
<i>Man-machine interfaces</i>			Organizational aspects
USE:	User interfaces		Outsourcing
<i>Man-machine systems</i>			Precision agriculture
USE:	Human-machine systems		Process planning
			Production management
			Program management
			Project management
			Public relations
			Quality management
			Requirements management
			Research and development
Management			Resource management
UF:	Reliability management		Risk analysis
BT:	Business	management	Safety management
RT:	Analytic hierarchy process		Security management
	Ethical aspects		Storage management
	Learning management		Supply chain management
systems			Technical management
	Management information		Technology management
systems			
	Management training		
	Operations research		
	Personnel		
	Productivity		
NT:	Asset management	Management accounting	
	Best practices	BT:	Financial management
	Building management	NT:	Cost accounting
systems			
	Business continuity	Management information base	
	Business process	UF:	MIB
management		BT:	Computer network
	Business process re-	management	
engineering		RT:	Information systems
	Communication system		Telecommunication
operations and management		network management	
	Conference management		Virtual environments
	Content management		



JULY 2025 IEEE Thesaurus

Management information systems

BT: Information systems
 RT: Customer relationship management
 NT: Knowledge management
 Management
 Supply chain management
 Portals

Management of innovation

USE: Innovation management

Management training

BT: Training
 RT: Continuing education
 Management

MANET

USE: Mobile ad hoc networks

Manganese

BT: Metals
 NT: Manganese alloys

Manganese alloys

BT: Manganese

Manifold learning

BT: Dimensionality reduction
 RT: Learning (artificial intelligence)

Manifolds

UF: Exhaust manifolds
 BT: Machine components
 RT: Engines
 Exhaust systems
 Valves

Manipulator dynamics

BT: Manipulators

Manipulator sensing systems

USE: Robot sensing systems

Manipulator vision systems

USE: Robot vision systems

Manipulators

BT: Robots
 RT: Assembly
 Assembly systems
 Control equipment
 Control systems
 Industrial control

Manufacturing automation
 Materials handling
 Mechanical variables

control

Medical robotics
 Motion control
 Nonlinear systems
 Position control
 Service robots
 Servomechanisms
 Servosystems
 Telerobotics
 End effectors
 Manipulator dynamics
 Micromanipulators

NT:

Manipulators (nonrobotic)

USE: Remote handling

Manpower planning

USE: Labor resources

Manuals

UF: Technical manuals
 BT: Professional communication
 RT: Documentation
 Training
 Writing

Manufactured products

UF: Counterfeit goods
 BT: Manufacturing
 RT: Product customization
 Product design
 Product development
 NT: Ceramic products
 Chemical products
 Consumer products
 Electrical products
 Food products
 Fuels
 Glass products
 Mechanical products
 Metal products
 Paper products
 Paper pulp
 Plastic products
 Rubber products
 Sports equipment
 Textile products
 Tools
 Windows



JULY 2025 IEEE Thesaurus

Manufacturing

BT: Industry applications
 RT: Bonding
 Business
 Discrete-event systems
 Industrial plants
 Machine tools
 Machining
 Materials handling
 Materials processing
 Production control
 Production engineering
 Production facilities
 Production systems
 Productivity
 Soldering
 Stereolithography
 Welding
 Wheels
 Wire drawing
 NT: Assembly
 Assembly systems
 Embossing
 Fabrication
 Fourth Industrial Revolution
 Green manufacturing
 Lithography
 Manufactured products
 Manufacturing systems
 Mass customization
 Smart manufacturing
 Tolerance analysis

Manufacturing automation

UF: Factory automation
 BT: Automation
 Industrial electronics
 RT: Assembly
 Assembly systems
 Automatic optical inspection
 Industrial control
 Industrial robots
 Machine vision
 Manipulators
 Mobile robots
 Process control
 Programmable control
 Robots
 NT: Computer aided
 manufacturing
 Computer integrated
 manufacturing
 Computer numerical control
 Flexible manufacturing
 systems

Manufacturing economics

USE: Industrial economics

Manufacturing facilities

USE: Production facilities

Manufacturing industries

BT: Industries
 NT: Aerospace industry
 Cement industry
 Ceramics industry
 Clothing industry
 Electrical products industry
 Electronics industry
 Food industry
 Footwear industry
 Fuel processing industries
 Glass industry
 Machinery production

industries

Metal product industries
 Plastics industry
 Pulp and paper industry
 Rubber industry
 Shipbuilding industry
 Textile industry
 Toy manufacturing industry

Manufacturing management

USE: Production management

Manufacturing process

USE: Manufacturing processes

Manufacturing processes

UF: Compliant mechanisms
 Froth flotation
 Manufacturing process
 BT: Manufacturing systems
 RT: Rapid prototyping
 NT: Sintering
 Social manufacturing

Manufacturing systems

BT: Manufacturing
 Production systems
 RT: Bleaching
 Industrial facilities
 Production engineering
 NT: Agile manufacturing
 Automobile manufacture
 Batch production systems
 Blanking
 Cellular manufacturing
 Flow production systems



JULY 2025 IEEE Thesaurus

Food manufacturing
Forging
Glass manufacturing
Integrated manufacturing

systems

Intelligent manufacturing

systems

Job production systems
Joining processes
Layered manufacturing
Lean production
Manufacturing processes
Mass production
Melt processing
Pulp manufacturing
Sheet metal processing
Thermoforming
Three-dimensional printing

Many core processing
USE: Multicore processing

Many core systems
USE: Multicore processing

Many valued logic
USE: Multivalued logic

Manycore computing
USE: Manycore processors

Manycore processors
UF: Manycore computing
BT: Multicore processing
RT: Program processors

Marine accidents
BT: Accidents
RT: Marine pollution
Marine safety
Marine vehicles

Marine animals
UF: Ocean animals
Sea animals
Sea lions
BT: Animals
Marine ecosystems
RT: Aquaculture
NT: Dolphins
Jellyfish
Whales

Marine cables
USE: Underwater cables

Marine communications
USE: Maritime communications

Marine ecosystems
BT: Aquatic ecosystems
NT: Marine animals
Marine vegetation

Marine engineering
BT: Engineering - general

Marine equipment
UF: Maritime technology
BT: Marine technology
RT: Marine robots

Marine navigation
BT: Navigation
Oceanic engineering and
marine technology
RT: Marine robots
Sea state
Underwater navigation

Marine pollution
BT: Water pollution
RT: Marine accidents
Oil pollution
Oils
Thermal pollution

Marine robots
BT: Marine vehicles
Robots
Underwater technology
RT: Autonomous underwater
vehicles

Boats
Marine equipment
Marine navigation
Military vehicles
Mobile robots
Oceanography
Rescue robots
Underwater vehicles

Marine safety
BT: Safety
RT: Marine accidents
Marine technology
Marine vehicles

Marine science
USE: Oceanography



JULY 2025 IEEE Thesaurus

Marine technology

UF: Ocean technology
 BT: Oceanic engineering and
 marine technology
 RT: Excavation
 Marine safety
 Military systems
 Oceans
 Underwater vehicles
 NT: Marine equipment
 Marine transportation
 Underwater cables
 Underwater communication
 Underwater equipment
 Underwater structures
 Underwater technology

Marine transportation

BT: Marine technology
 RT: Global Positioning System
 Seaports
 NT: Marine vehicles

Marine vegetation

UF: Ocean vegetation
 Sea vegetation
 BT: Marine ecosystems
 Vegetation
 NT: Seaweed

Marine vehicles

UF: Maritime vehicles
 Ships
 BT: Marine transportation
 RT: Marine accidents
 Marine safety
 Propellers
 Seaports
 NT: Amphibious robots
 Boats
 Marine robots
 Underactuated surface
 vessels
 Underwater vehicles

Maritime communications

UF: Marine communications
 BT: Communication networks

Maritime technology

USE: Marine equipment

Maritime vehicles

USE: Marine vehicles

Market opportunities

BT: Marketing management
 RT: Consumer behavior
 Customer profiles
 Disruptive innovation
 Disruptive technologies
 Emissions trading
 Neuromarketing

Market research

BT: Customer relationship
 management
 RT: Engineering management
 Brand management
 Competitive intelligence
 Consumer products
 Customer satisfaction
 Neuromarketing

Marketing management

BT: Management
 RT: Electronic commerce
 Public relations
 NT: Advertising
 Brand management
 Distribution strategy
 Market opportunities
 Mass customization
 Promotion - marketing

Markov decision processes

BT: Markov processes

Markov network

USE: Markov random fields

Markov processes

BT: Stochastic processes
 RT: Belief propagation
 Dynamic programming
 Hidden Markov models
 Infinite horizon
 Multi-armed bandit problem
 Q-learning
 NT: Markov decision processes
 Markov random fields

Markov random fields

UF: Markov network
 BT: Markov processes

Markup languages

BT: Computer languages
 RT: Cascading style sheets
 Semantic Web



JULY 2025 IEEE Thesaurus

NT: HTML
OWL
Page description languages
SGML
XML

Mars

BT: Planets

Mars Express

USE: Interplanetary exploration

Mars Odyssey

USE: Interplanetary exploration

Martensite

BT: Crystalline materials
Steel

RT: Smart materials

Masers

UF: Microwave lasers
BT: Microwave devices
Microwave technology
RT: Atomic clocks

Relativistic effects
Ring oscillators
Stimulated emission
NT: Gyrotrons

MASH

USE: Multi-stage noise shaping

Mashing

USE: Mashups

Mashups

UF: Mashing
BT: Web services
World Wide Web

Masking threshold

BT: Psychoacoustic models

Mass customization

BT: Manufacturing
Marketing management

Mass production

BT: Manufacturing systems
RT: Production management

Mass spectrometry

USE: Mass spectroscopy

Mass spectroscopy

UF: Mass spectrometry
BT: Spectroscopy

Massive machine type communications

UF: MMTC
mmtc
BT: Machine-to-machine
communications
RT: Intelligent systems

Massive MIMO

BT: MIMO

Mast cells

BT: White blood cells
RT: Parasitic diseases

Mastectomy

BT: Surgery
RT: Breast cancer

Mastercard

USE: Credit cards

Masticatory muscles

BT: Stomatognathic system

Matched filters

BT: Filters
RT: Filtering theory

Matching pursuit algorithms

BT: Algorithms

Material properties

BT: Materials
NT: Biocompatibility
Creep
Elasticity
Elongation
Resilience
Rigidity

Material storage

BT: Materials, elements, and
compounds
RT: Canning
Energy storage
NT: Bulk storage
Containers
Fuel storage
Secure storage
Stacking
Storage automation



JULY 2025 IEEE Thesaurus

Materials

BT: Materials, elements, and compounds

RT: Materials handling
Oxidation

NT: Acoustic materials
Additives
Aggregates
Amorphous materials
Auxetic materials
Bio-inspired materials
Biological materials
Biomedical materials
Building materials
Catalysts
Ceramics
Composite materials
Conducting materials
Corrosion inhibitors
Crystalline materials
Crystals
Dielectric materials
Films
Fluids
Hazardous materials
Inorganic materials
Intelligent materials
Lacquers
Laminates
Magnetic materials
Material properties
Media
Mesoporous materials
Metal foam
Metallic materials
Metamaterials
Nanostructured materials
Oils
Optical materials
Organic inorganic hybrid

materials

Organic materials
Paints
Paper pulp
Petrochemicals
Phase change materials
Photoconducting materials
Plastics
Polymer foams
Polymer gels
Polymers
Production materials

Quantum materials
Radioactive materials
Raw materials
Resins
Resists
Semiconductor materials
Sheet materials
Smart materials
Solids
Superconducting materials
Surfactants
Terahertz materials
Textiles
Thermoelectric materials
Waste materials
Wire

Materials handling

UF: Materials handling systems
Scrubbers
BT: Materials science and technology

RT: Canning
Compaction
Die casting
Dispatching
Lifting equipment
Manipulators
Manufacturing
Materials
Mobile robots
Pipelines
Radioactive waste
Radioactive waste disposal
Robots
Stacking
Cleaning
Decontamination
Freight handling
Materials handling

NT: equipment

Pallets
Remote handling
Sieving

Materials handling equipment

BT: Materials handling
RT: Machinery
Production equipment
Waste handling equipment
NT: Containers
Grippers
Lifting equipment
Pulleys



JULY 2025 IEEE Thesaurus

equipment	Remote handling	Smelting
	Winches	Softening
		Swaging
		Vapor deposition
<i>Materials handling systems</i>		
	USE: Materials handling	
Materials preparation		Materials reliability
UF: Atmospheric sintering		BT: Materials science and
BT: Materials science and		technology
technology		RT: Reliability
RT: Corrosion inhibitors		Green's function methods
Flame retardants		
NT: Doping		Materials requirements planning
Firing		UF: MRP
Ion implantation		BT: Production planning
Laser sintering		RT: Lot sizing
Sputtering		Scheduling
		Supply chain management
		Supply chains
		NT: Bills of materials
Materials processing		
UF: Mineral processing		<i>Materials science</i>
BT: Production		USE: Materials science and
RT: Bonding		technology
Canning		
Corrosion inhibitors		Materials science and technology
Electrochemical deposition		UF: Materials science
Fabrication		BT: Materials, elements, and
Finishing		compounds
Foundries		RT: Austenite
Manufacturing		Crystals
Materials science and		Gases
technology		Liquids
		Materials processing
		Solid-state physics
		Solids
		NT: Absorption
		Aging
		Chemical analysis
		Computational materials
		science
		Contamination
		Degradation
		Filtration
		Hysteresis
		Impurities
		Materials handling
		Materials preparation
		Materials reliability
		Materials testing
		Metallurgy
		Microstructure
		Periodic structures
		Pigmentation
		Separation processes
		Surface engineering
processing		
	Plating	
	Pressing	
	Punching	
	Refining	
	Shearing	



JULY 2025 IEEE Thesaurus

	Surfaces		Viterbi algorithm
			Waveguide theory
Materials testing		NT:	Algebra
BT:	Materials science and		Algorithms
technology			Arithmetic
	Testing		Azimuth
NT:	Accelerated aging		Boundary value problems
	Acoustic testing		Calculus
	Adhesive strength		Chemical reaction network
	Bonding forces	theory	
	Delamination		Closed-form solutions
	Elastic recovery		Combinatorial mathematics
	Nondestructive testing		Computational efficiency
			Conformal mapping
Materials, elements, and compounds			Convergence
NT:	Atoms		Convex functions
	Chemical elements		Cyclic redundancy check
	Compounds		Dynamical systems
	Material storage		Eigenvalues and
	Materials	eigenfunctions	
	Materials science and		Equations
technology			Estimation
	Metals		Euclidean distance
			Finite difference methods
<i>Maternity benefits</i>			Finite element analysis
USE:	Employee welfare		Fourier series
			Functional analysis
Mathematical analysis			Geometry
BT:	Mathematical models		Gradient methods
NT:	Accuracy		Graph theory
	Formal concept analysis		Harmonic analysis
	Fractional calculus		Hypercomplex
	Modal analysis		Iterative methods
			Kernel
Mathematical models			Laplace equations
BT:	Mathematics		Lattices
	Modeling		Lie groups
RT:	Artificial neural networks		Limit-cycles
	Hindcasting		Linear matrix inequalities
NT:	Geometric modeling		Linear systems
	Mathematical analysis		Linearization techniques
	Optimization models		Mathematical models
	Overfitting		Mathematical programming
			Method of moments
Mathematical programming			Minimization
BT:	Mathematics		Mode matching methods
	Optimization methods		Network theory (graphs)
			Nonlinear equations
Mathematics			Nonlinear systems
RT:	Bio-inspired computing		Numerical analysis
	Econometrics		Optimization
	Maximum likelihood		Piecewise linear techniques
detection			Predator prey systems
	Metaheuristics		Probability
	STEM		Quaternions



JULY 2025 IEEE Thesaurus

	Random processes	RT:	Signal processing
	Root mean square		Statistics
	Sequences		
	Set theory	<i>Matrix laboratory</i>	
	Simulated annealing	USE:	MATLAB
	Smoothing methods		
	Spirals	Matter waves	
	Statistics	UF:	De Broglie methods
	Stochastic processes		De broglie hypothesis
	Superposition calculus	BT:	Waves
	Taylor series		
	Tensors	<i>Max-min composition</i>	
	Topology	USE:	Minimax techniques
	Transforms		
	Transmission line matrix	Maximum a posteriori estimation	
methods	Uncertain systems	UF:	Maximum a posteriori
	Utility theory	estimator	
			Maximum a posteriori
		framework	
			Maximum a posteriori
Mathematics computing		method	
BT:	Computer applications		Maximum a posteriori
RT:	Graph drawing	probability	
NT:	MATLAB		Maximum a-posteriori
			Maximum aposteriori
MATLAB			Estimation theory
UF:	Matrix laboratory	BT:	
BT:	Mathematics computing		
RT:	Computer aided instruction	<i>Maximum a posteriori estimator</i>	
	Numerical analysis	USE:	Maximum a posteriori
	Simulation	estimation	
	Software libraries		
		<i>Maximum a posteriori framework</i>	
Matrices		USE:	Maximum a posteriori
UF:	Matrix algebra	estimation	
BT:	Linear algebra		
RT:	Method of moments	<i>Maximum a posteriori method</i>	
	Mode matching methods	USE:	Maximum a posteriori
NT:	Jacobian matrices	estimation	
	Matrix decomposition		
	Singular value	<i>Maximum a posteriori probability</i>	
decomposition		USE:	Maximum a posteriori
		estimation	
<i>Matrix algebra</i>			
USE:	Matrices	<i>Maximum a-posteriori</i>	
		USE:	Maximum a posteriori
Matrix converters		estimation	
UF:	Matrix convertors		
BT:	Power conversion	<i>Maximum aposteriori</i>	
RT:	Power electronics	USE:	Maximum a posteriori
		estimation	
<i>Matrix convertors</i>			
USE:	Matrix converters	Maximum likelihood decoding	
		BT:	Decoding
Matrix decomposition		RT:	Algorithms
BT:	Matrices		



JULY 2025 IEEE Thesaurus

Maximum likelihood detection

UF: Additive metric
Complexity constrained
detection

BT: Linear filtering
Algorithms
RT: Filtering theory
Mathematics
Probability
Statistics

Maximum likelihood estimation

UF: MLE
BT: Estimation
Statistics
RT: Set theory
Tracking

Maximum likelihood linear regression

BT: Linear regression

Maximum power point trackers

UF: MPPT
Maximum power point
tracking
BT: Solar power generation
RT: Inverters
Power conversion
Solar energy

Maximum power point tracking

USE: Maximum power point
trackers

Maxwell equations

BT: Equations
RT: Electric fields
Magnetic fields
Perfectly matched layers

Maxwell-Boltzmann distribution

UF: Maxwell-Boltzmann
statistics
BT: Probability distribution

Maxwell-Boltzmann statistics

USE: Maxwell-Boltzmann
distribution

MC-CDMA

USE: Multicarrier code division
multiple access

MCCDMA

USE: Multicarrier code division
multiple access

MCDA

USE: MCDM

MCDM

UF: MCDA
Multi-criteria decision
analysis
Multi-criteria decision
making
BT: Decision making
RT: Decision analysis
Decision support systems
Operations research

MDDI

USE: Musical instrument digital
interfaces

Mean field theory

UF: MFT
Self-consistent field theory
BT: Statistical analysis
RT: Probability
Random processes
Stochastic processes
Stochastic systems

Mean square error methods

BT: Approximation methods
RT: Error analysis
Estimation theory
Least squares
approximations
NT: Least mean squares
methods

Measles

BT: Infectious diseases
RT: Viruses (medical)

Measurement

UF: Metrics
BT: Instrumentation and
measurement
RT: Containers
Data acquisition
Food security
Instruments
Measurement standards
Phase frequency detectors
Telemetry



JULY 2025 IEEE Thesaurus

	Testing		Micrometers
	Transducers		Moisture measurement
NT:	Accelerometers		Noise measurement
	Acoustic measurements		Nuclear measurements
	Antenna measurements		Optical variables
	Anthropometry	measurement	
	Area measurement		Particle beam
	Atmospheric	measurements	
measurements			Particle measurements
	Atomic measurements		Performance evaluation
	Bathymetry		Phase measurement
	Biomedical measurement		Plasma measurements
	Calorimetry		Pollution measurement
machines	Coordinate measuring		Pressure measurement
			Pulse measurements
	Cytometry		Reflectometry
	Density measurement		Replicability
	Depth measurement		Reproducibility of results
	Distance measurement		Scintillation counters
	Distortion measurement		Sea state
	Doppler measurement		Semiconductor device
	Dosimetry	measurement	
	Dynamic range		Sensitivity
measurement	Electric variables		Shape measurement
			Size measurement
	Electromagnetic		Software measurement
measurements			Soil measurements
	Environmental		Spectral efficiency
measurement			Spectroscopy
	Extraterrestrial		Thermal variables
measurements		measurement	
	Fluid flow measurement		Time measurement
	Frequency measurement		UHF measurements
	Gain measurement		Ultrasonic variables
	Gas chromatography	measurement	
	Geologic measurements		Viscosity
	Geophysical measurements		Wavelength measurement
	Height measurement		Wide area measurements
	Hydrophobicity		pH measurement
	Interferometry		
	Key performance indicator	Measurement by laser beam	
	Length measurement	BT: Measurement	
	Lifetime estimation	RT: Laser applications	
	Loss measurement	NT: Laser velocimetry	
	Lumen		
	Magnetic variables	Measurement errors	
measurement		BT: Measurement	
	Measurement by laser	RT: Error analysis	
beam			Statistical analysis
	Measurement errors		
	Measurement techniques	Measurement standards	
	Measurement uncertainty	BT: Standards categories	
	Measurement units	RT: ISO	
	Mechanical variables		Measurement
measurement			Measurement units



JULY 2025 IEEE Thesaurus

Measurement techniques

BT: Measurement
RT: Measurement uncertainty
NT: Calibration
Dynamic equilibrium

Measurement uncertainty

BT: Measurement
RT: Estimation
Measurement techniques

Measurement units

UF: Units (measurement)
BT: Measurement
RT: Measurement standards
NT: Crop yield
International System of

Units

Nanometers

Mechanical bearings

BT: Friction
RT: Ball bearings
Lubrication
Mechanical factors
NT: Rolling bearings

Mechanical cables

UF: Cables (mechanical)
BT: Cables

Mechanical energy

BT: Mechanical systems
RT: Kinetic energy
Potential energy

Mechanical engineering

BT: Engineering - general
RT: Mechanical products
Precision engineering
Pressure vessels
NT: Dynamic response
Mechanical power

transmission

Mechanical systems

Mechanical factors

UF: Mechanical properties
BT: Physics
RT: Acoustic noise
Electrostriction
Magnetomechanical effects
Mechanical bearings
Mechanical variables

control

Oils
Structural engineering
Aerodynamics
Bending
Biomechanics
Damping
Deformation
Dynamics
Fatigue
Force
Friction
Hydrodynamics
Kinematics
Lubrication
Magnetohydrodynamics
Photoelasticity
Pressure effects
Shock (mechanics)
Strain
Stress
Surface cracks
Surface stress
Torque
Vibrations
Volume relaxation
Workability

Mechanical guides

UF: Guideways (mechanical)
Slideways (mechanical)
BT: Mechanical products
RT: Machine tools
Position control

Mechanical power transmission

UF: Continuously variable
transmission
BT: Powertrain
Mechanical engineering
RT: Cams
Drives
Engines
Gears
Oils
Power systems
Shafts
NT: Torque converters

Mechanical products

UF: Ball screws
BT: Manufactured products
Production
RT: Escalators
Mechanical engineering
Structural rings



JULY 2025 IEEE Thesaurus

NT: Automotive components
 Axles
 Bellows
 Blades
 Brakes
 Couplings
 Fasteners
 Flanges
 Gears
 Hoses
 Machine components
 Mechanical guides
 Needles
 Orifices
 Pistons
 Pressure vessels
 Seals
 Springs
 Steering systems
 Structural shapes
 Tires
 Vents
 Wheels

Mechanical properties

USE: Mechanical factors

Mechanical sensors

BT: Sensors
 NT: Capacitive sensors

Mechanical splines

BT: Machine components
 RT: Gears
 Machine tool spindles
 Shafts

Mechanical stress

USE: Stress

Mechanical systems

BT: Mechanical engineering
 RT: Gears
 Mechatronics
 Microelectromechanical

devices

Pneumatic systems
 Turbomachinery
 NT: Automated parking
 Mechanical energy
 Micromechanical devices
 Suspensions (mechanical

systems)

Mechanical variables control

BT: Control systems
 RT: Flexible structures
 Frequency control
 Manipulators
 Mechanical factors
 Mobile robots
 Motor drives
 Robots
 NT: Displacement control
 Force control
 Level control
 Motion control
 Pitch control (position)
 Position control
 Shape control
 Size control
 Strain control
 Stress control
 Thickness control
 Torque control
 Velocity control
 Vibration control
 Weight control

Mechanical variables measurement

BT: Measurement
 RT: Frequency measurement
 Transducers
 NT: Angular velocity
 Displacement

measurement

Force measurement
 Motion measurement
 Position measurement
 Rotation measurement
 Strain measurement
 Stress measurement
 Thickness measurement
 Torque measurement
 Velocity measurement
 Vibration measurement
 Volume measurement
 Weight measurement

Mechanical vibrations

USE: Vibrations

Mechanism design

UF: Reverse game theory
 BT: Economics
 Game theory



JULY 2025 IEEE Thesaurus

Mechanobiology

BT: Biology
RT: Biological system modeling
Biomechanics
Cell signaling
Nanomedicine

Mechatronics

BT: Electron devices
RT: Autonomous vehicles
Control equipment
Intelligent control
Intelligent sensors
Mechanical systems
Microelectromechanical

devices

systems

Microelectromechanical
Robots
Vehicular automation
NT: Biomechatronics

Media

BT: Materials
RT: Closed captioning
Design tools
NT: Fake news
Nonhomogeneous media
Photorealism
Random media

Media Access Control

UF: MAC
MAC protocol
Media Access Protocol
Medium access control
BT: Access protocols
RT: Local area networks
Metropolitan area networks
Source address validation

Media Access Protocol

USE: Media Access Control

Media streaming

USE: Streaming media

Mediated communication

USE: Computer mediated
communication

Mediated discourse

USE: Computer mediated
communication

Mediated interaction

USE: Computer mediated
communication

Mediated technology

USE: Computer mediated
communication

Mediation

BT: Middleware

Medical computing

USE: Biomedical computing

Medical conditions

UF: Medical disorders
BT: Medical services
RT: Allergies
Anxiety disorders
NT: Acidosis
Acute respiratory distress

syndrome

Addiction
Anemia
Aneurysm
Aphasia
Arrhythmia
Atrophy
Autism
Blindness
Carpal tunnel syndrome
Cataracts
Cerebral palsy
Chronic kidney disease
Congestive heart failure
Cybersickness
Deafness
Degenerative disc disease
Dementia
Depression
Diabetes
Diseases
Drug resistance
Dyslexia
Eczema
Gastritis
Hemorrhaging
Hydrocephalus
Hypertension
Hyperthermia
Hypoxia
Infertility
Inflammatory bowel disease
Injuries
Jaundice



JULY 2025 IEEE Thesaurus

Kidney stones
Motion sickness
Muscular dystrophy
Obesity
Paralysis
People with disabilities
Pregnancy
Psoriasis
Scoliosis
Sepsis
Sleep apnea
Spasticity
Stroke (medical condition)
Thrombosis
Tumors
Visual impairment

Medical control systems

BT: Control systems
RT: Assistive technologies
Biomedical equipment
Orthotics
Prosthetics

Medical devices

BT: Biomedical equipment
RT: Biocompatibility
Biomedical communication
Continuous glucose

monitoring

Medical diagnosis

UF: Diagnosis (medical)
Medical diagnostics
Patient diagnosis
BT: Medical services
RT: Biomedical imaging
Diagnostic radiography
Diseases
Electroencephalography
Electrophoresis
Medical expert systems
Occupational medicine
Radiography
Translational research
NT: Autopsy
Bronchoscopy
Cardiac catheterization
Colonography
Computer aided diagnosis
Differential diagnosis
Medical signal detection
Nanomedicine
Plethysmography
Sensitivity and specificity

Medical diagnostic imaging

BT: Biomedical imaging
RT: Cancer
Magnetic particle imaging
Positron emission

tomography

Solid scintillation detectors
Tumors
NT: Anatomical structure
Radionuclide imaging

Medical diagnostics

USE: Medical diagnosis

Medical disorders

USE: Medical conditions

Medical equipment

USE: Biomedical equipment AND
Medical instruments

Medical expert systems

BT: Biomedical computing
Expert systems
RT: Medical diagnosis
Medical treatment

Medical image processing

USE: Biomedical image
processing

Medical imaging

USE: Biomedical imaging

Medical information systems

BT: Biomedical computing
Computer applications
Information systems
NT: Electronic medical records

Medical instruments

UF: Medical equipment
BT: Biomedical equipment
Instruments

Medical robotics

UF: Medical robots
Robot assisted surgery
Robot-assisted surgery
Surgical robotics
Surgical robots
BT: Robots
RT: Biomedical equipment
Biomedical image

processing



JULY 2025 IEEE Thesaurus

	Endomicroscopy	Medical simulation	
	Kinematics	BT:	Simulation
	Manipulators		
	Motion control	Medical specialties	
	Position control	BT:	Engineering in medicine
	Soft robotics	and biology	
	Telerobotics	NT:	Anesthesiology
	Wearable robots		Cardiology
NT:	Assistive robots		Dermatology
			Embryology
<i>Medical robots</i>			Emergency medicine
USE:	Medical robotics		Endocrinology
			Gastroenterology
Medical services			Gerontology
UF:	Doctor		Gynecology
	Emergency medical		Hematology
services			Immunology
	Health care		Neonatology
	Healthcare		Nephrology
	Nursing		Neurology
	Physician		Obstetrics
BT:	Engineering in medicine		Oncology
and biology			Ophthalmology
RT:	Behavioral sciences		Otorhinolaryngology
	Chemotherapy		Pathology
	Emergency services		Pediatrics
	Translational research		Pharmacology
NT:	Assisted living		Psychiatry
	Catheterization		Pulmonology
	Clinical diagnosis		Radiology
	Cybercare		Rheumatology
	Electronic healthcare		Urology
	Health information		
management		Medical tests	
	Hospitals	BT:	Medical services
	In vitro	RT:	Cytometry
	In vivo		Mammography
	Internet of Medical Things	NT:	Amniocentesis
	Medical conditions		Biopsy
	Medical diagnosis		Cancer detection
	Medical tests		Colonoscopy
	Medical treatment		Pregnancy test
	Occupational medicine		
	Organ transplantation	Medical treatment	
	Point of care	UF:	Patient identification
	Prosthetics		Patient treatment
	Public healthcare		Therapy
	Sensory aids	BT:	Medical services
	Smart healthcare	RT:	Biohazards
	Vaccines		Biomedical applications of
	X-rays	radiation	
			Internet of Medical Things
Medical signal detection			Medical expert systems
BT:	Medical diagnosis		Medicinal plants
			Occupational medicine



JULY 2025 IEEE Thesaurus

NT: Psychiatry
Acupuncture
Amputation
Anesthesia
Angioplasty
Brachytherapy
Brain stimulation
Cancer treatment
Chemotherapy
Clinical trials
Cryotherapy
Defibrillation
Dentistry
Electrical stimulation
Electronic medical
prescriptions
Electroporation
Electrosurgery
Embolization
Fibrillation
Geriatrics
Hepatectomy
Hospitals
Hyperthermia
Immunotherapy
Intubation
Lithotripsy
Magnetic stimulation
Neuromuscular stimulation
Neutron capture therapy
Noninvasive treatment
Orthopedic procedures
Orthotics
Palliative care
Patient rehabilitation
Pharmaceuticals
Precision medicine
Proton therapy
Surgery

Medicinal plants

BT: Plants (biology)
RT: Drugs
Medical treatment

Medium access control

USE: Media Access Control

Medium resolution imaging spectrometer

USE: MERIS

Medium voltage

UF: Medium-voltage
BT: Voltage measurement

Medium-voltage

USE: Medium voltage

Meeting planning

BT: Planning

Meetings

UF: Technical meetings

BT: Professional

communication

RT: Public speaking

Teleconferencing

Video conferencing

NT: Conferences

Meetings (technical)

USE: Conferences

Mel frequency cepstral coefficient

UF: MFCC

Mel-frequency cepstral

coefficient

BT: Cepstral analysis

Mel-frequency cepstral coefficient

USE: Mel frequency cepstral

coefficient

Melanoma

BT: Skin cancer

Melittology

USE: Apicology

Melt processing

BT: Manufacturing systems

Materials processing

RT: Die casting

Smelting

NT: Vacuum arc remelting

Membrane potentials

UF: Membrane voltage

Transmembrane potential

BT: Cells (biology)

RT: Action potentials

Neurons

Membrane voltage

USE: Membrane potentials

Membranes

USE: Biomembranes



JULY 2025 IEEE Thesaurus

Memetics

BT: Evolution (biology)
RT: Cultural differences
Genetics

Memory management

Memory resistors

USE: Memristors

Memoirs

USE: Autobiographies

Memoryless channel

USE: Memoryless systems

Memory

UF: Data storage
BT: Computers and information

processing

RT: CMOS memory circuits
Cognitive load
Memory architecture
Phase change materials
Recording

NT: Analog memory
Associative memory
Cache memory
Content addressable

storage

Flash memories
Magnetic memory
Memory management
Nonvolatile memory
Phase change memory
Random access memory
Read only memory
Read-write memory
Registers
Scanning probe data

storage

Semiconductor memory

Memory architecture

BT: Computer architecture
RT: Memory
Memory management

Memory management

UF: Garbage collection
(computers)
BT: Computer architecture
Memory
RT: Memory architecture
Memory modules
Storage management
NT: In-memory computing
Neural network

compression

Memory modules

BT: Printed circuits
RT: Integrated circuits

Memoryless systems

UF: Memoryless channel
BT: Probability

Memristor circuits

USE: Memristors

Memristors

UF: Memory resistors
Memristor circuits
BT: Resistors
RT: Neuromorphic engineering
Resistive RAM

MEMS

USE: Microelectromechanical
systems

MEMS switches

USE: Microswitches

Mental disorders

UF: Mental illness
BT: Psychiatry
RT: People with disabilities
Schizophrenia
NT: Anxiety disorders
Eating disorders

Mental health

BT: Human factors
Psychology
RT: Anxiety disorders
Behavioral sciences

Mental illness

USE: Mental disorders

Mental models

USE: Cognitive science

Mentoring

BT: Career development
RT: Training

Mercury (metals)

UF: Hg



JULY 2025 IEEE Thesaurus

BT: Chemical elements
Metals

Mercury (planets)
BT: Planets

Mergers
USE: Corporate acquisitions

Merging
BT: Data handling
RT: Sorting

MERIS
UF: Medium resolution imaging spectrometer
BT: Spectroscopy

MERIT
USE: Magneto electrical resistivity imaging technique

Merit pay
USE: Incentive schemes

Mesencephalon
USE: Midbrain

MESFET circuits
BT: FET circuits
RT: MESFETs
NT: MESFET integrated circuits

MESFET integrated circuits
BT: FET integrated circuits
Integrated circuits
MESFET circuits
RT: MESFETs
NT: Microwave FET integrated circuits

MESFETs
UF: Schottky FETs
BT: Field effect transistors
RT: MESFET circuits
MESFET integrated circuits
Schottky barriers
NT: Microwave FETs

Mesh generation
BT: Computer displays
RT: Computer graphics

Mesh networks
BT: Ad hoc networks

Mesons
UF: Kaons
Muons
Pions
BT: Elementary particles
RT: Cosmic rays

Mesoporous
USE: Mesoporous materials

Mesoporous materials
UF: Mesoporous
BT: Materials
RT: Electrocatalysts

Message authentication
UF: Data authentication
BT: Data security
RT: Cryptography
Digital signatures
Message systems
Steganography

Message passing
BT: Distributed processing
RT: Belief propagation

Message services
UF: Messaging service
WeChat
BT: Web services

Message systems
BT: Communications technology
RT: Cluster computing
Digital signatures
Message authentication
Electronic mail
Electronic messaging
Postal services
Publish subscribe systems
Voice mail

Message-oriented middleware
BT: Middleware

Messaging service
USE: Message services

Meta cognition
USE: Metacognition

Meta data
USE: Metadata



JULY 2025 IEEE Thesaurus

<i>Meta heuristics</i>			Meta-heuristics
USE:	Metaheuristics	BT:	Metaheuristic algorithms
			Algorithmic efficiency
<i>Meta search</i>		RT:	Optimization
USE:	Metasearch		Ant colony optimization
			Evolutionary computation
<i>Meta verse</i>			Genetic algorithms
USE:	Metaverse		Heuristic algorithms
			Mathematics
<i>Meta-cognition</i>			Particle swarm optimization
USE:	Metacognition		Search problems
			Simulated annealing
<i>Meta-heuristics</i>		NT:	Quantum annealing
USE:	Metaheuristics		
<i>Meta-modeling</i>		Metal cutting tools	
USE:	Metamodeling	BT:	Cutting tools
<i>Meta-search</i>		Metal enclosures	
USE:	Metasearch	BT:	Metal products
<i>Metabolic networks</i>		Metal foam	
USE:	Biochemistry	BT:	Materials
		RT:	Lightweight structures
Metabolism			Metals
BT:	Biochemistry		Polymer foams
	Physiology		
Metabolomics		<i>Metal oxide semiconductor heterojunction FETs</i>	
BT:	Molecular biomarkers	USE:	MOSHFETs
Metacognition		Metal product industries	
UF:	Meta cognition	BT:	Manufacturing industries
	Meta-cognition	RT:	Metal products
BT:	Cognition		
Metacomputing		Metal products	
BT:	Distributed computing	BT:	Manufactured products
NT:	Grid computing	RT:	Ball bearings
			Blanking
Metadata			Metal product industries
UF:	Meta data		Metals industry
BT:	Data models		Swaging
RT:	Image annotation	NT:	Metal enclosures
	Linked data		
NT:	Annotations		
Metagenomics		<i>Metal vapor lasers</i>	
BT:	Genomics	USE:	Gas lasers
<i>Metaheuristic algorithms</i>		Metal-insulator structures	
USE:	Metaheuristics	BT:	Insulators
		RT:	Electrodes
			MIS devices
			MOS integrated circuits
		NT:	MIM capacitors
			MIM devices
Metaheuristics		<i>Metal-insulator-metal capacitors</i>	
UF:	Meta heuristics	USE:	MIM capacitors



JULY 2025 IEEE Thesaurus

Metal-insulator-metal devices

USE: MIM devices

Metal-insulator-semiconductor devices

USE: MIS devices

Metal-oxide semiconductor field effect transistor

USE: MOSFET circuits

Metal-oxide semiconductors

USE: MOS devices

Metal-oxide-nitride-oxide-semiconductors

USE: MONOS devices

Metal-oxide-nitride-oxide-silicon

USE: MONOS devices

Metal-oxide-semiconductor devices

USE: MOS devices

Metal-semiconductor interfaces

USE: Semiconductor-metal
interfaces

Metallic materials

BT: Materials

RT: Cermet

Metallic superlattices

BT: Superlattices

Metallisation

USE: Metallization

Metallization

UF: Metallisation

BT: Metals

RT: Wiring

NT: Integrated circuit

metallization

Metallurgy

BT: Materials science and
technology

RT: Iron alloys
Metals

Metalorganic vapor deposition

USE: MOCVD

Metals

UF: Alloys

BT: Materials, elements, and
compounds

RT:

Blanking

Die casting

Filler metals

Inorganic compounds

Metal foam

Metallurgy

Metalworking machines

NT:

Alloying

Aluminum

Barium

Bismuth

Boron

Cadmium

Calcium

Chromium

Cobalt

Copper

Digital alloys

Erbium

Gallium

Germanium

Gold

Hafnium

Indium

Iron

Lanthanum

Lead

Lithium

Magnesium

Manganese

Mercury (metals)

Metallization

Neodymium

Nickel

Niobium

Palladium

Platinum

Rare earth metals

Samarium

Silver

Steel

Strontium

Tin

Titanium

Tungsten

Yttrium

Zinc

Metals industry

UF:

Aluminium industry

Aluminum industry

BT:

Industries

RT:

Metal products

Smelting



JULY 2025 IEEE Thesaurus

Metalworking machines

BT: Machine tools
RT: Cutting tools
Materials processing
Metals

Metamaterial cloaking

USE: Optical cloaking

Metamaterials

UF: Acoustic metamaterials
Left handed materials
Left-handed materials

BT: Materials
RT: Metasurfaces
Nanocomposites
Optical materials
Refractive index
Smart materials
Split ring resonators
NT: Electromagnetic

metamaterials

Optical cloaking
Optical metamaterials

Metamodeling

UF: Meta-modeling
BT: Modeling

Metamorphic HEMTs

USE: mHEMTs

Metasearch

UF: Federated search
Federated searching
Meta search
Meta-search
BT: Search methods
RT: Triples (Data structure)
Web search

Metastasis

UF: Metastatic disease
BT: Cancer
RT: Diseases

Metastatic disease

USE: Metastasis

Metasurfaces

BT: Surfaces
RT: Metamaterials
Thin films

Metaverse

UF: Meta verse
BT: Virtual environments
RT: Augmented reality
Avatars
Blockchains
Games
Three-dimensional displays
User experience
User interfaces
Virtual reality

Meteorites

BT: Meteoroids
RT: Space debris

Meteoroids

BT: Asteroids
Comets
RT: Space debris
NT: Meteorites
Meteors

Meteorological factors

BT: Geoscience
RT: Fading channels
Multipath channels

Meteorological radar

UF: Radar meteorology
BT: Radar
RT: Backscatter
Radar imaging

Meteorology

UF: Climate
Weather
BT: Geophysics
RT: Air pollution
Atmosphere
Atmospheric

measurements

Barometers
Climatology
Data assimilation
Environmental factors
Ice
Ionosphere
Pressure effects
Remote sensing
Terrestrial atmosphere
NT: Climate variability
Droughts
Humidity
Ice accretion



JULY 2025 IEEE Thesaurus

	Lightning	RT:	Boundary-element methods
	Monsoons		Integral equations
	Precipitation		Matrices
	Storms		
	Weather forecasting	<i>Method-of-moments</i>	
	Weather modification	USE:	Method of moments
	Wind		
Meteors		<i>Methyl alcohol</i>	
BT:	Meteoroids	USE:	Methanol
RT:	Comets		
Meter reading		<i>Metrics</i>	
BT:	Power system	USE:	Measurement
measurements			
NT:	Automatic meter reading	<i>Metro area networks</i>	
	Smart meters	USE:	Metropolitan area networks
Meters		Metrology	
BT:	Instruments	BT:	Science - general
NT:	Dynamometers	NT:	Optical metrology
	Flowmeters		
	Goniometers	Metropolitan area networks	
	Potentiometers	UF:	Metro area networks
	Radiometers	BT:	Communication systems
	Tachometers		Computer networks
	Vibrometers		Digital systems
	Voltmeters	RT:	Distributed computing
	Wattmeters		IEEE 802.16 Standard
			Internetworking
			LAN interconnection
			Media Access Control
Methane			Multiprocessor
BT:	Natural gas	interconnection	
RT:	Anaerobic digestion		Open systems
	Carbon emissions		Protocols
	GOSAT		Regional area networks
	Greenhouse gases		Token networks
Methanol		<i>Metropolitan areas</i>	
UF:	Carbinol	USE:	Urban areas
	Methyl alcohol		
	Wood alcohol	<i>MFCC</i>	
	Wood naphtha	USE:	Mel frequency cepstral
	Wood spirits	coefficient	
BT:	Chemical compounds	<i>MFT</i>	
RT:	Anti-freeze	USE:	Mean field theory
	Fuels		
	Solvents	<i>Mg</i>	
Method of moments		USE:	Magnesium
UF:	Galerkin method		
	Method-of-moments	<i>MgO</i>	
	MoM	USE:	Magnesium oxide
	Moment methods		
BT:	Mathematics	<i>MHD</i>	
	Numerical analysis	USE:	Magnetohydrodynamics



JULY 2025 IEEE Thesaurus

mHEMTs

UF: Metamorphic HEMTs
BT: HEMTs

MIB

USE: Management information
base

MIC

USE: Microwave integrated
circuits

Mice

UF: Mouse
BT: Animals

Mice flows

USE: Communication system
traffic AND
Computer networks

Micro air vehicles

USE: Autonomous aerial vehicles

Micro computers

USE: Microcomputers

Micro-computers

USE: Microcomputers

Micro-electro-mechanical devices

USE: Microelectromechanical
devices

Micro-electro-mechanical systems

USE: Microelectromechanical
systems

Micro-electromechanical devices

USE: Microelectromechanical
devices

Micro-electromechanical systems

USE: Microelectromechanical
systems

Micro-hydro

USE: Microhydro power

Micro-mirrors

USE: Micromirrors

Micro-optical components

USE: Microoptics

Micro-optical/mechanical devices

USE: Microoptics

Microactuators

BT: Actuators
Microelectromechanical
devices

RT: Microrelays

Microarchitecture

BT: Software architecture

Microassembly

UF: Die attach
Die bonding
Assembly
BT: Flip-chip devices
RT: Integrated circuit

manufacture

Micromachining
Semiconductor device

manufacture

Microbial eletrolysis cells

USE: Fuel cells

Microbial fuel cells

USE: Fuel cells

Microbiology

BT: Biology
NT: Electroporation
Virology
Virulence

Microbiome

BT: Microorganisms
RT: Digestive system
Immune system
Pathogens

Microcavities

BT: Optical resonators
RT: Cavity resonators
Light emitting diodes
Microoptics
Photoluminescence
Spontaneous emission
Whispering gallery modes

Microcell networks

UF: Microcells
Small cell networks
BT: Cellular networks
RT: Ultra-dense networks



JULY 2025 IEEE Thesaurus

Microcells

USE: Microcell networks

Microchannels

BT: Hydraulic diameter

Microchip lasers

BT: Solid lasers

Microchips

USE: Integrated circuits

Microcomputers

UF: Laptops
Micro computers
Micro-computers
Minicomputers
Personal computers
BT: Computers
RT: Consumer electronics
Home computing
Mainframes
Microprocessors
Office automation
NT: Portable computers
Workstations

Microcontact printing

USE: Soft lithography

Microcontrollers

BT: Control equipment
Microprocessors
RT: CMOS technology
Control systems
High-speed integrated

circuits

Neurocontrollers
System-on-chip
Tiny machine learning

Microdisplays

BT: Displays
RT: Liquid crystal devices
Liquid crystal on silicon
Microoptics

Microeconomics

BT: Economics
RT: Linear programming
Monopoly
Oligopoly
Supply and demand
NT: Economies of scale
Industrial economics

Microelectrodes

BT: Electrodes
RT: Neurophysiology
Neurostimulation

Microelectromechanical devices

UF: Micro-electro-mechanical

devices Micro-electromechanical

devices

BT: Microelectromechanical
systems

RT: Magnetic particles
Mechanical systems
Mechatronics
Micromachining
Microsensors
NT: Microactuators
Micromotors
Micropumps
Microvalves

Microelectromechanical systems

UF: MEMS
Micro-electro-mechanical

systems

Micro-electromechanical

systems

BT: Electron devices
RT: Mechatronics
Nanoelectromechanical

systems

NT: Microelectromechanical

devices

Radiofrequency
microelectromechanical systems

Microelectronic implants

BT: Implants

Microelectronic stimulation

USE: Electrical stimulation

Microelectronics

BT: Electronic equipment
RT: Integrated circuits

Microfabrication

BT: Fabrication
Micromechanical devices
RT: Fiducial markers
Nanotechnology



JULY 2025 IEEE Thesaurus

Microfiltration

BT: Filtration
RT: Contamination

Microfluidics

BT: Electron devices
Fluidics
RT: Biochips
Biomedical engineering
Fluidic microsystems
Hydrodynamics

Micrographs

USE: Photomicrography

Microgrids

BT: Power grids
RT: Distributed power
generation
Power distribution networks
Power generation
Power system management
Power system reliability
Smart grids

Microgrippers

USE: Grippers

Microhydro power

UF: Micro-hydro
BT: Hydroelectric power
generation
RT: Appropriate technology

Microinjection

BT: Biology

Microinverters

BT: Inverters
RT: DC-AC power converters
Solar panels
Solar power generation

Micromachining

BT: Electronic equipment
manufacture
RT: Electrochemical machining
Embossing
Etching
Integrated circuit
manufacture
Microassembly
Microelectromechanical
devices

Semiconductor device

manufacture

Micromagnetics

BT: Magnets

Micromanipulators

BT: Manipulators

Micromechanical devices

UF: Micromechanical systems
Microsystems
BT: Electron devices
Mechanical systems
RT: Microoptics
Nanogenerators
NT: Biomedical
microelectromechanical systems
Fluidic microsystems
Microfabrication

Micromechanical systems

USE: Micromechanical devices

Micrometers

UF: Micrometres
Micrometry
Microns
BT: Measurement
RT: Distance measurement
Interferometry
Length measurement
Strain measurement
Thickness measurement

Micrometres

USE: Micrometers

Micrometry

USE: Micrometers

Micromirrors

UF: Digital micromirror devices
Micro-mirrors
BT: Microoptics
Mirrors
RT: Optical arrays
Optical projectors

Micromobility

BT: Shared transport
RT: Bicycles
Motorcycles



JULY 2025 IEEE Thesaurus

Micromotors

BT: Microelectromechanical devices

Motors
Rotating machines

NT: Hydrophones
Microphone arrays

Microphotographs

USE: Photomicrography

Microns

USE: Micrometers

Microphotography

USE: Photomicrography

Microoptical components

USE: Microoptics

Microprocessor chips

BT: Microprocessors

RT: Flip-chip devices

Substrates

Yield estimation

NT: AI accelerators

Microoptics

UF: Micro-optical components
Micro-opticalmechanical

devices

BT: Microoptical components
Optics
RT: Integrated optics
Integrated optoelectronics
Microcavities
Microdisplays
Micromechanical devices
Microswitches
NT: Micromirrors

Microprocessors

BT: Circuits
Integrated circuits
RT: CMOS technology
Embedded systems
Flip-chip devices
Microcomputers
Processor scheduling
System-on-chip
NT: Automatic logic units
Biomimetics
Coprocessors
Microcontrollers
Microprocessor chips
Vector processors

Microorganisms

UF: Viruses (microorganisms)
BT: Organisms
RT: Antibodies
Biological cells
Immune system
Molecular biophysics
Paleontology
NT: Adenoviruses
Anaerobic digestion
Bacteria
Biochemical oxygen

demand

Biofilms
Fungi
Microbiome
Viruses (medical)

Microprogramming

UF: Firmware
BT: Programming
RT: Computer architecture
Software

Micropumps

BT: Microelectromechanical devices
Pumps

Micropayments

BT: Financial services
Online banking
RT: Blockchains
Cryptocurrency

Microrelays

BT: Relays
RT: Microactuators

Microsatellites

USE: Small satellites

Microphone arrays

BT: Microphones

Microscopy

BT: Imaging
Instruments
RT: Optical imaging
NT: Atomic force microscopy

Microphones

BT: Audio systems



JULY 2025 IEEE Thesaurus

microscopy	Electron microscopy	RT:	Microwave communication
	Endomicroscopy		
	Immunofluorescence	<i>Microstrip lines</i>	
	Scanning microwave	USE:	Microstrip
	Scanning probe microscopy	Microstrip resonators	
		BT:	Microstrip components
		RT:	Resonance
Microsensors		Microstructure	
BT:	Electromechanical sensors	BT:	Materials science and
RT:	Control systems	technology	
	Microelectromechanical	RT:	Crystal microstructure
devices			
	Wireless sensor networks		
		<i>Microstructured fibers</i>	
Microservice architectures		USE:	Photonic crystal fibers
BT:	Service-oriented		
architecture		<i>Microstructured fibres</i>	
		USE:	Photonic crystal fibers
<i>Microsoft Excel</i>			
USE:	Spreadsheet programs		
<i>Microsoft Windows</i>		Microsurgery	
USE:	Operating systems	BT:	Surgery
		Microswitches	
Microstrip		UF:	MEMS switches
UF:	Microstrip lines	BT:	Switches
BT:	Planar transmission lines	RT:	Microoptics
RT:	Broadband antennas		
NT:	Microstrip components	<i>Microsystems</i>	
		USE:	Micromechanical devices
Microstrip antenna arrays		<i>Microtransit</i>	
UF:	Microstrip arrays	USE:	Shared transport
BT:	Antenna arrays		
RT:	Antennas	Microvalves	
	Aperture coupled antennas	BT:	Microelectromechanical
	Microstrip antennas	devices	
			Valves
Microstrip antennas		Microwave ablation	
BT:	Antennas	BT:	Cancer treatment
RT:	Aperture coupled antennas		Microwave technology
	Microstrip antenna arrays		
	Patch antennas	Microwave amplifiers	
<i>Microstrip arrays</i>		BT:	Microwave devices
USE:	Microstrip antenna arrays		
		Microwave antenna arrays	
Microstrip components		BT:	Antenna arrays
BT:	Microstrip		
RT:	Power combiners	Microwave antennas	
	Power dividers	BT:	Antennas
	Thick film inductors		
NT:	Microstrip resonators	Microwave bands	
		BT:	Microwave technology
Microstrip filters		NT:	C-band
BT:	Filters		



JULY 2025 IEEE Thesaurus

K-band
Ka-band
Ku-band
L-band

NT: High power microwave generation
Microwave heating
USE: Electromagnetic heating

Microwave circuits

BT: Circuits
Microwave technology
RT: Analog circuits
Distributed parameter
circuits
Microwave devices
Microwave integrated
circuits
Microwave photonics

Microwave communication

BT: Communication systems
Microwave technology
RT: Microstrip filters
Microwave photonics
NT: Rectennas

Microwave devices

BT: Microwave technology
RT: Electromagnetic
waveguides
Microwave circuits
Microwave photonics
Photonic crystals
Superconducting
microwave devices
NT: Masers
Microwave amplifiers
Microwave filters
Microwave transistors

Microwave FET integrated circuits

BT: MESFET integrated circuits
RT: Microwave FETs

Microwave FETs

BT: MESFETs
Microwave transistors
RT: Microwave FET integrated
circuits

Microwave filters

BT: Microwave devices

Microwave frequencies

BT: Microwave measurement

Microwave generation

BT: Microwave technology

Microwave imaging

BT: Imaging
RT: Remote sensing

Microwave integrated circuits

UF: MIC
BT: Integrated circuits
RT: Analog integrated circuits
Microwave circuits
NT: MMICs

Microwave lasers

USE: Masers

Microwave magnetics

BT: Magnetics

Microwave measurement

BT: Electromagnetic
measurements
RT: Microwave technology
NT: Microwave frequencies

Microwave metamaterials

BT: Electromagnetic
metamaterials
RT: Split ring resonators

Microwave oscillators

BT: Oscillators

Microwave ovens

BT: Consumer electronics
Consumer products
Home appliances
Ovens

Microwave photonics

BT: Microwave technology
Photonics
RT: Electro-optic modulators
Elementary particles
Integrated optoelectronics
Microwave circuits
Microwave communication
Microwave devices
Optical modulation



JULY 2025 IEEE Thesaurus

Microwave plasmas

BT: Electromagnetic scattering
Plasmas

RT: Forebrain
Hindbrain

Microwave propagation

BT: Electromagnetic
propagation
RT: Broadband antennas
Electromagnetic
waveguides

Microwave radar

USE: Radar

Microwave radiometry

BT: Radiometry

Microwave sensors

BT: Microwave technology

Microwave technology

BT: Microwave theory and
techniques
RT: Microwave measurement
Radar
NT: Baluns
Beam steering
Circulators
Masers
Microwave ablation
Microwave bands
Microwave circuits
Microwave communication
Microwave devices
Microwave generation
Microwave photonics
Microwave sensors

Microwave theory and techniques

NT: Microwave technology
Millimeter wave technology
Submillimeter wave

technology

Microwave transistors

BT: Microwave devices
NT: Microwave FETs

Microwave-assisted magnetic recording

BT: Magnetic recording

Midbrain

UF: Mesencephalon
BT: Brain
Central nervous system

Middleboxes

BT: Computer network
management
Internet

Middleware

BT: Client-server systems
Software
RT: Computer applications
Computer networks
Internet of Things
Publish subscribe systems
Mediation
Message-oriented
middleware
Web services

Mie scattering

BT: Electromagnetic scattering
RT: Electromagnetic analysis
Electromagnetic fields
Electromagnetic forces
Electromagnetic
measurements
propagation
Electromagnetic

Migraine

BT: Neurological diseases

Mil standards

USE: Military standards

Military aircraft

BT: Military equipment
RT: Aircraft
Hyperspectral sensors
Military robotics
NT: Payloads

Military command and control

USE: Command and control
systems

Military communication

BT: Communication systems
RT: Air to ground
communication
Command and control
systems
Cross layer design
Electronic countermeasures



JULY 2025 IEEE Thesaurus

communication
NT: Hyperspectral sensors
Military satellites
Ultra wideband
Reconnaissance

Military computing

BT: Computer applications
RT: Military systems
Mobile computing

Military control

BT: Military systems

Military equipment

systems
BT: Aerospace and electronic
RT: Defense industry
Explosion protection
Ground support
Landmine detection
Magnetic anomaly

detectors

Military systems
Night vision
Open area test sites
Wearable robots
NT: Military aircraft
Military satellites
Military vehicles
Weapons

Military robotics

BT: Military systems
Robots
RT: Autonomous aerial vehicles
Autonomous underwater

vehicles

Military aircraft
Military vehicles
Mobile robots
Underwater vehicles
Wearable robots

Military satellites

BT: Artificial satellites
Military equipment
RT: Global Positioning System
Hyperspectral sensors
Military communication

Military standards

UF: Mil standards
BT: Standards categories

Military systems

theory
BT: Systems engineering and
RT: Aerospace control
Autonomous aerial vehicles
Command and control

systems

Helicopters
Marine technology
Military computing
Military equipment
Military vehicles
Weapons
Wearable robots
NT: Military control
Military robotics

Military vehicles

BT: Military equipment
Vehicles
RT: Marine robots
Military robotics
Military systems

Milk

USE: Dairy products

Millennial generation

USE: Millennials

Millennials

UF: Generation Y
Millennial generation
BT: Social groups

Millimeter wave circuits

UF: Millimeter-wave circuits
BT: Circuits
Millimeter wave technology
RT: Analog circuits
Distributed parameter

circuits

Millimeter wave devices
NT: Millimeter wave integrated

circuits

Millimeter wave communication

UF: Millimeter-wave
communication
BT: Radio communication
RT: Millimeter wave
propagation



JULY 2025 IEEE Thesaurus

Millimeter wave devices

UF: Millimeter-wave devices
BT: Millimeter wave technology
RT: Millimeter wave circuits
Millimeter wave integrated

circuits

NT: Millimeter wave transistors

Millimeter wave integrated circuits

UF: Millimeter-wave integrated
circuits
BT: Circuits
Integrated circuits
Millimeter wave circuits
Millimeter wave technology
RT: Analog integrated circuits
Millimeter wave devices
NT: MIMICs

Millimeter wave measurements

UF: Millimeter-wave
measurements
BT: Electromagnetic
measurements
RT: Millimeter wave technology

Millimeter wave monolithic integrated circuits

USE: MIMICs

Millimeter wave propagation

UF: Millimeter-wave
propagation
BT: Electromagnetic
propagation
RT: Millimeter wave
communication

Millimeter wave radar

UF: Millimeter-wave radar
BT: Millimeter wave technology
Radar

Millimeter wave technology

UF: Millimeter-wave technology
BT: Microwave theory and
techniques
RT: Millimeter wave
measurements
NT: Millimeter wave circuits
Millimeter wave devices
Millimeter wave integrated
circuits
Millimeter wave radar

Millimeter wave transistors

UF: Millimeter-wave transistors
BT: Millimeter wave devices
Transistors

Millimeter-wave circuits

USE: Millimeter wave circuits

Millimeter-wave communication

USE: Millimeter wave
communication

Millimeter-wave devices

USE: Millimeter wave devices

Millimeter-wave integrated circuits

USE: Millimeter wave integrated
circuits

Millimeter-wave measurements

USE: Millimeter wave
measurements

Millimeter-wave monolithic integrated circuits

USE: MIMICs

Millimeter-wave propagation

USE: Millimeter wave
propagation

Millimeter-wave radar

USE: Millimeter wave radar

Millimeter-wave technology

USE: Millimeter wave technology

Millimeter-wave transistors

USE: Millimeter wave transistors

Millimicron

USE: Nanometers

Milling

BT: Machining
RT: Boring
Milling machines

Milling machines

BT: Machine tools
RT: Ball milling
Cutting tools
Milling



JULY 2025 IEEE Thesaurus

MIM capacitors

UF: Metal-insulator-metal
capacitors
BT: Metal-insulator structures

MIM devices

UF: Metal-insulator-metal
devices
BT: Metal-insulator structures
RT: Semiconductor-insulator
interfaces

MIMICs

UF: Millimeter wave monolithic
integrated circuits
integrated circuits
BT: Millimeter wave integrated
circuits
circuits
Monolithic integrated
RT: MMICs
Radiofrequency integrated
circuits

MIMO

UF: MIMO systems
Multiple antenna systems
Multiple input multiple
output
Multiple input multiple
output systems
Multiple-input multiple-
output
Multiple-input multiple-
output systems
Multiple-input-multiple-
output
Multivariable systems
BT: Communications
technology
RT: Wireless communication
3G mobile communication
Control systems
IEEE 802.11 Standard
IEEE 802.11n Standard
IEEE 802.16 Standard
MISO
Multipath channels
NOMA
OFDM
Optimization methods
Radio communication
SIMO
SISO

NT: Massive MIMO
Rician channels

MIMO radar

BT: Multistatic radar

MIMO systems

USE: MIMO

Mind-machine interfaces

USE: Brain-computer interfaces

Mineral processing

USE: Materials processing

Mineral resources

BT: Minerals

Mineralization

BT: Minerals

Minerals

BT: Geology
NT: Mineral resources
Mineralization
Ores
Salt

Miniaturized satellites

USE: Small satellites

Minicomputers

USE: Microcomputers

Minimally invasive surgery

UF: Laparoscopic surgery
BT: Surgery
RT: Concentric tube robots
Laparoscopes

Minimax techniques

UF: Max-min composition
Minimax techniques
BT: Statistics
RT: Artificial intelligence
Game theory
Minimization methods

Minimisation

USE: Minimization

Minimisation methods

USE: Minimization methods



JULY 2025 IEEE Thesaurus

Minimization

UF: Minimisation
BT: Mathematics
RT: Optimization
NT: Minimization methods

strain

Magnetic field induced

Misinformation

USE: Fake news

Minimization methods

UF: Minimisation methods
BT: Minimization
RT: Approximation methods
Minimax techniques

MISO

UF: multiple input single-output
multiple-input single output
multiple-input single-output
BT: Communications

technology

RT: Wireless communication
MIMO
SIMO
SISO

Minimum analog-digital integrated circuits

USE: Analog-digital integrated circuits

Mining equipment

BT: Production equipment
RT: Mining industry

Missile control

BT: Control systems

Mining industry

BT: Industries
RT: Excavation
Fracking
Fuel processing industries
Geoengineering
Hyperspectral sensors
Mining equipment
Raw materials
NT: Coal mining

Missile guidance

BT: Missiles
RT: Target recognition

Missiles

UF: Torpedoes
BT: Weapons
RT: Aerospace control
Ground support
Hypersonic vehicles
NT: Missile guidance

Minimax techniques

USE: Minimax techniques

Mission critical systems

UF: Mission-critical systems
BT: Contingency management

Mirrors

BT: Optical devices
RT: Optical materials
Optical reflection
Reflection
NT: Distributed Bragg reflectors
Micromirrors

Mission-critical systems

USE: Mission critical systems

MIS devices

UF: Metal-insulator-semiconductor devices
BT: Semiconductor devices
RT: Metal-insulator structures
Semiconductor-insulator
interfaces
NT: Charge coupled devices
MOS devices

Mitochondria

UF: Mitochondrion
BT: Cells (biology)

Mitochondrion

USE: Mitochondria

Mitral valves

USE: Heart valves

Mixed analog digital integrated circuits

USE: Mixed analog-digital integrated circuits

MISFETs

BT: Field effect transistors
RT: CMOSFET logic devices



JULY 2025 IEEE Thesaurus

Mixed analog-digital integrated circuits

UF: Mixed analog digital integrated circuits
BT: Analog-digital integrated circuits
RT: Analog processing circuits
System-on-chip

Mixed convection

USE: Convection

Mixed integer linear programming

UF: Mixed-integer linear programming
BT: Integer linear programming

Mixed reality

BT: Simulation
RT: Augmented reality
Multimedia systems
Spatial computing
Virtual reality

Mixed source separation

USE: Blind source separation

Mixed-integer linear programming

USE: Mixed integer linear programming

Mixers

BT: Frequency conversion
RT: Demodulation
Modulation
Nonlinear circuits

Mixture models

BT: Statistics
RT: Feature extraction
Image segmentation
Probabilistic logic

MLE

USE: Maximum likelihood estimation

MLFMA

UF: Multilevel fast multipole algorithm
BT: Algorithms

MMICs

UF: Monolithic microwave integrated circuits

BT: Microwave integrated circuits
Monolithic integrated circuits
RT: Analog integrated circuits
MIMICs
Radiofrequency integrated circuits

MMTC

USE: Massive machine type communications

mmtc

USE: Massive machine type communications

MNN

USE: Multi-layer neural network

Mobile ad hoc networks

UF: MANET
Wireless ad hoc network
BT: Ad hoc networks

Mobile agents

BT: Knowledge based systems
RT: Computer applications
Distributed computing
Intelligent systems
Learning systems
Mobile computing
Software agents

Mobile antennas

BT: Antennas
Land mobile radio equipment
RT: Land mobile radio

Mobile application development

USE: Application programming interfaces

Mobile applications

UF: Mobile apps
BT: Computer applications
RT: Fintech
Mobile communication
Mobile handsets
Ride hailing
Wireless communication
NT: Mobility as a service



JULY 2025 IEEE Thesaurus

Mobile apps

USE: Mobile applications

Mobile communication

BT: Communication systems
Near field communication

RT: Acoustic communication
(telecommunication)
Block codes
Film bulk acoustic

resonators
Indoor communication
Long Term Evolution
Mobile applications
Mobile handsets
Mobility as a service
Multiuser detection
Network resource

management
Radio communication
Routing protocols
Time-varying channels
Transceivers
NT: Vehicular ad hoc networks
3G mobile communication
4G mobile communication
5G mobile communication
6G mobile communication
Ambient networks
Cellular technology
Dual band
Land mobile radio
Location awareness
Mobile learning
Mobile nodes
Mobile security
Mobile video
Mobility models
Open RAN
SIM card
Software radio
Ultra-dense networks

Mobile computing

BT: Computers and information
processing
RT: Ad hoc networks
Bring your own device
Crowdsensing
Crowdsourcing
Data dissemination
Edge computing
Location awareness
Military computing
Mobile agents

Mobile learning
Software defined

networking
Telecommunication

computing
NT: User experience
Multi-access edge

computing
Wireless access points

Mobile device security

USE: Mobile security

Mobile devices

USE: Mobile handsets

Mobile edge computing

USE: Multi-access edge
computing

Mobile handsets

UF: Mobile devices
Mobile phones
BT: Telephone sets
RT: Dual band
Land mobile radio
Long Term Evolution
Mobile applications
Mobile communication
Personal communication

networks
Tablet computers
Transceivers
UHF communication
NT: SIM card
Smart phones

Mobile learning

BT: Electronic learning
Mobile communication
RT: Distance learning
Hybrid learning
Mobile computing

Mobile location management

USE: Location awareness

Mobile nodes

BT: Mobile communication
Telecommunication
network management

Mobile office

USE: Remote working



JULY 2025 IEEE Thesaurus

Mobile payment

USE: Online banking

Mobile phones

USE: Mobile handsets

Mobile radio

USE: Land mobile radio

Mobile radio mobility management

USE: Location awareness

Mobile robot sensing systems

USE: Robot sensing systems

Mobile robot vision systems

USE: Robot vision systems

Mobile robots

BT: Robots

RT: Advanced driver assistance

systems

Agricultural robots
Amphibious robots
Assembly systems
Control systems
Drones
Humanoid robots
Industrial control
Manufacturing automation
Marine robots
Materials handling
Mechanical variables

control

Military robotics
Motion control
Motion detection
Nonlinear systems
Service robots
Social robots
Soft robotics
Stairs
Telerobotics
Vehicles
Vehicular automation
Wearable robots
NT: Climbing robots
Field robots
Legged locomotion

Mobile security

UF: Mobile device security

BT: Computer security

Mobile communication

RT: Hardware security

Mobile television

USE: TV

Mobile TV

BT: TV

Mobile video

BT: Mobile communication

Streaming media

RT: Video recording

Mobility as a service

UF: MaaS

Mobility on demand

BT: Mobile applications

Online services

RT: Mobile communication

Ride hailing

Shared transport

Mobility models

BT: Mobile communication

Modeling

Mobility on demand

USE: Mobility as a service

MOCVD

UF: Metalorganic vapor

deposition

BT: Chemical vapor deposition

RT: Vapor deposition

Modal analysis

BT: Mathematical analysis

RT: Vibration measurement

Mode matching methods

BT: Mathematics

Numerical analysis

Statistical analysis

RT: Antenna theory

Matrices

Waveguide theory

Model checking

BT: System testing

RT: Algorithms

Concurrent computing

Formal verification

Static analysis

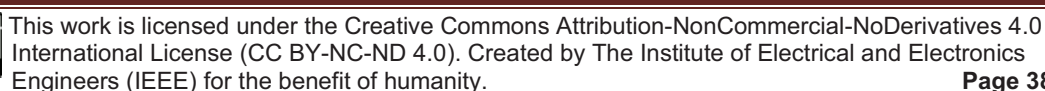
Model compression

BT: Algorithm design and

analysis



	RT:	Machine learning Artificial intelligence Deep learning Inference algorithms			Data-driven modeling Deformable models Digital elevation models Emulation Evaluation models Foundation models Graphical models Green's function methods Hidden Markov models Input variables Integrated circuit modeling Inverse problems Load modeling Mathematical models Metamodeling Mobility models Numerical models Object oriented modeling Power system modeling Process modeling Semiconductor device
Model driven engineering	UF:	Model-driven engineering			
	BT:	Software design			
<i>Model predictive control</i>					
	USE:	Predictive control			
<i>Model reduction</i>					
	USE:	Reduced order systems			
<i>Model-based reasoning</i>					
	USE:	Inference mechanisms			
Model-driven development					
	BT:	Software development management			
				modeling	
<i>Model-driven engineering</i>					Semiconductor process
	USE:	Model driven engineering		modeling	
<i>Model-predictive control</i>					Signal representation Simulation Solid modeling Space mapping System identification Systems modeling
	USE:	Predictive control			
Modeling					
	UF:	Modelling System modeling			
	BT:	Systems engineering and		<i>Modelling</i>	
theory				USE:	Modeling
	RT:	Computer graphics Data visualization Digital simulation Haptic interfaces Human in the loop Monte Carlo methods Numerical simulation Petri nets Plasma simulation Power system analysis			
				<i>Models of emotion</i>	
				USE:	Emotion recognition
				Modems	
				UF:	Modulator-demodulators
				BT:	Communication equipment Computer peripherals
				RT:	Data communication Demodulation Modulation
computing					
		Systems Modeling			
Language				<i>Moderate resolution imaging spectroradiometer</i>	
		Time series analysis		USE:	MODIS
	NT:	Analytical models Atmospheric modeling Brain modeling Building information		<i>Moderate-resolution Imaging Spectroradiometer</i>	
				USE:	MODIS
management				MODFET circuits	
		Computational modeling Context modeling Data models		BT:	FET circuits



JULY 2025 IEEE Thesaurus

modfet integrated circuits

USE: MODFETs

MODFETs

UF: Heterostructure FETs
SDHTs
Selectively doped

heterojunction transistors

TEGFETs
Two-dimensional electron

gas FETs

BT: modfet integrated circuits
Field effect transistors
RT: HEMTs

MODIS

UF: Moderate resolution
imaging spectroradiometer
Moderate-resolution

Imaging Spectroradiometer

BT: Payloads
Spectroradiometers

Modular construction

BT: Construction
RT: Buildings
Prefabricated construction

Modular multi-level converters

USE: Multilevel converters AND
Voltage-source converters

Modular multilevel converters

USE: Multilevel converters

Modulation

UF: Modulation format
Modulation index
Modulation-coding
Modulators

BT: Communications
technology

RT: Signal processing
Direct sequence spread

spectrum communication

Encoding
IEEE 802.11 Standard
IEEE 802.11g Standard
IEEE 802.11n Standard
Linearization techniques
Mixers
Modems
OFDM
Phase locked loops
Tracking loops

Transmitters

NT: Amplitude modulation
Chirp modulation
Demodulation
Digital modulation
Frequency modulation
Magnetic modulators
Modulation coding
Optical modulation
Optical modulators
Phase modulation
Pulse modulation
Pulse width modulation

Modulation coding

BT: Modulation
RT: Encoding
Information theory
NT: Interleaved codes

Modulation format

USE: Modulation

Modulation index

USE: Modulation

Modulation-coding

USE: Modulation

Modulator-demodulators

USE: Modems

Modulators

USE: Modulation

Modules (abstract algebra)

BT: Abstract algebra

Moisture

BT: Geophysics
RT: Moisture control
Moisture measurement
Trees - insulation

Moisture control

BT: Control systems
RT: Humidity effects
Moisture
NT: Humidity control

Moisture measurement

BT: Measurement
RT: Moisture
Soil measurements
NT: Humidity measurement



JULY 2025 IEEE Thesaurus

Molded case circuit breakers

UF: Molded-case circuit breakers
BT: Circuit breakers
RT: Short-circuit currents

DNA
Genetic engineering
Genetics
Microorganisms
NT: Nucleic acids

Molded-case circuit breakers

USE: Molded case circuit breakers

Molecular clones

USE: Cloning

Molding equipment

UF: Moulding equipment
BT: Production equipment

Molecular communication

BT: Biological systems
Communication systems
RT: Nanoantennas
Nanocommunication

Molecular beam applications

BT: Molecular beams
RT: Light emitting diodes
Semiconductor devices
Semiconductor lasers

Molecular computing

BT: Computers and information processing
RT: Nanotechnology
DNA computing
Quantum chemistry

Molecular beam epitaxial growth

BT: Epitaxial growth
RT: Crystals
Gallium
Thin films

Molecular electronics

UF: Biomolecular electronics
BT: Nanotechnology
RT: Graphene devices
Nanoelectronics
Organic light emitting

Molecular beams

BT: Beams
RT: Epitaxial growth
Thin films

NT: Molecular beam applications

Molecular imaging

BT: Biomedical imaging

Molecular biology

BT: Biological processes
NT: Biochips

Molecular sieves

BT: Chemical processes
Sieving
RT: Adsorption

Molecular biomarkers

BT: Biomarkers
RT: Drugs
NT: Genomics
Glycomics
Lipidomics
Metabolomics
Proteomics

Molybdenum

BT: Chemical elements

MoM

USE: Method of moments

Moment methods

USE: Method of moments

Molecular biophysics

UF: Biological macromolecules
Biomolecules
BT: Biophysics
RT: Biochemistry
Biomedical equipment
Biomedical imaging
Biomedical materials
Cellular biophysics

Money management

USE: Financial management

Monitoring

BT: Instrumentation and measurement
RT: Alarm systems
Maintenance engineering



JULY 2025 IEEE Thesaurus

NT: Power system management
Computerized monitoring
Environmental monitoring
Load monitoring
Patient monitoring
Process monitoring
Radiation monitoring
Remote monitoring
Surveillance
Water monitoring

Modeling
Probability
Simulated annealing
Simulation
Temporal difference

learning

Monte Carlo simulations

USE: Monte Carlo methods

Monte-Carlo methods

USE: Monte Carlo methods

Monte-Carlo simulations

USE: Monte Carlo methods

Monoclonal antibodies

BT: Antibodies
RT: Cancer treatment
Immunotherapy
Proteins

Monolithic integrated circuits

UF: Monolithic integration
BT: Circuits
Integrated circuits
NT: MIMICs
MMICs

Monolithic integration

USE: Monolithic integrated
circuits

Monolithic microwave integrated circuits

USE: MMICs

Monopoly

BT: Economics
RT: Microeconomics

MONOS devices

UF: Metal-oxide-nitride-oxide-
semiconductors
Metal-oxide-nitride-oxide-
silicon
BT: Semiconductor devices

Monsoons

BT: Meteorology
RT: Rain
Storms

Monte Carlo methods

UF: Importance sampling
Monte Carlo simulations
Monte-Carlo methods
Monte-Carlo simulations
BT: Statistical analysis
RT: Computational
electromagnetics

Mood

BT: Psychology

Moon

UF: Lunar
BT: Satellites

Moore's Law

BT: Integrated circuit
technology

Mopeds

USE: Motorcycles

Morals

USE: Ethics

Morphological operations

BT: Image processing
RT: Image transformation
Topology
NT: Image morphing
Image thinning

Morphology

BT: Natural language
processing
RT: Entomology

Mortality

UF: Death rate
BT: Statistics
RT: Failure analysis

Mortar

BT: Building materials
Chemical products
RT: Construction industry



JULY 2025 IEEE Thesaurus

Mortgages

USE: Loans and mortgages

MOS capacitors

BT: MOS devices

RT: Capacitors

MOS devices

UF: Metal-oxide
semiconductors

devices Metal-oxide-semiconductor

BT: MIS devices

RT: Semiconductor-insulator

interfaces

NT: MOS capacitors
MOSFET
Negative bias temperature

instability

MOS integrated circuits

BT: MOSFET circuits

RT: Metal-insulator structures

MOS transistors

USE: MOSFET

MOSFET

UF: MOS transistors
nMOSFETs
pMOSFETs
BT: Field effect transistors
MOS devices
RT: CMOS technology
CMOSFET logic devices
Gate drivers
TFETs
NT: CMOSFETs
FinFETs
Interface states
Junctionless nanowire

transistors

MOSFET circuits

UF: Metal-oxide semiconductor
field effect transistor

BT: Circuits

FET circuits

RT: Active inductors
Linearization techniques
Operational amplifiers
Power dissipation
Rail to rail amplifiers
Rail to rail operation
Threshold voltage

NT: CMOSFET circuits
MOS integrated circuits
Power MOSFET

MOSHFETs

UF: Metal oxide semiconductor
heterojunction FETs

BT: Field effect transistors

Motion analysis

BT: Robot kinematics

RT: 3-DOF

5-DOF

6-DOF

NT: Active contours
Motion segmentation
Robot localization

Motion artifacts

BT: Biomedical image
processing

Video signal processing

Motion capture

BT: Kinematics
RT: Animation
Biomechanics
Feature extraction
Gait recognition
Image motion analysis
Image sensors
Motion compensation
Motion estimation
Object detection
Object tracking

Motion compensation

BT: Control systems
RT: Image communication
Motion capture

Motion control

BT: Mechanical variables
control

RT: Aerospace control
Legged locomotion
Manipulators
Medical robotics
Mobile robots
Motion detection
Motor coordination
Servosystems
Structure from motion
Trajectory
Trajectory tracking



JULY 2025 IEEE Thesaurus

NT:	Velocity control	Motion segmentation BT: Motion analysis <i>Motion sensors</i> USE: Motion detection Motion sickness BT: Medical conditions <i>Motor control</i> USE: Motor drives Motor coordination BT: Kinematics RT: Motion control Paralysis Motor drives UF: Motor control BT: Drives RT: Industrial control Mechanical variables control Motors Sensorless control Servosystems Torque control Variable speed drives Velocity control Voltage control <i>Motor vehicles</i> USE: Automobiles <i>Motorbikes</i> USE: Motorcycles Motorcycles UF: Mopeds Motorbikes Scooters BT: Road vehicles RT: Micromobility Motors BT: Energy conversion Machinery RT: Coils Motor drives Sensorless control NT: AC motors Brushless motors Commutation DC motors Electric motors
	Collision avoidance	
	Collision mitigation	
	Formation control	
	Kinetic theory	
	Motion planning	
	Path planning	
	Visual servoing	
Motion detection		
UF:	Motion sensors	
BT:	Signal detection	
RT:	Alarm systems	
	Corner detection	
	Image motion analysis	
	Image sensors	
	Infrared detectors	
	Mobile robots	
	Motion control	
	Surveillance	
	Video signal processing	
	Video surveillance	
NT:	Odometry	
Motion estimation		
BT:	Parameter estimation	
RT:	Motion capture	
	Object tracking	
Motion measurement		
BT:	Mechanical variables	
measurement		
RT:	Doppler measurement	
	Gaze tracking	
	Velocity measurement	
NT:	Tracking	
	Tribology	
Motion pictures		
UF:	Cinema	
	Films (Motion pictures)	
	Movies	
	Moving pictures	
BT:	Broadcasting	
RT:	Cameras	
	Cinematography	
	Entertainment industry	
	Imaging	
	Optical projectors	
Motion planning		
BT:	Motion control	
RT:	Navigation	
	Robot control	



JULY 2025 IEEE Thesaurus

	Hysteresis motors			MPEG4
	Induction motors		BT:	MPEG standards
	Micromotors		RT:	Digital multimedia
	Permanent magnet motors	broadcasting		
	Servomotors			High efficiency video coding
	Traction motors			Streaming media
	Universal motors			Vector quantization
				Video codecs
				Video coding
				Video signal processing
<i>Moulding equipment</i>				
USE:	Molding equipment			
<i>Mouse</i>		MPEG 7 Standard		
USE:	Mice	UF:	MPEG7	
		BT:	MPEG standards	
Mouth		RT:	Audio coding	
BT:	Digestive system		Content management	
	Head		Digital multimedia	
RT:	Stomatognathic system	broadcasting		
NT:	Teeth		Multimedia communication	
			Multimedia systems	
<i>Movies</i>		MPEG standards		
USE:	Motion pictures	UF:	Moving picture experts	
<i>Moving object databases</i>		group		
USE:	Visual databases	BT:	IEC Standards	
			ISO Standards	
<i>Moving picture experts group</i>		RT:	Digital multimedia	
USE:	MPEG standards	broadcasting		
<i>Moving pictures</i>			Image coding	
USE:	Motion pictures		Streaming media	
			Transform coding	
			Video codecs	
			Video coding	
			Video signal processing	
Moving Pictures Experts Group		NT:	MPEG 1 Standard	
BT:	IEC		MPEG 2 Standard	
	ISO		MPEG 21 Standard	
			MPEG 4 Standard	
			MPEG 7 Standard	
<i>MP3</i>				
USE:	Digital audio players AND Portable media players			
<i>MPEG</i>		<i>MPEG-2</i>		
USE:	Transform coding	USE:	MPEG 2 Standard	
MPEG 1 Standard		<i>MPEG4</i>		
BT:	MPEG standards	USE:	MPEG 4 Standard	
MPEG 2 Standard		<i>MPEG7</i>		
UF:	MPEG-2	USE:	MPEG 7 Standard	
BT:	MPEG standards			
MPEG 21 Standard		<i>MPLS</i>		
BT:	MPEG standards	USE:	Multiprotocol label	
		switching		
MPEG 4 Standard				
UF:	H.264			



JULY 2025 IEEE Thesaurus

MPPT
trackers
USE: Maximum power point

MPTCP
UF: Multipath TCP
BT: TCP
RT: Multipath channels

MRI
imaging
USE: Magnetic resonance

MRP
planning
USE: Materials requirements

Mud
USE: Sediments

Mufflers
USE: Exhaust systems

Multi access edge computing
computing
USE: Multi-access edge

Multi label classification
UF: Multi-label classification
Multilabel classification
BT: Classification algorithms

Multi lingual
USE: Multilingual

Multi modal integration
USE: Multisensory integration

Multi party computation
USE: Multi-party computation

Multi sensory integration
USE: Multisensory integration

Multi stage noise shaping
USE: Multi-stage noise shaping

Multi-access edge computing
UF: Mobile edge computing
Multi access edge
computing
BT: Edge computing
Mobile computing

Multi-agent models

USE: Multi-agent systems
Multi-agent systems
UF: Multi-agent models
Multiagent models
Multiagent systems
BT: Adaptive systems
RT: Agent-based modeling
Autonomous vehicles
Formation control
System analysis and design
Vehicular automation
NT: Collaborative intelligence

Multi-armed bandit problem
UF: K-armed bandit problem
N-armed bandit problem
BT: Machine learning
Probability
RT: Game theory
Markov processes
Optimization
Reinforcement learning
Resource management
Statistical distributions
Stochastic processes

Multi-attribute optimization
USE: Pareto optimization

Multi-carrier code division multiple access
multiple access
USE: Multicarrier code division

Multi-cast addressing
USE: Multicast communication

Multi-casting
USE: Multicast communication

Multi-core processing
USE: Multicore processing

Multi-core processors
USE: Multicore processing

Multi-criteria decision analysis
USE: MCDM

Multi-criteria decision making
USE: MCDM

Multi-factor authentication
BT: Access control
Authentication



JULY 2025 IEEE Thesaurus

Multi-hop

USE: Spread spectrum communication

Multi-label classification

USE: Multi label classification

Multi-layer neural network

UF: MNN
BT: Neural networks

Multi-level converters

USE: Multilevel converters

Multi-level inverters

USE: Multilevel inverters

Multi-level invertors

USE: Multilevel inverters

Multi-lingual

USE: Multilingual

Multi-modal sensors

USE: Multimodal sensors

Multi-objective programming

USE: Pareto optimization

Multi-party computation

UF: Multi party computation
BT: Cryptography

Multi-physics

USE: Multiphysics

Multi-resolution

USE: Multiresolution analysis

Multi-robot systems

UF: Multirobot systems
BT: Robotics and automation
NT: Swarm robotics

Multi-spectral imaging

USE: Multispectral imaging

Multi-stage noise shaping

UF: MASH
Multi stage noise shaping
Multistage noise shaping
BT: Noise shaping

Multi-tasking

USE: Multitasking

Multi-threaded systems

USE: Program processors

Multi-threading systems

USE: Program processors

Multi-user channels

USE: Multiuser channels

Multi-user detection

USE: Multiuser detection

Multi-vibrators

USE: Multivibrators

Multi-wave mixing

USE: Multiwave mixing

Multiaccess communication

UF: CDMA
CSMA
Carrier sense multiaccess
Code division multiaccess
Code division multiple

access

Code-division multiple

access

Code-division multiple-

access

Multiaccess systems

Multiple access

communication

Random access

communication

BT: Cellular technology
Communication systems
3G mobile communication
Delay estimation
Multiplexing
OFDM
Telecommunications
Viterbi algorithm

NT: Access charges
Direct-sequence code-

division multiple access

Frequency division

multiaccess

Multicarrier code division

multiple access

Subscriber loops

Time division multiple

access

Time division synchronous

code division multiple access

Zero correlation zone



JULY 2025 IEEE Thesaurus

Multiaccess systems

USE: Multiaccess communication

Multiagent models

USE: Multi-agent systems

Multiagent systems

USE: Multi-agent systems

Multicarrier code division multiple access

UF: MC-CDMA
MCCDMA
Multi-carrier code division

multiple access

BT: Multiaccess communication
RT: Code division multiplexing
Communication channels
OFDM
Protocols
Spread spectrum

communication

Telecommunications
Time division synchronous

code division multiple access

Multicast addressing

USE: Multicast communication

Multicast algorithms

BT: Algorithms

Multicast communication

UF: Multi-cast addressing
Multi-casting
Multicast addressing
Multicasting
BT: Communication systems
RT: Ad hoc networks
Multicast protocols
Optical wavelength

conversion

Routing
Telecommunications
Wavelength division

multiplexing

NT: Multicast VPN

Multicast protocols

BT: Protocols
RT: Internet
Multicast communication
Routing protocols

Multicast VPN

BT: Multicast communication

Multicasting

USE: Multicast communication

Multichip modules

UF: Heterogeneous integration
BT: Integrated circuit packaging
Packaging

Multiconductor transmission lines

BT: Transmission lines
RT: Coupled mode analysis

Multicore

USE: Multicore processing

Multicore processing

UF: Many core processing
Many core systems
Multi-core processing
Multi-core processors
Multicore
BT: Parallel architectures
NT: Embedded multicore
processing
Manycore processors

Multidimensional signal processing

BT: Signal processing
RT: Image processing
NT: Video signal processing

Multidimensional systems

BT: Systems engineering and theory

Multifilamentary superconductors

BT: Superconducting materials
Superconducting wires

Multifrequency antennas

BT: Antennas

Multigrid methods

BT: Numerical analysis

Multihop

USE: Spread spectrum communication

Multilabel classification

USE: Multi label classification

Multilayer perceptrons

BT: Feedforward neural networks



JULY 2025 IEEE Thesaurus

Multimodal sensors

UF: Multi-modal sensors
Multimodal sensing
BT: Sensors
RT: Sensor fusion

Multiobjective programming

USE: Pareto optimization

Multipath channels

BT: Communication channels
RT: Channel estimation
Diversity methods
Fading channels
MIMO
MPTCP
Meteorological factors
Multiuser detection
Radio propagation
Terrain factors
Ultra wideband

communication

Multipath TCP

USE: MPTCP

Multiphysics

UF: Multi-physics
BT: Computational modeling
RT: Computer simulation
Physics computing

Multiple access communication

USE: Multiaccess communication

Multiple access interference

BT: OFDM

Multiple antenna systems

USE: MIMO

Multiple input multiple output

USE: MIMO

Multiple input multiple output systems

USE: MIMO

multiple input single-output

USE: MISO

Multiple sclerosis

BT: Diseases
RT: Spasticity

Multiple signal classification

UF: MUSIC
BT: Noise measurement

Multiple-input multiple-output

USE: MIMO

Multiple-input multiple-output systems

USE: MIMO

multiple-input single output

USE: MISO

multiple-input single-output

USE: MISO

Multiple-input-multiple-output

USE: MIMO

Multiplexed

USE: Multiplexing

Multiplexing

UF: Multiplexed
BT: Communications

technology

RT: Arrayed waveguide gratings
Multiaccess communication
NT: Code division multiplexing
Demultiplexing
Frequency division

multiplexing

Layered division

multiplexing

Multiplexing equipment
OFDM
Space division multiplexing
Time division multiplexing
Wavelength division

multiplexing

Multiplexing equipment

BT: Multiplexing
RT: Communication equipment
NT: Add-drop multiplexers

Multiplying circuits

BT: Circuits
RT: Digital integrated circuits
Logic circuits

Multiprocessing systems

BT: Parallel processing
RT: AI accelerators
Computer networks



JULY 2025 IEEE Thesaurus

processing Computers and information

BT: Sense organs
RT: Somatosensory

NT: Concurrency control
Distributed computing
Parallel languages
Parallel programming
Pipeline processing
Data flow computing
Processor scheduling
Systolic arrays

Multiskilling

UF: Job rotation
BT: Human resource
management RT: Industrial training
Job specification
Vocational training

Multiprocessor interconnection

UF: Interconnection networks
Parallel processor
interconnection BT: Computer architecture
RT: Computer networks
Data communication
Local area networks
Metropolitan area networks
Wide area networks
NT: Hypercubes

Multiprocessor interconnection networks

BT: Computer networks

Multiprocessor scheduling

USE: Processor scheduling

Multiprotocol label switching

UF: Label swapping
MPLS
BT: Communication switching
Packet switching
Protocols
RT: Asynchronous transfer
mode Internet
Routing protocols

Multiresolution analysis

UF: Multi-resolution
BT: Wavelet analysis

Multirobot systems

USE: Multi-robot systems

Multisensor systems

BT: Sensor fusion
RT: Robot sensing systems

Multisensory integration

UF: Multi modal integration
Multi sensory integration
Multimodal integration

Multispectral imaging

UF: Multi-spectral imaging
BT: Imaging

Multistage noise shaping

USE: Multi-stage noise shaping

Multistatic radar

BT: Radar
NT: MIMO radar

Multitasking

UF: Multi-tasking
BT: Computers and information
processing NT: Parametric study

Multithreaded systems

USE: Program processors

Multithreading

BT: Parallel processing

Multithreading systems

USE: Program processors

Multiusers channels

UF: Multi-user channels
BT: Communication channels

Multiusers detection

UF: Multi-user detection
BT: Signal detection
RT: Cellular radio
Land mobile radio
Mobile communication
Multipath channels
Spread spectrum
communication



JULY 2025 IEEE Thesaurus

Multivalued logic

UF: Many valued logic
Ternary logic
BT: Logic
RT: Logic functions

Multivariable systems

USE: MIMO

Multivariate regression

BT: Regression analysis

Multivibrators

UF: Multi-vibrators
BT: Electronic circuits

Multiwave mixing

UF: Multi-wave mixing
BT: Optical mixing
RT: Four-wave mixing

Munitions

USE: Weapons

Muon colliders

UF: Muon sources
BT: Colliding beam devices
RT: Luminescence
Luminescent devices
Storage rings

Muon sources

USE: Muon colliders

Muons

USE: Mesons

Muscle-like actuators

USE: Artificial muscles

Muscles

BT: Musculoskeletal system
RT: Myoelectric control
Spasticity
NT: Myocardium
Neuromuscular

Muscular dystrophy

BT: Diseases
Medical conditions
RT: Musculoskeletal system

Musculoskeletal system

BT: Anatomy
RT: Muscular dystrophy

Rheumatology

NT: Cartilage
Fascia
Ligaments
Muscles
Skeleton
Tendons

Museums

BT: Educational institutions
RT: Art
Cultural aspects
Cultural differences
Humanities
Research and development
Technology
NT: Virtual museums

MUSIC

USE: Multiple signal classification

Music

UF: Computer music
Musical
BT: Humanities
RT: Audio systems
White noise
NT: Acoustics
Computer generated music
Electronic music
Musical instrument digital

interfaces

Rhythm
Timbre

Music information retrieval

BT: Information retrieval
RT: Cepstral analysis
Cross modal retrieval

Music recommendation

USE: Recommender systems

Musical

USE: Music

Musical instrument digital interfaces

UF: MDDI
BT: Computer interfaces
Music
RT: Digital communication

Must carry regulations

USE: Must-carry regulations



JULY 2025 IEEE Thesaurus

Must-carry regulations

UF: Must carry regulations
BT: Cable TV
Government policies
RT: Licenses
TV

Mutual conductance

USE: Transconductance

Mutual coupling

BT: Electromagnetic coupling
NT: Inductive coupling

Mutual funds

BT: Financial management

Mutual information

UF: Transinformation
BT: Information theory

Myelin

BT: Nerve fibers
RT: Axons

Myocardial

USE: Myocardium

Myocardium

UF: Myocardial
BT: Muscles

Myoelectric control

BT: Prosthetics
RT: Muscles
Robot kinematics

Myopia

USE: Vision defects

Myspace

USE: Social networking (online)

N-armed bandit problem

USE: Multi-armed bandit problem

N95

USE: Face masks

NACE International

UF: National Association of
Corrosion Engineers
BT: Standards organizations

NACE Standards

BT: Standards publications

Nails

BT: Integumentary system

Naive Bayes algorithms

USE: Naive Bayes methods

Naive Bayes classification

USE: Naive Bayes methods

Naive Bayes classifiers

USE: Naive Bayes methods

Naive Bayes methods

UF: Naive Bayes algorithms
Naive Bayes classification
Naive Bayes classifiers
BT: Bayes methods
Learning (artificial
intelligence)
RT: Pattern classification
Data mining
Machine learning
Probability
Supervised learning
Support vector machines
Text analysis

Nakagami distribution

BT: Probability distribution

Named entity recognition

BT: Natural language
processing
RT: Information retrieval

NAND flash

USE: Flash memories

Nano biophotonics

USE: Nanobiophotonics

Nano communication

USE: Nanocommunication

Nano devices

USE: Nanoscale devices

Nano generators

USE: Nanogenerators

Nano packaging

USE: Nanopackaging



JULY 2025 IEEE Thesaurus

Nano ribbons

USE: Nanoribbons

Nano-magnetics

USE: Nanomagnetism

Nano-rods

USE: Nanorods

Nanoactuators

USE: Actuators AND
Nanoelectronics

Nanoantennas

BT: Nanoscale devices
Optical antennas
RT: Integrated optics
Integrated optoelectronics
Molecular communication
Nanoelectromechanical

systems

Nanoelectronics
Nanophotonics
Nanotubes
Optical communication

equipment

Optical metamaterials
Plasmons

Nanobiophotonics

UF: Nano biophotonics
BT: Nanobiotechnology
Photonics
RT: Biomedical imaging
Biosensors
Lasers
Nanoparticles
Nanoscale devices

Nanobioscience

BT: Biology
Nanotechnology
RT: Colloidal lithography
Nanofluidics
NT: DNA computing
Nanobiotechnology

Nanobiotechnology

BT: Nanobioscience
RT: Nanomedicine
Nanopores
NT: Nanobiophotonics

Nanocarriers

BT: Nanomaterials

RT: Drug delivery

Nanocommunication

UF: Nano communication
BT: Communication systems
Nanotechnology
RT: Biomedical communication
Molecular communication
Wireless networks
Wireless sensor networks

Nanocomposites

BT: Nanostructured materials
RT: Metamaterials

Nanocontacts

BT: Nanoscale devices
RT: Enhanced
magnetoresistance

Magnetoresistance
Nanoelectronics
Nanowires

Nanocrystal

USE: Nanocrystals

Nanocrystals

UF: Nanocrystal
BT: Crystalline materials
Nanoparticles
RT: Quantum dots
NT: Colloidal nanocrystals

Nanodevices

USE: Nanoscale devices

Nanoelectromechanical systems

UF: NEMS
BT: Nanotechnology
RT: Microelectromechanical

systems

Nanoantennas

Nanoelectronics

UF: Nanoactuators
BT: Nanotechnology
RT: Graphene devices
Molecular electronics
Nanoantennas
Nanocontacts
NT: Junctionless nanowire

transistors

Nanofabrication

BT: Nanotechnology



JULY 2025 IEEE Thesaurus

Nanofiltration

USE: Filtration

BT: Nanometres
Measurement units

Nanofluidics

UF: Nanofluids
BT: Fluidics
Nanotechnology
RT: Nanobioscience

Nanometres

USE: Nanometers

Nanopackaging

UF: Nano packaging
BT: Nanotechnology
Packaging
RT: Nanomaterials

Nanofluids

USE: Nanofluidics

Nanogenerators

UF: Nano generators
BT: Energy harvesting
RT: Electric generators
Low power electronics
Micromechanical devices
Nanowires
Piezoelectric devices
Triboelectricity
Vibrations

Nanoparticles

UF: Nanopowders
BT: Nanostructures
RT: Nanobiophotonics
Nanomedicine
Nanosensors
NT: Magnetic nanoparticles
Nanocrystals

Nanoimprint lithography

USE: Nanolithography

Nanopatterning

BT: Nanotechnology
RT: Nanolithography
Nanotopography
Soft lithography
Colloidal lithography
NT:

Nanolithography

UF: Nanoimprint lithography
BT: Lithography
Nanotechnology
RT: Nanopatterning
Soft lithography

Nanophotonics

BT: Nanotechnology
Photonics
RT: Nanoantennas
Optical antennas

Nanomagnetics

UF: Nano-magnetics
BT: Magnetism
Nanotechnology
RT: Magnetic particles
Nanostructured materials

Nanoplasmonics

BT: Nanotechnology
Plasmons
NT: Surface plasmon
resonance

Nanomaterials

BT: Nanotechnology
RT: Nanopackaging
NT: Nanocarriers

Nanopores

BT: Nanoscale technology
RT: Nanobiotechnology
Nanoporous materials
Nanostructures

Nanomedicine

BT: Biomedical monitoring
Medical diagnosis
RT: Cellular biophysics
Mechanobiology
Nanobiotechnology
Nanoparticles

Nanoporous materials

BT: Nanostructured materials
RT: Nanopores

Nanopositioning

BT: Nanotechnology
Position control

Nanometers

UF: Millimicron



JULY 2025 IEEE Thesaurus

Nanopowders

USE: Nanoparticles

nanostructures

Semiconductor

Nanoribbons

UF: Nano ribbons
BT: Nanostructures

Nanotechnology

RT: Atomic force microscopy
Bio-inspired materials
Epitaxial growth
Fluidics
Lithography
Microfabrication
Nanotube devices
Power dissipation
Quantum mechanics
Semiconductor device

Nanorods

UF: Nano-rods
BT: Nanostructures

Nanosatellites

USE: Small satellites

Nanoscale devices

UF: Nano devices
Nanodevices
BT: Nanoscale technology
RT: Nanobiophotonics
Single electron devices
NT: Nanoantennas
Nanocontacts
Nanotube devices

manufacture

NT: Single electron devices
Very large scale integration
Bionanotechnology
Casimir effect
Molecular computing
Molecular electronics
Nanobioscience
Nanocommunication
Nanoelectromechanical

Nanoscale technology

BT: Nanotechnology
NT: Nanopores
Nanoscale devices

systems

Nanoelectronics
Nanofabrication
Nanofluidics
Nanolithography
Nanomagnetics
Nanomaterials
Nanopackaging
Nanopatterning
Nanophotonics
Nanoplasmonics
Nanopositioning
Nanoscale technology
Nanosensors
Nanostructured materials
Nanostructures
Self-assembly
Self-replicating machines

Nanosensors

BT: Nanotechnology
Sensors
RT: Biomedical equipment
Nanoparticles
Nanostructures
Wearable sensors

Nanostructured materials

UF: Core-shelf nanostructures
BT: Materials
Nanotechnology
RT: Nanomagnetics
NT: Nanocomposites
Nanoporous materials

Nanostructures

BT: Nanotechnology
RT: Nanopores
Nanosensors
NT: Nanoparticles
Nanoribbons
Nanorods
Nanotubes
Nanowires

Nanotopography

BT: Surface topography
RT: Colloidal lithography
Nanopatterning

Nanotube devices

BT: Nanoscale devices
RT: Nanotechnology

Nanotubes

BT: Nanostructures
RT: Nanoantennas



JULY 2025 IEEE Thesaurus

NT: Carbon nanotubes
Semiconductor nanotubes

Nanowires

BT: Nanostructures
RT: Junctionless nanowire

transistors

Nanocontacts
Nanogenerators
Wires

Narrowband

BT: Bandwidth
Communication systems
RT: Wideband

NASA

UF: National Aeronautics &
Space Administration
National Aeronautics and
Space Administration
BT: US Government agencies
RT: European Space Agency
Landsat
Space exploration
Space missions
Space technology

Nash equilibrium

BT: Game theory

National Aeronautics & Space Administration
USE: NASA

National Aeronautics and Space Administration
USE: NASA

National Association of Corrosion Engineers
USE: NACE International

National Bureau of Standards
USE: NIST

National Electric Code

UF: National electric safety
code
BT: ANSI Standards

National electric safety code
USE: National Electric Code

National Fire Protection Agency
USE: NFPA

National Fire Protection Association
USE: NFPA

National Institute of Standards & Technology
USE: NIST

National Institute of Standards and Technology
USE: NIST

National Institutes of Health

UF: NIH
BT: US Department of Health
and Human Services

National Oceanic and Atmospheric Administration

UF: NOAA
BT: US Department of
Commerce

National security

BT: Terrorism
RT: Biological weapons
Chemical weapons
Control system security
Cyber warfare
Nuclear weapons
Weapons of mass
destruction

*National Security Laboratory-Knowledge
Discovery and Data Mining*
USE: NSL-KDD

National Society Agreement awards

BT: IEEE Awards activities

*National Telecommunications and Information
Administration*
USE: NTIA

National vocational qualification
USE: Vocational training

Natural fibers

UF: Natural fibres
BT: Textile fibers
RT: Cotton
Wool

Natural fibres
USE: Natural fibers



JULY 2025 IEEE Thesaurus

Natural gas

BT: Fossil fuels
 RT: Air pollution
 Energy resources
 Fracking
 Gases
 Hydrocarbons
 Natural gas industry
 NT: Liquefied natural gas
 Methane

Natural gas industry

BT: Industries
 RT: Natural gas
 Petroleum industry
 Pipelines

Natural language generation

UF: NLG
 BT: Natural language
 processing
 RT: Computational linguistics
 Human-machine systems
 Semantic technology
 Speech synthesis

Natural language processing

UF: NLP
 BT: Natural languages
 RT: Bidirectional long short term
 memory
 Conditional random fields
 Digital humans
 Generative Pre-trainer

transformer

High dimensional data
 Multilingual
 Personal voice assistants
 Phonetics
 Pragmatics
 Semantic search
 Semantic technology
 Semantics
 Semiotics
 Social robots
 Syntactics
 Text summarization
 Translation
 NT: Bag of words model
 Chatbots
 Machine translation
 Morphology
 Named entity recognition
 Natural language

generation

Question answering
 (information retrieval)

Question generation
 Sentiment analysis
 Tokenization

Natural languages

UF: Natural speech
 BT: Humanities
 RT: Artificial intelligence
 Computer languages
 Multilingual
 NT: Lexicon
 Linguistics
 Natural language

processing

Translation

Natural resources

BT: Geoscience

Natural response

USE: Transient response

Natural speech

USE: Natural languages

Navier-Stokes equations

BT: Differential equations
 Fluid dynamics
 RT: Finite volume methods
 Viscosity

Navigation

UF: Direction-finding
 Geomagnetic navigation
 BT: Intelligent transportation

systems

Vehicular and wireless

technologies

RT: Compass
 Ground support
 Location awareness
 Motion planning
 Position measurement
 Sensor systems
 NT: Aircraft navigation
 Course correction
 Dead reckoning
 Indoor navigation
 Inertial navigation
 Marine navigation
 Radio navigation
 Satellite navigation systems
 Sonar navigation



JULY 2025 IEEE Thesaurus

		Underwater navigation			Nearest neighbour methods
<i>Nb</i>					k neighbor methods
	USE:	Niobium		BT:	k neighbour methods
				intelligence)	Learning (artificial
<i>Nb3Sn</i>					Nonparametric statistics
	USE:	Niobium-tin			Pattern recognition
				RT:	Data mining
<i>NBS</i>					Pattern classification
	USE:	NIST			Pattern clustering
					Regression analysis
<i>NBTI</i>					Search methods
instability	USE:	Negative bias temperature			Statistical analysis
<i>NC machines</i>					<i>Nearest neighbor searches</i>
	USE:	Computer numerical control		USE:	Nearest neighbor methods
<i>Nd</i>					<i>Nearest neighbour methods</i>
	USE:	Neodymium		USE:	Nearest neighbor methods
<i>Nd2O3</i>					<i>Nearfield communication</i>
	USE:	Neodymium compounds		USE:	Near field communication
<i>NDVI</i>					Neck
vegetation index	USE:	Normalized difference		BT:	Body regions
				RT:	Otorhinolaryngology
<i>NDWI</i>					Needles
water index	USE:	Normalized difference		BT:	Mechanical products
				RT:	Biomedical equipment
					Textile machinery
					Negative bias temperature instability
Near field communication				UF:	NBTI
	UF:	NFC		BT:	MOS devices
		Nearfield communication			
	BT:	Communication standards			
		Radio communication			
	RT:	Magnetic communication			
	NT:	Mobile communication			
<i>Near field radiation pattern</i>					Negative feedback
	USE:	Near-field radiation pattern		BT:	Feedback
<i>Near vertical incidence skywave</i>					<i>Negative feedback amplifier</i>
	USE:	NVIS		USE:	Feedback amplifiers
Near-field radiation pattern					Negative feedback loops
	UF:	Near field radiation pattern		BT:	Feedback loop
	BT:	Antenna radiation patterns			
					NEMA
				BT:	Standards organizations
Nearest neighbor methods					<i>NEMS</i>
	UF:	K-NN methods		USE:	Nanoelectromechanical
		K-nearest neighbor			systems
		KNN methods			
		Nearest neighbor searches			
					Neodymium
				UF:	Nd
				BT:	Metals



JULY 2025 IEEE Thesaurus

NT:	Neodymium alloys Neodymium compounds	NT:	Axons Myelin
Neodymium alloys		Nerve tissues	
BT:	Neodymium	BT:	Nervous system
RT:	Alloying		
Neodymium compounds		Nervous system	
UF:	Nd ₂ O ₃ Neodymium oxide	BT:	Anatomy
BT:	Neodymium	RT:	Bioelectric phenomena Computational
<i>Neodymium oxide</i>		neuroscience	
USE:	Neodymium compounds		Neural networks Neurological diseases Neurology Neuromuscular stimulation Neuropathology
Neon		NT:	Autonomic nervous system Brain Brain mapping Central nervous system Cranial Ganglia Glial cells Nerve endings Nerve tissues Neural pathways Neuroanatomy Neurons Neuroradiology Neuroscience Peripheral nervous system Pituitary gland Spinal cord Spine Synapses
BT:	Chemical elements		
Neonatology			
BT:	Medical specialties		
RT:	Pediatrics		
<i>Neoplasia</i>			
USE:	Neoplasms		
Neoplasms			
UF:	Neoplasia		
BT:	Biological tissues		
NT:	Breast neoplasms Liver neoplasms Lung neoplasms Skin neoplasms		
<i>Nephrolithiasis</i>			
USE:	Kidney stones		
Nephrology		<i>Net neutrality</i>	
BT:	Medical specialties	USE:	Network neutrality
RT:	Kidney Kidney stones		
Neptunium		Net zero	
BT:	Chemical elements	UF:	Net-Zero
<i>NeRF</i>		BT:	Environmental
USE:	Neural radiance field	management	
<i>Nerve cells</i>		RT:	Carbon dioxide Global warming Green communications Greenhouse gases
USE:	Neurons	<i>Net-Zero</i>	
Nerve endings		USE:	Net zero
BT:	Nervous system	Network address translation	
Nerve fibers		BT:	Computer network
BT:	Neurons	management	



JULY 2025 IEEE Thesaurus

Network analysis

USE: Network analyzers

Network analyzers

UF: Network analysis

BT: Instruments

Network architecture

BT: Network topology
Telecommunication

network management

NT: Active networking
Information-centric

networking

Network function

virtualization

Network slicing

Network coding

BT: Information theory
RT: Network security

Network control systems

USE: Networked control systems

Network function virtualization

UF: NFV
BT: Computer networks
Network architecture
RT: Application virtualization
Cloud computing
Computer network

management

Intrusion detection
Routing
Servers
Software defined

networking

Virtual machining
Virtualization
NT: Cloud radio access

networks

Virtual LAN

Network interfaces

BT: Interface phenomena
RT: Interface management

Network intrusion

BT: Data breach
RT: Data security
Network security
Privacy
NT: Network intrusion detection

Network intrusion detection

BT: Intrusion detection
Network intrusion
NT: NSL-KDD

Network location awareness

BT: Location awareness

Network motifs

BT: Graph theory
RT: Pattern recognition

Network neutrality

UF: Internet neutrality
Net neutrality
BT: Telecommunication

network management

Network of workstations

USE: Cluster computing

Network operating systems

BT: Operating systems
RT: Software defined

networking

NT: Autonomic systems

Network reconnaissance

UF: Footprinting
BT: Network security

Network resource management

UF: Dynamic service delivery
BT: Resource management
Telecommunication

network management

RT: Cellular radio
Mobile communication
NT: Intercell interference

Network security

BT: Security
RT: Communication networks
Computer networks
Hardware security
NSL-KDD
Network coding
Network intrusion
NT: Network reconnaissance

Network servers

BT: Computer networks



JULY 2025 IEEE Thesaurus

Network slicing

BT: Network architecture
RT: Augmented reality

Network synthesis

BT: Computer network management

Network systems

BT: Systems engineering and theory
NT: Autonomous networks
DC distribution systems

Network theory (graphs)

BT: Computer science
Mathematics
Physics
RT: Social sciences

Network throughput

USE: Throughput

Network topology

BT: Communications technology
RT: Overlay networks
Telecommunication network topology
NT: Complex networks
Computer network reliability
Network architecture

Network traffic

USE: Telecommunication traffic

Network-on-a-chip

USE: Network-on-chip

Network-on-chip

UF: Network-on-a-chip
BT: System-on-chip

Networked control systems

UF: Network control systems
BT: Control systems
RT: Real-time systems
System of systems

Neural activity

UF: Neural oscillation
BT: Brain
RT: Stability plasticity

Neural architecture search

UF: Neural architectures search
BT: Artificial neural networks
RT: Automated machine learning

Neural architectures search

USE: Neural architecture search

Neural chips

USE: Neural network hardware

Neural circuits

BT: Circuits
Neural engineering
RT: Neurons

Neural engineering

UF: Neuro engineering
Neuroengineering
BT: Biomedical engineering
RT: Brain-computer interfaces
Intracranial pressure sensors
NT: Neural circuits
Neural microtechnology
Neural nanotechnology
Neural prosthesis

Neural implants

UF: Brain implants
BT: Brain
Implants
RT: Deep brain stimulation

Neural machine translation

BT: Machine translation
RT: Artificial neural networks

Neural microtechnology

BT: Neural engineering

Neural nanotechnology

BT: Neural engineering

Neural nets

USE: Neural networks

Neural network compression

BT: Data compression
Memory management
Neural networks

Neural network hardware

UF: Neural chips



JULY 2025 IEEE Thesaurus

	BT:	Neural networks	Neural pathways	BT:	Nervous system
	RT:	AI accelerators			
		Analog integrated circuits	<i>Neural prostheses</i>	USE:	Prosthetics
		Integrated circuits			
		Neurocontrollers			
Neural networks			Neural prosthesis		
	UF:	Neural nets	BT:	Neural engineering	
		Wavelet neural networks			
	BT:	Computational and artificial	<i>Neural prosthetics</i>	USE:	Neuroprostheses
intelligence	RT:	AI accelerators			
		Adaptive systems	Neural radiance field		
		Artificial intelligence	UF:	NeRF	
		Associative memory	BT:	Deep learning	
		Backpropagation		Image analysis	
		Bio-inspired computing		Image synthesis	
		Cybernetics	RT:	Object detection	
		Deep architecture		Synthetic data	
		Deep learning		Three-dimensional displays	
		Dynamic programming		Two-dimensional displays	
		Fish schools			
		Fuzzy cognitive maps	Neural style transfer		
		Generative AI	BT:	Image transformation	
		Generative adversarial			
networks			Neurites		
		Large language models	UF:	Neuronal process	
		Nervous system	BT:	Neurons	
		Neurophysiology			
		Nonlinear dynamical	<i>Neuro engineering</i>	USE:	Neural engineering
systems					
		Pattern classification	<i>Neuro fuzzy networks</i>	USE:	Fuzzy neural networks
		Reinforcement learning			
		Semisupervised learning	<i>Neuro imaging</i>	USE:	Neuroimaging
		Soft sensors			
	NT:	Systems neuroscience	<i>Neuro marketing</i>	USE:	Neuromarketing
		Artificial neural networks			
		Biological neural networks	<i>Neuro transmitters</i>	USE:	Neurotransmitters
		Cellular neural networks			
		Feedforward neural	<i>Neuro-feedback</i>	USE:	Neurofeedback
networks					
		Graph neural networks	<i>Neuro-fuzzy networks</i>	USE:	Fuzzy neural networks
		Multi-layer neural network			
compression		Neural network	<i>Neuro-imaging</i>	USE:	Neuroimaging
		Neural network hardware			
		Perception evolution	<i>Neuro-modulation</i>	USE:	Neuromodulation
networks					
		Radial basis function			
networks					
		Recurrent neural networks			
		Stability plasticity			
<i>Neural oscillation</i>					
	USE:	Neural activity			



JULY 2025 IEEE Thesaurus

Neuro-rehabilitation

USE: Neurorehabilitation

RT: Nervous system
Spinal cord injury
NT: Migraine

Neuro-transmitters

USE: Neurotransmitters

Neurological disorders

USE: Neurological diseases

Neuroanatomy

BT: Anatomy
Nervous system

Neurology

BT: Medical specialties
RT: Nervous system
NT: Dyslexia
Neurorehabilitation

Neurocontrollers

BT: Intelligent control
RT: Artificial intelligence
Microcontrollers
Neural network hardware

Neuromarketing

UF: Neuro marketing
BT: Consumer behavior
Neuroscience
RT: Electronic commerce
Ethics
Market opportunities
Market research

Neurodynamics

BT: Brain
RT: Neurophysiology

Neuroengineering

USE: Neural engineering

Neuromodulation

UF: Neuro-modulation
BT: Neurons
Physiology
RT: Control systems
NT: Neurostimulation
Optogenetics

Neurofeedback

UF: Neuro-feedback
BT: Feedback

Neuroglia

USE: Glial cells

Neuromorphic computing

USE: Neuromorphic engineering

Neuroimaging

UF: Brain imaging
Neuro imaging
Neuro-imaging
BT: Biomedical image
processing
Brain mapping
RT: Functional near-infrared
spectroscopy
Neuroradiology
NT: Functional neuroimaging

Neuromorphic engineering

UF: Neuromorphic computing
BT: Neuromorphics
RT: AI accelerators
Artificial neural networks
CMOS integrated circuits
Memristors
Neurophysiology
Synapses

Neuroinformatics

BT: Bioinformatics
Informatics
Neuroscience
RT: Analytical models
Big Data
Computational modeling
Data science
Synapses

Neuromorphics

BT: Very large scale integration
RT: Analog circuits
Biological system modeling
NT: Neuromorphic engineering

Neurological diseases

UF: Neurological disorders
BT: Diseases

Neuromuscular stimulation

UF: Functional electrical
stimulation



JULY 2025 IEEE Thesaurus

BT:	Medical treatment	BT:	Brain
RT:	Nervous system		Neuroscience
			Prosthetics
<i>Neuronal networks</i>		RT:	Brain-computer interfaces
USE:	Biological neural networks		
<i>Neuronal process</i>		<i>Neuroprosthetics</i>	
USE:	Neurites	USE:	Neuroprostheses
<i>Neurone</i>		Neuropsychology	
USE:	Neurons	BT:	Brain
			Psychology
Neurons		Neuroradiology	
UF:	Nerve cells	BT:	Nervous system
	Neurone		Radiology
BT:	Nervous system	RT:	Electromagnetics
RT:	Action potentials		Neuroimaging
	Membrane potentials		
	Neural circuits	Neurorehabilitation	
	Synapses	UF:	Neuro-rehabilitation
NT:	Dendrites (neurons)	BT:	Neurology
	Nerve fibers		Patient rehabilitation
	Neurites		
	Neuromodulation	Neuroscience	
	Photoreceptors	BT:	Nervous system
	Soma		Science - general
Neuropathic pain		RT:	Fish schools
BT:	Pain	NT:	Clinical neuroscience
			Cognitive neuroscience
Neuropathology			Computational
BT:	Pathology	neuroscience	Functional connectivity
RT:	Nervous system		Neuroinformatics
			Neuromarketing
Neurophysiology			Neuroprostheses
BT:	Brain		Systems neuroscience
RT:	Biomedical signal		Transcranial direct current
processing		stimulation	Transcranial magnetic
	Microelectrodes	stimulation	
	Neural networks	Neurostimulation	
	Neurodynamics	UF:	Electroceuticals
	Neuromorphic engineering	BT:	Neuromodulation
	Science - general	RT:	Deep brain stimulation
NT:	Biological neural networks		Microelectrodes
	Neuroplasticity	NT:	Transcranial direct current
Neuroplasticity		stimulation	Transcranial magnetic
UF:	Brain plasticity	stimulation	
	Cortical plasticity	Neurosurgery	
BT:	Neurophysiology	BT:	Surgery
RT:	Stability plasticity	NT:	Deep brain stimulation
Neuroprostheses			
UF:	Neural prosthetics		
	Neuroprosthetics		



JULY 2025 IEEE Thesaurus

Neurotechnology

BT: Brain
Technology

Neurotransmission

USE: Neurotransmitters

Neurotransmitters

UF: Neuro transmitters
Neuro-transmitters
Neurotransmission
Synaptic transmission
BT: Transmitters
RT: Synapses

Neutrino

USE: Neutrino sources

Neutrino sources

UF: Neutrino
Neutrinos
BT: Elementary particles
RT: Radioactive materials

Neutrinos

USE: Neutrino sources

Neutron beams

USE: Particle beams

Neutron capture therapy

UF: BNCT
Boron neutron capture

therapy

BT: Medical treatment
RT: Biological effects of

radiation

Dosimetry

Neutron radiation effects

BT: Radiation effects

Neutron scattering

USE: Neutron spin echo

Neutron spin echo

UF: Neutron scattering
BT: Spectroscopy

Neutron stars

BT: Stars

Neutrons

BT: Elementary particles
RT: Cosmic rays

New media age

USE: Information age

New Radio

BT: 5G mobile communication
Radio access technologies
RT: 3GPP

Newborns

USE: Pediatrics

Newton Fourier method

USE: Newton method

Newton method

UF: Newton Fourier method
Newton Raphson method
Newton's method
Newton-Fourier method
Newton-Raphson method
Newtons method
BT: Numerical analysis
RT: Optimization methods
Poles and zeros

Newton Raphson method

USE: Newton method

Newton's method

USE: Newton method

Newton-Fourier method

USE: Newton method

Newton-Raphson method

USE: Newton method

Newtons method

USE: Newton method

Next generation network architecture

USE: Next generation networking

Next generation networking

UF: 21CN
21st century networks
NGN
NGNA
Next generation network

architecture

Next generation networks
Next-generation networks
BT: Computer networks
RT: 3G mobile communication
4G mobile communication



JULY 2025 IEEE Thesaurus

NIST Standards				Electromagnetic
BT:	Standards publications	interference		
Nitrification				Interference
BT:	Oxidation			Noise generators
				Noise measurement
Nitrogen		NT:		Roundoff errors
BT:	Chemical elements			1/f noise
	Gases			Additive noise
NT:	Denitrification			Colored noise
	Nitrogen compounds			Gaussian noise
	Silicon nitride			Laser noise
Nitrogen compounds				Low frequency noise
UF:	Potassium nitrate			Noise cancellation
	Sodium nitrate			Phase noise
BT:	Nitrogen	noise		Signal to noise ratio
NT:	Ammonia			Superconducting device
	Nitrous oxide			White noise
Nitrous oxide		<i>Noise abatement</i>		
BT:	Nitrogen compounds	USE:		Noise reduction
RT:	Greenhouse gases	Noise cancellation		
NLG		UF:		Noise cancellers
USE:	Natural language	BT:		Acoustic noise
generation		RT:		Noise
NLP				Filtering
USE:	Natural language	<i>Noise cancellers</i>		
processing		USE:		Noise cancellation
nMOSFETs		Noise figure		
USE:	MOSFET	BT:		Noise measurement
		RT:		Signal to noise ratio
NMR		Noise generators		
USE:	Nuclear magnetic	BT:		Signal generators
resonance		RT:		Noise
NMR imaging		Noise level		
USE:	Magnetic resonance	BT:		Acoustic noise
imaging		Noise measurement		
NOAA		UF:		Noisy
USE:	National Oceanic and	BT:		Measurement
Atmospheric Administration		RT:		Distortion measurement
Nobel Prize				Electric variables
BT:	Awards	measurement		
Noise				Noise
BT:	Signal processing	NT:		Packet loss
RT:	Autoregressive processes			Multiple signal classification
	Cyclic redundancy check			Noise figure
	Distortion			Noise shaping
		Noise reduction		



JULY 2025 IEEE Thesaurus

UF: Audio enhancement
De-noising
Denoising
Noise abatement
Noise suppression
BT: Acoustic noise
NT: Active noise reduction
Noise robustness
Wiener filters

Noise robust

USE: Noise robustness

Noise robustness

UF: Noise robust
BT: Noise reduction

Noise shaping

UF: Noise-shaping
BT: Noise measurement
NT: Multi-stage noise shaping

Noise suppression

USE: Noise reduction

Noise-shaping

USE: Noise shaping

Noisy

USE: Noise measurement

NOMA

UF: Nonorthogonal multiple
access
non-orthogonal multiple
access
BT: Access protocols
Communication systems
RT: Cellular radio
Free-space optical
communication
MIMO
OFDM
Radio communication
Radiofrequency
interference

Non fungible tokens

USE: Nonfungible tokens

Non relational databases

USE: NoSQL databases

Non repudiation

USE: Non-repudiation

Non-flowering plants

UF: Conifers
Gymnosperms
BT: Plants (biology)

Non-fungible tokens

USE: Nonfungible tokens

Non-government organizations

USE: Non-governmental
organizations

Non-governmental organizations

UF: NGO
Non-government
organizations
Nongovernmental
organizations
BT: Organizations
RT: Professional societies

Non-gyroscopes

USE: Gyroscopes

non-orthogonal multiple access

USE: NOMA

Non-parametric statistics

USE: Nonparametric statistics

Non-repudiation

UF: Non repudiation
BT: Access control
Data integrity
RT: Digital forensics

Non-united-states activities

USE: IEEE professional activities

Non-volatile memory

USE: Nonvolatile memory

Nonce

BT: Cryptography
Random variables

Nonconductive adhesives

BT: Adhesives

Nondestructive testing

BT: Materials testing
RT: Acoustic emission
Ultrasonic transducers
NT: Magnetic flux leakage



JULY 2025 IEEE Thesaurus

Nondeterministic polynomial-time hard

USE: NP-hard problem

Nonfungible tokens

UF: NFT
Non fungible tokens
Non-fungible tokens
BT: Authentication
Blockchains
RT: Bitcoin
Cryptocurrency
Distributed ledger

Nongovernmental organizations

USE: Non-governmental organizations

Nongyroscopes

USE: Gyroscopes

Nonhomogeneous media

UF: Composite media
Inhomogeneous media
Layered media
Multilayers
Periodic media
Stratified media
BT: Media
RT: Random media

Noninvasive diagnosis

USE: Noninvasive treatment

Noninvasive measurement

USE: Noninvasive treatment

Noninvasive surgery

USE: Noninvasive treatment

Noninvasive technique

USE: Noninvasive treatment

Noninvasive therapy

USE: Noninvasive treatment

Noninvasive treatment

UF: Noninvasive diagnosis
Noninvasive measurement
Noninvasive surgery
Noninvasive technique
Noninvasive therapy
BT: Medical treatment
RT: Pulse oximeter
NT: Embolization
Pulse oximetry

Nonlinear acoustics

BT: Acoustics
RT: Acoustic distortion
Nonlinear wave

propagation

Nonlinear circuits

BT: Circuits
RT: Chaos
Mixers
Power conversion
Rail to rail inputs
Rail to rail outputs
NT: Nonlinear network analysis

Nonlinear control systems

BT: Control systems
RT: Control nonlinearities
Piecewise linear techniques

Nonlinear distortion

BT: Distortion
RT: Limiting
Predistortion
NT: Harmonic distortion
Intermodulation distortion

Nonlinear dynamical systems

UF: Nonlinear dynamics
BT: Dynamical systems
Nonlinear systems
RT: Chaos
Econophysics
Fuzzy sets
Kalman filters
Neural networks
Pattern formation
Possibility theory
Predator prey systems
Spatiotemporal phenomena
Uncertainty

Nonlinear dynamics

USE: Nonlinear dynamical systems

Nonlinear equations

BT: Equations
Mathematics
RT: Algebra
Chaotic mapping
Linear approximation
Nonlinear systems
Numerical analysis
NT: Bifurcation



JULY 2025 IEEE Thesaurus

Nonlinear filters

BT: Filters
RT: Detectors
Phase locked loops

BT: Statistics
NT: Nearest neighbor methods

Nonlinear magnetics

BT: Magnetics
RT: Ferroresonance

Nonrelational databases

USE: NoSQL databases

Nonuniform electric fields

BT: Electric fields

Nonlinear network analysis

BT: Circuit analysis
Nonlinear circuits

Nonuniform sampling

BT: Sampling methods

Nonlinear optical devices

BT: Nonlinear optics
RT: Optical detectors

Nonuniform transmission lines

USE: Distributed parameter circuits

Nonlinear optics

BT: Optics
RT: Cross-phase modulation
Electro-optic effects
Pattern formation
Photonic crystals
Thermal lensing
NT: Fiber nonlinear optics
Nonlinear optical devices
Optical mixing
Optical saturation
Photorefractive effect
Raman scattering
Supercontinuum generation

Nonvolatile memories

USE: Nonvolatile memory

Nonvolatile memory

UF: Non-volatile memory
Nonvolatile memories
BT: Memory
NT: Racetrack memory

Normal distribution

USE: Gaussian distribution

Normalized difference vegetation index

UF: NDVI
BT: Environmental measurement
Vegetation
RT: Feature detection

Normalized difference water index

UF: NDWI
BT: Environmental measurement
Water
RT: Feature detection

Nonlinear systems

UF: Bilinear systems
Multilinear systems
BT: Mathematics
RT: Control systems
Linear approximation
Manipulators
Mobile robots
Nonlinear equations
Robots
NT: Chaos
Nonlinear dynamical

North America

BT: Continents

systems

North Pole

BT: Arctic

Nonlinear wave propagation

BT: Propagation
RT: Nonlinear acoustics

Nose

BT: Head
Sense organs
NT: Olfactory

Nonorthogonal multiple access

USE: NOMA

Nonparametric statistics

UF: Non-parametric statistics

NoSQL databases

UF: Non relational databases



JULY 2025 IEEE Thesaurus

	BT:	Nonrelational databases			Colliding beam devices
	RT:	Database systems			Electron emission
		Big Data			Elementary particles
		Data structures			Fusion power generation
		Data warehouses			Fusion reactors
		Distributed databases			Gamma-rays
		Linked data			Gas discharge devices
		Query processing			Helioseismology
					High energy physics
Notch filters				instrumentation computing	
	UF:	Band-stop filters			Ion beam applications
	BT:	Filters			Nuclear electronics
					Nuclear imaging
Novelty detection					Nuclear medicine
	USE:	Anomaly detection			Nuclear physics
					Particle accelerators
NP hard problem					Particle beam handling
	USE:	NP-hard problem			Particle beam injection
					Plasmas
NP-C					Radiation effects
	USE:	NP-complete problem			Radiation hardening
				(electronics)	
NP-complete problem					Radiation monitoring
	UF:	NP-C			Radiation safety
	BT:	Complexity theory			Reactor instrumentation
					Scintillation counters
NP-hard problem					Thermionic emission
	UF:	NP hard problem			
		Nondeterministic		Nuclear bombs	
polynomial-time hard				USE:	Nuclear weapons
	BT:	Complexity theory			
	NT:	Traveling salesman			
problems				Nuclear electronics	
				BT:	Nuclear and plasma
				sciences	
				RT:	FET circuits
NSL-KDD					High energy physics
	UF:	National Security		instrumentation computing	
Laboratory-Knowledge Discovery and Data Mining					
	BT:	Data models		Nuclear energy	
		Network intrusion detection		UF:	Nuclear fuels
	RT:	Benchmark testing		BT:	Energy resources
		Data mining		RT:	Nuclear power generation
		Knowledge discovery			Radioactive waste
		Network security			
				Nuclear facility licensing	
NTIA				USE:	Nuclear facility regulation
	UF:	National			
Telecommunications and Information Administration				Nuclear facility regulation	
	BT:	US Department of		UF:	Licensing (nuclear facilities)
Commerce					Nuclear facility licensing
				BT:	Power industry
				RT:	Radioactive waste
Nuclear and plasma sciences					
	NT:	Biomedical applications of		Nuclear fission	
radiation				USE:	Fission reactors



JULY 2025 IEEE Thesaurus

Nuclear fuels

USE: Nuclear energy

Nuclear imaging

UF: Gamma-ray imaging

BT: Imaging
Nuclear and plasma

sciences

RT: Nuclear medicine
Radiography

NT: Energy resolution
Ion emission

Nuclear magnetic resonance

UF: NMR

BT: Magnetic resonance

Nuclear magnetic resonance imaging

USE: Magnetic resonance

imaging

Nuclear measurements

BT: Measurement

RT: Atomic measurements
CAMAC
Position sensitive particle

detectors

Radiation detectors
Spectroscopy
Particle tracking

NT:

Nuclear medicine

BT: Engineering in medicine

and biology

Nuclear and plasma

sciences

RT: Energy resolution
Gamma-rays
Nuclear imaging
Positron emission

tomography

Nuclear phase transformations

UF: Nuclear phase transitions
Phase transformations,

nuclear

BT: Phase transitions, nuclear
Nuclear physics
RT: Nuclear thermodynamics

Nuclear phase transitions

USE: Nuclear phase

transformations

Nuclear physics

BT: Nuclear and plasma
sciences

RT: Hafnium

NT: Alpha particles

Beta rays

Ignition

Ion sources

Isotopes

Nuclear phase

transformations

Nuclear thermodynamics

Relativistic effects

Nuclear Power Generating Stations

USE: Nuclear power generation

Nuclear power generation

UF: Atomic energy
Nuclear Power Generating

Stations

BT: Power generation

RT: Nuclear energy

NT: Atomic batteries

Fission reactors

Fusion power generation

Nuclear reactors (fission)

USE: Fission reactors

Nuclear reactors (fusion)

USE: Fusion reactors

Nuclear thermodynamics

BT: Nuclear physics

RT: Elementary particles

Entropy

Nuclear phase

transformations

Phase change materials

Nuclear warfare

USE: Nuclear weapons

Nuclear warheads

USE: Nuclear weapons

Nuclear wastes

USE: Radioactive pollution

Nuclear weapons

UF: A-bomb

Atom bomb

Atomic warfare

Atomic weapons



JULY 2025 IEEE Thesaurus

	Nuclear bombs		Convergence of numerical
	Nuclear warfare	methods	
	Nuclear warheads		Finite difference methods
	Nuke		Finite element analysis
BT:	Weapons		Finite volume methods
RT:	Biological weapons		Gradient methods
	Chemical weapons	analysis	Independent component
	Electromagnetic pulses		
	National security		Iterative methods
	Terrorism		Least squares
	US Department of	approximations	
Homeland Security			Method of moments
			Mode matching methods
Nucleic acids			Multigrid methods
BT:	Molecular biophysics		Newton method
RT:	DNA		Numerical simulation
	DNA sequencing		Numerical stability
	RNA		Relaxation methods
			Sparse matrices
<i>Nuke</i>			Splines (mathematics)
USE:	Nuclear weapons		Surface fitting
			Symmetric matrices
			Transmission line matrix
Null space			
BT:	Kernel	methods	
Null value		Numerical models	
UF:	Nullvalue	BT:	Modeling
BT:	Data structures	RT:	Numerical analysis
RT:	Programming		
		Numerical simulation	
<i>Nullvalue</i>		BT:	Numerical analysis
USE:	Null value	RT:	Modeling
			Plasma simulation
			Simulation
<i>Number plate recognition</i>		Numerical stability	
USE:	License plate recognition	BT:	Numerical analysis
		RT:	Algorithms
Number portability			
BT:	Telecommunication	<i>Nursing</i>	
services		USE:	Medical services
Numerical analysis		Nutrients	
BT:	Mathematics	BT:	Food products
RT:	Convolution		
	Deconvolution	<i>Nuts (fasteners)</i>	
	Difference equations	USE:	Fasteners
	Differential equations		
	Error analysis	NVIS	
	Integral equations	UF:	Near vertical incidence
	Inverse problems	skywave	
	MATLAB	BT:	Broadcasting
	Nonlinear equations		Radiowave propagation
	Numerical models		
	Transforms		
NT:	Adaptive mesh refinement		
	Approximation methods		



JULY 2025 IEEE Thesaurus

NVQ

USE: Vocational training

Nylon fiber

USE: Synthetic fibers

O-RAN

USE: Open RAN

O-rings

USE: Structural rings

OATS

USE: Open area test sites

Obesity

BT: Medical conditions

Obituaries

BT: IEEE indexing

Object detection

UF: Image object detection

Target detection

BT: Image analysis

RT: Advanced driver assistance

systems

Fine-grained image

recognition

Image matching

Instance segmentation

Internet of Things

Magnetic anomaly

detection

Magnetic anomaly

detectors

Motion capture

Neural radiance field

Photogrammetry

Robot vision systems

NT: Buried object detection

Time difference of arrival

YOLO

Object oriented databases

BT: Database systems

Databases

RT: Object oriented methods

Object oriented methods

BT: Programming

RT: Object oriented databases

Object oriented

programming

Object oriented modeling

BT: Modeling

Object oriented programming

UF: Object-oriented

programming

BT: Programming

RT: C languages

C# languages

Object oriented methods

Python

Software libraries

Software reusability

NT: Dispatching

Object recognition

UF: Image object recognition

BT: Machine vision

RT: Image matching

Image recognition

Object tracking

Robot vision systems

NT: Affordances

Target recognition

Object segmentation

BT: Machine vision

NT: Subspace constraints

Object tracking

BT: Tracking

RT: Cinematography

Image motion analysis

Image segmentation

Motion capture

Motion estimation

Object recognition

Trajectory

Video signal processing

Object-oriented programming

USE: Object oriented
programming

Observability

BT: Control theory

Observatories

BT: Astronomy

RT: Telescopes

Observers

BT: State estimation

RT: Machine vision

NT: Disturbance observers



JULY 2025 IEEE Thesaurus

	Earth Observing System		Protective clothing
			Radioactive materials
Obstacle avoidance			Risk analysis
USE:	Collision avoidance		Working environment noise
Obstetrics		Occupational stress	
BT:	Medical specialties	BT:	Occupational health
RT:	Pregnancy	RT:	Employee welfare
			Hazards
Occipital Lobe		OCDM	
BT:	Brain	USE:	Code division multiplexing
Occupational health		Ocean acidification	
UF:	Health (occupational)	BT:	Acidification
BT:	Health and safety		Oceans
RT:	Accidents		
	Biological effects of		
radiation		Ocean animals	
	Domestic safety	USE:	Marine animals
	Electric shock		
	Employee welfare	Ocean circulation	
	Environmental factors	BT:	Ocean dynamics
	Ergonomics		Oceanography
	Eye protection	RT:	Ocean waves
	Occupational medicine		Sea level
	Occupational safety		Tides
	Pollution		
	Protective clothing	Ocean composition	
	Radioactive materials	USE:	Oceans
	Risk analysis		
	Safety	Ocean dynamics	
	Toxicology	BT:	Oceanography
	Working environment noise	RT:	Aquatic ecosystems
NT:	Occupational stress		Ocean temperature
			Ocean waves
Occupational medicine			Tides
BT:	Medical services	NT:	Ocean circulation
RT:	Medical diagnosis		Storm surge
	Medical treatment		
	Occupational health		
Occupational pensions		Ocean salinity	
USE:	Pensions	BT:	Oceans
		RT:	Aquatic ecosystems
			Salinity (geophysical)
		NT:	SMOS mission
Occupational safety		Ocean surface temperature	
UF:	OSHA	USE:	Sea surface temperature
BT:	Health and safety		
RT:	Accidents	Ocean technology	
	Domestic safety	USE:	Marine technology
	Electric shock		
	Employee welfare	Ocean temperature	
	Eye protection	BT:	Oceanic engineering and
	Industrial accidents	marine technology	
	Occupational health		Oceans
	Protection		



JULY 2025 IEEE Thesaurus

RT: Global warming
Land surface temperature
Ocean dynamics
NT: Ocean thermal energy
conversion
Sea surface temperature

Ocean thermal energy conversion

UF: OTEC
BT: Energy conversion
Ocean temperature
RT: Thermal energy

Ocean vegetation

USE: Marine vegetation

Ocean waves

BT: Hydrology
RT: Ocean circulation
Ocean dynamics
NT: Sea state
Wave power

Oceanic crust

BT: Geology
RT: Continental crust
Rocks
Tectonics

Oceanic engineering and marine technology

NT: Marine navigation
Marine technology
Ocean temperature
Oceanographic techniques
Water pollution

Oceanographic techniques

BT: Oceanic engineering and
marine technology
RT: Acoustic imaging
Hydrologic measurements
Radar applications
Remote sensing

Oceanography

UF: Marine science
Oceanology
BT: Geoscience
RT: Hydrography
Marine robots
Oceans
NT: Ocean circulation
Ocean dynamics

Oceanology

USE: Oceanography

Oceans

UF: Ocean composition
Planetary oceans
BT: Geoscience
RT: Aquatic ecosystems
Geophysics
Marine technology
Oceanography
Sea ice
Sea measurements
Water
NT: Antarctic Ocean
Arctic Ocean
Atlantic Ocean
Indian Ocean
Ocean acidification
Ocean salinity
Ocean temperature
Pacific Ocean
Sea coast
Sea floor
Sea level
Sea surface
Tides

OCR

USE: Optical character
recognition

Octrees

BT: Data structures

Odometers

BT: Distance measurement
Instruments

Odometry

BT: Motion detection
Position measurement
RT: Calibration
Location awareness
Robot control
Sensors

OFDM

UF: Orthogonal frequency
division multiple access
Orthogonal frequency
division multiplexing
BT: Multiplexing
RT: 3G mobile communication



JULY 2025 IEEE Thesaurus

(telecommunication)	Acoustic communication		BT:	Structural engineering
	Communication channels		RT:	Oil drilling
	Digital signal processing			Petroleum industry
	MIMO			Power industry
	Modulation		<i>Offshore platforms</i>	
multiple access	Multiaccess communication		USE:	Offshore installations
	Multicarrier code division		<i>Offshore power plants</i>	
	NOMA		USE:	Offshore installations
	NT:	Multiple access interference	OGC	
	OFDM modulation		USE:	Open Geospatial
ratio	Partial transmit sequences		Consortium	
	Peak to average power		Ohmic contacts	
	OFDM modulation		BT:	Contacts
	BT:	OFDM	RT:	Linear circuits
	OFETs		<i>Ohmmeters</i>	
transistors	UF:	Organic FETS	USE:	Electrical resistance
	Organic field effect		measurement	
	Organic field-effect		Oil drilling	
	Field effect transistors		UF:	Drilling oil
	BT:	Field effect transistors	BT:	Petroleum industry
Office automation	Automation		RT:	Drilling
	RT:	Bring your own device	Fuel processing industries	
	Communication systems		Offshore installations	
	Data communication		Technology	
	Desktop publishing		Well logging	
software	Document handling		Oil filled cables	
	Electronic mail		BT:	Oil insulation
	Information systems		RT:	Cable insulation
	Local area networks		<i>Oil filters</i>	
	Microcomputers		USE:	Lubricating oils
Offshore distribution systems	Teleconferencing		<i>Oil industry</i>	
	Text processing		USE:	Petroleum industry
	Unsolicited e-mail		Oil insulation	
	Voice mail		UF:	Transformer oil
	NT:	Workflow management	BT:	Insulation
Offshore installations	Gas platforms		RT:	Oils
	Offshore distribution		NT:	Oil filled cables
	Offshore platforms		<i>Oil platforms</i>	
	Offshore power plants		USE:	Offshore installations
	Oil platforms		Oil pollution	
systems	Pollution		BT:	Pollution
	Accidents		RT:	Accidents
	Land pollution		Land pollution	



JULY 2025 IEEE Thesaurus

Marine pollution
Oils
Petroleum
Petroleum industry

Oil refineries
BT: Petroleum industry

Oil sands
USE: Hydrocarbons

Oil shale
USE: Hydrocarbons

Oil tanks
USE: Fuel storage

Oiling (lubrication)
USE: Lubricating oils

Oils
BT: Materials
RT: Engines
Fats
Fluids
Fractionation
Fuel processing industries
Insulation
Marine pollution
Mechanical factors
Mechanical power

transmission
Oil insulation
Oil pollution
Petroleum
Petroleum industry
Pipelines
Water pollution
NT: Lubricating oils
Vegetable oils

Older adults
UF: Elderly
Senior citizens
BT: Social groups
RT: Aging
Alzheimer's disease
Assisted living
Assistive robots
Geriatrics
Gerontology

OLED
USE: Organic light emitting diodes

Olfactory
BT: Nose

Olfactory bulb
BT: Forebrain
Sense organs

Oligopoly
BT: Economics
RT: Game theory
Microeconomics

Omnidirectional antennas
BT: Antennas

On board unit
BT: Communication equipment
RT: Dedicated short range communication
Vehicle-to-everything

On demand software
USE: Software as a service

On load tap changers
UF: Load tap changers
On-load tap changers
Onload tap changers
BT: Power transformers
Tap changers
RT: Voltage control

On the job training
UF: On-the-job training
BT: Training
RT: Industrial training

On-chip
USE: System-on-chip

On-demand software
USE: Software AND
Software as a service

On-line services
USE: Online services

On-load tap changers
USE: On load tap changers

On-the-job training
USE: On the job training



JULY 2025 IEEE Thesaurus

Oncological surgery

UF: Otologic surgery
Surgery oncology
BT: Surgery
RT: Cancer
Oncology

Oncology

BT: Medical specialties
RT: Cancer
Cell therapy
Chemotherapy
Oncological surgery
Tumors
NT: Radiation therapy

One shot learning

UF: One-shot learning
BT: Machine learning
RT: Computer vision
Few shot learning
Training data

One-shot learning

USE: One shot learning

Online banking

UF: Digital currency
E-banking
E-currency
E-wallets
Electronic banking
Electronic currency
Electronic wallets
Internet banking
Mobile payment
Virtual currency
BT: Banking
Online services
RT: Bitcoin
Cryptocurrency
Digital economy
Electronic commerce
Fintech
Open banking
NT: Distributed ledger
Micropayments

Online bullying

USE: Cyberbullying

Online conferencing

USE: Web conferencing

Online indexing

USE: Indexing

Online learning

USE: Electronic learning

Online services

UF: Inverted classroom
On-line services
Reverse teaching
BT: Information retrieval
RT: Cloud gaming
Electronic learning
Internet
NT: Mobility as a service
Online banking
Web conferencing

Online shopping

USE: Electronic commerce

Online social networks

USE: Social networking (online)

Online voting

USE: Electronic voting

Onload tap changers

USE: On load tap changers

Ontologies

UF: Ontology
BT: Knowledge representation
RT: Linked data
Open data
Ranking (statistics)
Semantic Web
Semantic search
Thesauri
NT: Description logic

Ontology

USE: Ontologies

ONU

USE: Optical network units

OOO

USE: Out of order

Op amp

USE: Operational amplifiers

Open Access

BT: Open systems



JULY 2025 IEEE Thesaurus

NT: Publishing
Public domain software

Open AI

USE: Artificial intelligence

Open area test sites

UF: OATS
BT: Test facilities
RT: Electromagnetic compatibility and interference
Electromagnetic interference
Immunity testing
Military equipment

Open banking

BT: Banking
Open source software
RT: Finance
Investment
Online banking
Open systems

Open data

BT: Data handling
RT: Electronic publishing
Government policies
Internet
Linked data
Ontologies
Open systems
Public domain software
Semantic Web

Open Educational Resources

BT: Educational courses
Open systems

Open Geospatial Consortium

UF: OGC
BT: Standards organizations

Open loop control

USE: Open loop systems

Open loop systems

UF: Open loop control
BT: Control systems
RT: Feedforward systems
Operational amplifiers

Open radio access networks

USE: Open RAN

Open RAN

UF: O-RAN
Open radio access networks
BT: Mobile communication
Radio access networks
RT: Open systems

Open source hardware

UF: Open-source hardware
BT: Hardware

Open source software

UF: Open-source software
BT: Software
RT: Public domain software
NT: Open banking

Open systems

UF: OSI
BT: Computers and information processing
RT: System analysis and design
Common Information Model (electricity)

Computer networks
Internetworking
Interoperability
Local area networks
Metropolitan area networks
Open RAN
Open banking
Open data
Standards
Wide area networks
NT: Open Access
Open Educational

Resources

Physical layer

Open wireless architecture

UF: OWA
BT: Wireless communication

Open-source hardware

USE: Open source hardware

Open-source software

USE: Open source software

Operating cost reduction

USE: Costing



JULY 2025 IEEE Thesaurus

Operating systems

systems	UF:	Android (operating system)
		Computer operating
		Executive programs
		Microsoft Windows
		Robot operating systems
		Supervisory programs
	BT:	System software
	RT:	Computer security
		Cyber-physical systems
		Program processors
networking		Software defined
		System recovery
	NT:	Bootimg
		Embedded systems
		Input-output programs
		Kernel
		Network operating systems
		System kernels

Operational amplifiers

UF:	Op amp
BT:	Active circuits
	Amplifiers
RT:	FET circuits
	Linearization techniques
	MOSFET circuits
	Open loop systems
NT:	Feedback amplifiers

Operations research

analysis	BT:	Business
	RT:	Linear programming
		MCDM
		Management
		Optimization methods
		Principal component
		Resource management
		Statistics
		TOPSIS
	NT:	Inventory control
		Virtual enterprises

Ophthalmology

BT:	Medical specialties
RT:	Cornea
	Eyes
	Iris
	Pupils
	Retina

Opinion dynamics

BT:	Social dynamics
RT:	Computational modeling

Opinion mining

USE:	Sentiment analysis
------	--------------------

Opioids

BT:	Drugs
-----	-------

Opportunistic software systems development

BT:	Programming
-----	-------------

Optic flow

USE:	Optical flow
------	--------------

Optical add-drop multiplexers

UF:	ROADMS
BT:	Add-drop multiplexers

Optical amplification

USE:	Stimulated emission
------	---------------------

Optical amplifiers

BT:	Optics
RT:	Erbium
NT:	Doped fiber amplifiers
	Erbium-doped fiber

amplifiers

	Semiconductor optical
amplifiers	

Optical antennas

BT:	Antennas
	Optics
RT:	Nanophotonics
	Optical communication

equipment

	Optical metamaterials
	Optoelectronic devices
	Plasmons
	Receivers
	Terahertz materials
	Transceivers
	Transmitters
NT:	Nanoantennas

Optical arrays

BT:	Optical devices
RT:	Micromirrors
	Phased arrays



JULY 2025 IEEE Thesaurus

Optical attenuators

UF: Variable optical attenuators
 BT: Attenuators
 Optical devices
 RT: Optical communication
 equipment
 Optical losses

RT: Biomedical optical imaging
 Nanoantennas
 Optical antennas
 Optical attenuators
 Optical switches
 NT: Optical transmitters

Optical beam splitting

BT: Optical beams

Optical components

USE: Optical devices

Optical beams

BT: Beams
 RT: Bragg gratings
 Laser beams
 Laser theory
 NT: Optical beam splitting

Optical computing

BT: Computers and information
 processing

Optical control

BT: Control systems
 RT: Optical switches
 NT: Lighting control
 Optical variables control
 Optogenetics

Optical bistability

UF: Bistability (optical)
 BT: Electro-optic effects
 RT: Electro-optic devices
 Optical switches

Optical coupling

BT: Electromagnetic coupling
 RT: Optical fiber couplers

Optical buffering

BT: Optical fiber communication

Optical crosstalk

BT: Optics
 RT: Optical fiber communication

Optical burst switching

BT: Burst switching

Optical design

BT: Optics
 RT: Laser theory
 NT: Optical design techniques

Optical character recognition

UF: OCR
 BT: Software
 NT: License plate recognition

Optical design techniques

BT: Optical design
 RT: Design methodology
 NT: High-speed optical
 techniques

Optical cloaking

UF: Metamaterial cloaking
 BT: Metamaterials
 Optical materials

Optical code division multiplexing

USE: Code division multiplexing

Optical detectors

BT: Optical sensors
 RT: Nonlinear optical devices
 NT: Bar codes

Optical coherence tomography

BT: Tomography
 RT: Eyes

Optical device fabrication

UF: Optical device manufacture
 BT: Fabrication
 Optical devices
 RT: Electronic equipment
 manufacture

Optical collimators

BT: Optical devices

Optical communication

USE: Optical fiber communication

Optical device manufacture

USE: Optical device fabrication

Optical communication equipment

BT: Communication equipment



JULY 2025 IEEE Thesaurus

Optical devices

UF: Optical components
 BT: Optics
 RT: Biomedical optical imaging
 Endomicroscopy
 Gratings
 Optical materials
 NT: Bragg gratings
 Collimators
 Displays
 Holographic optical

components

Lenses
 Light deflectors
 Lighting
 Luminescent devices
 Mirrors
 Optical arrays
 Optical attenuators
 Optical collimators
 Optical device fabrication
 Optical filters
 Optical modulators
 Optical resonators
 Optical sensors
 Optical tweezers
 Retroreflectors
 Thermo-optical devices

Optical diffraction

BT: Electromagnetic diffraction
 RT: Photonic band gap
 NT: Diffraction gratings

Optical distortion

BT: Optics
 RT: Lasers
 Optical noise
 Thermal lensing

Optical distortion measurement

USE: Distortion measurement

Optical emission spectroscopy

BT: Spectroscopy
 RT: Plasmas

Optical engineering

BT: Engineering - general
 Optics
 RT: Optical materials

Optical feedback

BT: Image processing

RT: Distributed feedback
 devices

Optical fiber amplifiers

UF: Optical fibre amplifiers
 BT: Optical fibers
 RT: Amplifiers

Optical fiber applications

UF: Optical fibre applications
 BT: Optics
 RT: Channel spacing
 Code division multiplexing
 Optical fiber cables
 Optical fiber communication
 Optical fibers
 NT: Optical fiber devices

Optical fiber cables

UF: Communication cables
 (optical)
 Optical fibre cables
 BT: Cables
 RT: Optical fiber applications
 Splicing
 NT: Claddings

Optical fiber communication

UF: Infrared communication
 Optical communication
 Optical fibre communication
 Optical links
 BT: Communication systems
 RT: Avalanche photodiodes
 Broadband communication
 Indoor communication
 Optical crosstalk
 Optical fiber applications
 Optical transmitters
 Quantum communication
 Silicon photonics
 Synchronous digital

hierarchy

NT: FDDI
 Free-space optical

communication

Optical buffering
 Optical fiber networks
 Optical fiber subscriber

loops

Optical interconnections
 Optical packet switching
 Optical wavelength

conversion

SONET



JULY 2025 IEEE Thesaurus

Scheduling algorithms
Visible light communication

Optical fiber couplers

UF: Optical fibre couplers
BT: Optical fibers
RT: Optical coupling

Optical fiber devices

UF: Optical fibre devices
BT: Optical fiber applications
RT: Optical fibers
NT: Optical fiber sensors

Optical fiber dispersion

UF: Optical fibre dispersion
BT: Dispersion

Optical fiber filters

BT: Optical filters

Optical fiber LAN

UF: Optical fiber local area
network

Optical fibre LAN
Optical fibre local area

network
BT: Optical fiber networks

Optical fiber local area network

USE: Optical fiber LAN

Optical fiber loss

USE: Optical fiber losses

Optical fiber losses

UF: Optical fiber loss
Optical fibre losses
BT: Optical fibers

Optical fiber networks

UF: Optical fibre networks
Optical networks
Optical-fiber networks
Optical-fibre networks
BT: Optical fiber communication
RT: Light fidelity
NT: All-optical networks
Elastic optical networks
LAN emulation
Optical fiber LAN
Optical network units
Passive optical networks
Protection switching
Wavelength assignment

Optical fiber polarization

UF: Optical fibre polarisation
Polarization-maintaining

optical fibers

BT: Optical fibers
RT: Optical fiber sensors
Optical interferometry
NT: Polarization mode

dispersion

Optical fiber sensors

UF: Fiber optic sensors
Fibre optic sensors
Optical fibre sensors
BT: Optical fiber devices
Optical sensors
RT: Optical fiber polarization
Partial discharge

measurement

Optical fiber subscriber loops

UF: FTTH
Fiber-in-the-loop
Optical fibre subscriber

loops

BT: Optical fiber communication

Optical fiber testing

UF: Optical fibre testing
BT: Testing
RT: Optical fibers

Optical fiber theory

UF: Optical fibre theory
BT: Optical fibers
RT: Electromagnetic field theory

Optical fibers

UF: Optical fibres
BT: Fiber optics
Optical waveguides
RT: Electromagnetic

waveguides

Optical fiber applications
Optical fiber devices
Optical fiber testing
Optical materials
Optical propagation
Optical waveguide theory
Optical wavelength

conversion

Supercontinuum generation
Temperature sensors
NT: Optical fiber amplifiers
Optical fiber couplers



JULY 2025 IEEE Thesaurus

Optical fiber losses		<i>Optical fibres</i>	
Optical fiber polarization		USE:	Optical fibers
Optical fiber theory		Optical films	
Plastic optical fiber		BT:	Films
Wavelength conversion		RT:	Integrated optics Optical materials
<i>Optical fibre amplifiers</i>		Optical filters	
USE:	Optical fiber amplifiers	BT:	Optical devices
<i>Optical fibre applications</i>		RT:	Photography
USE:	Optical fiber applications	NT:	Optical fiber filters
<i>Optical fibre cables</i>		Optical flow	
USE:	Optical fiber cables	UF:	Optic flow
<i>Optical fibre communication</i>		BT:	Optical imaging Relativistic effects
USE:	Optical fiber communication		
<i>Optical fibre couplers</i>		<i>Optical frequency combs</i>	
USE:	Optical fiber couplers	USE:	Optical harmonic generation
<i>Optical fibre devices</i>		Optical frequency conversion	
USE:	Optical fiber devices	BT:	Frequency conversion
<i>Optical fibre dispersion</i>		<i>Optical gratings</i>	
USE:	Optical fiber dispersion	USE:	Gratings
<i>Optical fibre LAN</i>		Optical harmonic generation	
USE:	Optical fiber LAN	UF:	Optical frequency combs
<i>Optical fibre local area network</i>		BT:	Optics
USE:	Optical fiber LAN	<i>Optical heterodyning</i>	
<i>Optical fibre losses</i>		USE:	Optical mixing
USE:	Optical fiber losses	Optical imaging	
<i>Optical fibre networks</i>		BT:	Imaging
USE:	Optical fiber networks	RT:	Infrared imaging Microscopy Remote sensing
<i>Optical fibre polarisation</i>		NT:	Optical flow Optical projectors Talbot effect Thermoreflectance imaging
USE:	Optical fiber polarization		
<i>Optical fibre sensors</i>		Optical interconnections	
USE:	Optical fiber sensors	UF:	Optical interconnects
<i>Optical fibre subscriber loops</i>		BT:	Optical fiber communication
USE:	Optical fiber subscriber loops	<i>Optical interconnects</i>	
<i>Optical fibre testing</i>		USE:	Optical interconnections
USE:	Optical fiber testing	Optical interferometry	
<i>Optical fibre theory</i>		UF:	Light interferometry
USE:	Optical fiber theory	BT:	Interferometry



JULY 2025 IEEE Thesaurus

RT:	Optical fiber polarization Speckle Talbot effect	Optical microscopy BT: Optics
<i>Optical lattices</i> USE:	Lattices	Optical mixing UF: Optical heterodyning BT: Nonlinear optics Optics RT: Photorefractive materials NT: Multiwave mixing
<i>Optical links</i> USE:	Optical fiber communication	Optical modulation BT: Modulation RT: Indoor communication Microwave photonics Optical transmitters NT: Cross-phase modulation Intensity modulation
Optical losses BT: RT:	Optics Loss measurement Optical attenuators Optical scattering	Optical modulators BT: Modulation Optical devices NT: Electro-absorption modulators Electro-optic modulators
Optical materials BT: RT:	Materials Glass Indium tin oxide Lenses Magnesium oxide Metamaterials Mirrors Optical devices Optical engineering Optical fibers Optical films Optics Organic inorganic hybrid	<i>Optical multilayers</i> USE: Optical superlattices
materials	Phase change materials Photonic crystals SIMO NT: Colloidal nanocrystals Optical cloaking Optical polymers Optical retarders Optical superlattices Photorefractive materials	Optical network units UF: ONU BT: Optical fiber networks
<i>Optical measurements</i> USE:	Optical variables	<i>Optical networks</i> USE: Optical fiber networks
measurement		Optical noise BT: Integrated circuit noise RT: Optical distortion NT: Speckle
Optical metamaterials UF: BT: RT:	Photonic metamaterials Metamaterials Electromagnetic	Optical packet switching BT: Optical fiber communication
metamaterials	Nanoantennas Optical antennas	Optical planar waveguides BT: Optical waveguides
Optical metrology BT:	Metrology	<i>Optical polarisation</i> USE: Optical polarization
		Optical polarization UF: Light polarisation Light polarization Optical polarisation BT: Optics RT: Photoelasticity



JULY 2025 IEEE Thesaurus

NT:	Polarization shift keying Stokes parameters	RT:	Antireflection coatings Mirrors Optical scattering Reflectivity Reflectometry Thermooptic effects
Optical polymers			
BT:	Optical materials Polymers		
Optical projectors		Optical refraction	
UF:	projectors (optical)	BT:	Physical optics
BT:	Optical imaging Video equipment	RT:	Photorefractive effect Photorefractive materials Refractive index Thermooptic effects
RT:	Image processing Micromirrors Motion pictures		
Optical propagation		<i>Optical regenerators</i>	
UF:	Infrared propagation	USE:	Repeaters
BT:	Electromagnetic propagation	Optical resonators	
RT:	Optical fibers Thermooptic effects	BT:	Optical devices
NT:	Optical surface waves Optical waveguides	RT:	Digital filters Laser cavity resonators Resonance Split ring resonators
Optical pulse compression		NT:	Microcavities Optical ring resonators
BT:	Pulse compression methods	Optical retarders	
Optical pulse generation		UF:	Half-wave plates Quarter-wave plates
BT:	Pulse generation	BT:	Optical materials Optics
RT:	Optical pulse shaping	RT:	Polarimetry
Optical pulse shaping		Optical ring resonators	
BT:	Pulse shaping methods	UF:	Ring resonators
RT:	Optical pulse generation	BT:	Optical resonators
Optical pulses		Optical saturation	
BT:	Optics	BT:	Nonlinear optics Optics
Optical pumping		Optical scattering	
BT:	Laser excitation	BT:	Electromagnetic scattering
<i>Optical radar</i>		RT:	Laser radar Light scattering Optical losses Optical reflection Speckle
USE:	Laser radar		
Optical receivers		Optical sensors	
BT:	Receivers	BT:	Optical devices Sensors
Optical recording		RT:	Image sensors Wearable sensors
BT:	Recording	NT:	Optical detectors
RT:	Laser applications		
NT:	CD recording		
Optical reflection			
BT:	Electromagnetic reflection		



JULY 2025 IEEE Thesaurus

Optical fiber sensors

Optical signal detection
 BT: Signal detection
 RT: Photodetectors

Optical signal processing
 BT: Signal processing
 NT: Laser noise

Optical solitons
 BT: Optics
 Solitons
 RT: Optical vortices

Optical squeezing
 UF: Squeezed light
 Squeezed states
 BT: Quantum optics

Optical superlattices
 UF: Optical multilayers
 BT: Optical materials
 Superlattices

Optical surface waves
 BT: Optical propagation

Optical switch
 USE: Optical switches

Optical switches
 UF: Optical switch
 BT: Switches
 RT: Optical bistability
 Optical communication

equipment
 Optical control
 Photothyristors
 Smart pixels
 Thermo-optical devices

Optical transmitters
 BT: Optical communication

equipment
 Transmitters
 RT: Bragg gratings
 Diodes
 Optical fiber communication
 Optical modulation
 Photodiodes
 Semiconductor lasers
 Semiconductor optical

amplifiers

Optical tuning
 BT: Optics
 Tuning
 RT: Laser tuning

Optical tweezers
 BT: Optical devices

Optical variables control
 BT: Optical control
 RT: Frequency control
 Phase control

Optical variables measurement
 UF: Optical measurements
 BT: Measurement
 RT: Frequency measurement
 Phase measurement
 Reflectometry
 Wavelength measurement
 NT: Ellipsometry
 Photometry
 Reflection coefficient
 Refractive index

Optical vortex
 USE: Optical vortices

Optical vortices
 UF: Optical vortex
 Vortices, optical
 BT: Physical optics
 RT: Laser beams
 Optical solitons

Optical waveguide components
 BT: Optical waveguides

Optical waveguide theory
 BT: Optical waveguides
 RT: Optical fibers

Optical waveguides
 BT: Optical propagation
 Waveguide components
 RT: Electro-optic modulators
 Integrated optics
 Photonic crystals
 NT: Arrayed waveguide gratings
 Electro-optical waveguides
 Optical fibers
 Optical planar waveguides
 Optical waveguide

components
 Optical waveguide theory



JULY 2025 IEEE Thesaurus

Optical wavelength conversion

BT: Optical fiber communication
Signal processing
RT: Multicast communication
Optical fibers
Telecommunications

Optical tuning
Optogenetics
Particle beam optics
Photoluminescence
Physical optics
Ray tracing
Stray light
Ultrafast optics
Whispering gallery modes

Optical-fiber networks

USE: Optical fiber networks

Optical-fibre networks

USE: Optical fiber networks

Optics

BT: Lasers and electrooptics
RT: Erbium
Fourier transforms
Laser theory
Magneto optic effects
Optical materials
NT: Adaptive optics
Aspherical optics
Birefringence
Brightness
Color
Electron optics
Extinction coefficients
Fiber optics
Fluorescence
Four-wave mixing
Geometrical optics
Integrated optics
Light fields
Light sources
Luminescence
Microoptics
Nonlinear optics
Optical amplifiers
Optical antennas
Optical crosstalk
Optical design
Optical devices
Optical distortion
Optical engineering
Optical fiber applications
Optical harmonic

generation

Optical losses
Optical microscopy
Optical mixing
Optical polarization
Optical pulses
Optical retarders
Optical saturation
Optical solitons

Optimal control

BT: Control systems
RT: Game theory
H infinity control
NT: Bang-bang control
Infinite horizon

Optimal matching

BT: Graph theory

Optimal scheduling

BT: Optimization

Optimisation

USE: Optimization

Optimisation methods

USE: Optimization methods

Optimisation models

USE: Optimization models

Optimised production technology

USE: Optimized production technology

Optimising compilers

USE: Optimizing compilers

Optimization

UF: Optimisation
Performance optimisation
Performance optimization
BT: Mathematics
RT: Artificial bee colony

algorithm

Doping profiles
Least squares

approximations

Minimization
Multi-armed bandit problem
Parametric study
Performance analysis
TOPSIS
NT: Bees algorithm



JULY 2025 IEEE Thesaurus

	Cost function		BT:	Program processors
	Krill herd algorithm			
	Metaheuristics			<i>Opto-electronic devices</i>
	Optimal scheduling		USE:	Optoelectronic devices
	Optimization methods			
	Trajectory optimization			<i>Optoacoustic effects</i>
			USE:	Photoacoustic effects
Optimization methods		Optoelectronic and photonic sensors		
UF:	Optimisation methods	BT:	Sensors	
BT:	Optimization			
RT:	Infinite horizon	Optoelectronic devices		
	Linear programming	UF:	Opto-electronic devices	
	MIMO	BT:	Lasers and electrooptics	
	Newton method	RT:	Electro-optic devices	
	Operations research		Optical antennas	
	Processor scheduling		Phototransistors	
	Response surface		Charge-coupled image	
methodology		NT:		
	Search methods	sensors		Integrated optoelectronics
	Single machine scheduling			Light emitting diodes
	Traveling salesman			Photoconducting devices
problems				Photodetectors
NT:	Affordances			Superluminescent diodes
	Circuit optimization			
	Concave programming	Optogenetics		
	Design optimization	BT:	Genetics	
	Fireworks algorithm		Neuromodulation	
	Glowworm swarm		Optical control	
optimization			Optics	
	Gradient methods			
	H infinity control			
	Lagrangian functions	<i>Optothermal effects</i>		
	Mathematical programming	USE:	Photothermal effects	
	Optimization models			
	Optimized production	<i>Optothyristors</i>		
technology		USE:	Photothyristors	
	Pareto optimization			
	Quadratic programming	Oral communication		
	Simulated annealing	UF:	Speech communication	
		BT:	Professional	
Optimization models		communication		
UF:	Optimisation models	NT:	Public speaking	
BT:	Mathematical models		Speech	
	Optimization methods			
Optimized production technology		<i>Orange technology</i>		
UF:	Optimised production	USE:	Social implications of	
technology		technology		
BT:	Optimization methods			
	Production control	Orbital calculations		
RT:	Production planning	BT:	Energy states	
	Production systems			
Optimizing compilers		<i>Orbital debris</i>		
UF:	Optimising compilers	USE:	Space debris	



JULY 2025 IEEE Thesaurus

Orbital robotics

BT: Robots

Orbits

BT: Astrophysics
RT: Geostationary satellites
NT: Orbits (stellar)
Planetary orbits

Orbits (stellar)

BT: Orbits

Ordered logit models

USE: Logistic regression

Ordinance

USE: Weapons

Ordinary differential equations

BT: Differential equations

Ordinary magnetoresistance

BT: Magnetoresistance

Ores

BT: Minerals

Organ transplantation

UF: Transplants
BT: Medical services
NT: Heart transplantation

Organic chemicals

BT: Chemistry
NT: Hydrocarbons

Organic compounds

BT: Compounds
RT: Carbon
NT: Carbon compounds
Formaldehyde
Organic semiconductors
Volatile organic compounds

Organic electronics

UF: Paper electronics
BT: Electronic equipment
RT: Synapses

Organic FETS

USE: OFETs

Organic field effect transistors

USE: OFETs

Organic field-effect transistors

USE: OFETs

Organic inorganic hybrid materials

UF: Inorganic organic hybrid
materials
Inorganic-organic hybrid
materials
Organic-inorganic hybrid
materials
Organically modified
silicates

BT: Ormosils
Materials
RT: Bio-inspired materials
Inorganic compounds
Optical materials

Organic light emitting diodes

UF: OLED
Organic light-emitting
diodes
Polymer led
BT: Diodes
Light emitting diodes
RT: Electroluminescence
Molecular electronics
NT: Active matrix organic light
emitting diodes

Organic light-emitting diodes

USE: Organic light emitting
diodes

Organic materials

BT: Materials

Organic semiconductors

BT: Organic compounds
Semiconductor materials
NT: Pentacene

Organic thin film transistors

UF: OTFT
Organic thin-film transistors
BT: Thin film transistors

Organic thin-film transistors

USE: Organic thin film transistors

Organic-inorganic hybrid materials

USE: Organic inorganic hybrid
materials



JULY 2025 IEEE Thesaurus

Organically modified silicates

USE: Organic inorganic hybrid materials

Organisational aspects

USE: Organizational aspects

Organisational culture

USE: Organizational aspects

Organisational structure

USE: Organizational aspects

Organisms

BT: Biological systems

NT: Algae
Animals
Archaea
Fish
Invasive species
Microorganisms
Plankton
Plants (biology)

Organizational aspects

UF: Business organisation
Business organization
Organisational aspects
Organisational culture
Organisational structure
Organizational culture
Organizational structure

BT: Management
RT: Business process re-

engineering

NT: Industrial communication
Teamwork
Business communication
Corporate acquisitions
Data governance
Facilities management
Role transfer
Scheduling
Stakeholders

Organizational communication

USE: Industrial communication

Organizational culture

USE: Organizational aspects

Organizational structure

USE: Organizational aspects

Organizations

BT: Business
RT: Leadership
NT: BNSC
Companies
Decentralized autonomous

organization

European Space Agency
Government
Non-governmental

organizations

Sociotechnical systems
United Kingdom Space

Agency

Organobromine compounds

USE: Bromine compounds

Organoids

BT: Cells (biology)
RT: Biological systems

Organs (biological)

USE: Biological systems

Orientation control

USE: Position control

Orientation determination

USE: Position measurement

Orientation measurement

USE: Position measurement

Orifices

BT: Mechanical products

Ormosils

USE: Organic inorganic hybrid materials

Orthogonal frequency division multiple access

USE: OFDM

Orthogonal frequency division multiplexing

USE: OFDM

Orthopedic procedures

BT: Medical treatment

Orthopedic surgery

BT: Surgery

Orthotics

BT: Medical treatment



JULY 2025 IEEE Thesaurus

RT:	Assistive technologies Biomedical engineering Biomedical equipment Medical control systems Prosthetics Sensory aids Wearable robots	OTEC	USE:	Ocean thermal energy conversion
<i>Oscillations</i>		OTFT	USE:	Organic thin film transistors
USE:	Oscillators	Otolaryngology	USE:	Otorhinolaryngology
Oscillators		Otologic surgery	USE:	Oncological surgery
UF:	Oscillations	Otorhinolaryngology	UF:	Otolaryngology
BT:	Circuits and systems	BT:	Medical specialties	
RT:	Circuits Damping Klystrons Lasers Resonant frequency Vibrations	RT:	Head Neck	
NT:	Digital-controlled oscillators Injection-locked oscillators Local oscillators Microwave oscillators Phase noise Ring oscillators Voltage-controlled	OTT	USE:	Over-the-top media services
oscillators		Out of order	UF:	OOO
Oscilloscopes		BT:	Instruction sets	
UF:	Cathode-ray oscilloscopes	<i>Outlier detection</i>	USE:	Anomaly detection
BT:	Instruments	Output feedback	BT:	Feedback circuits
RT:	Electric variables	<i>Output power</i>	USE:	Power generation
measurement	Test equipment	Outsourcing	BT:	Management
<i>OSHA</i>		RT:	Crowdsourcing	
USE:	Occupational safety	Ovarian cancer	BT:	Cancer
<i>OSI</i>		Ovens	BT:	Home appliances
USE:	Open systems	NT:	Microwave ovens	
Osmium		<i>Over-the-air</i>	USE:	Wireless networks
BT:	Chemical elements	Over-the-top media services	UF:	OTT
Osmosis		BT:	Streaming media	
BT:	Chemical processes			
NT:	Electro-osmosis			
Osteoarthritis				
BT:	Bone diseases			
Osteoporosis				
BT:	Bone diseases			
RT:	Cancellous bone			



JULY 2025 IEEE Thesaurus

Overfitting	BT: Mathematical models	<i>P-I-N</i>	USE: PIN photodiodes
<i>Overflow oscillations</i>	USE: Finite wordlength effects	P-i-n diodes	BT: Diodes Semiconductor devices Semiconductor diodes
<i>Overhead distribution lines</i>	USE: Power distribution lines	RT: CMOSFET logic devices Electro-optic modulators Vertical cavity surface	
<i>Overhead transmission lines</i>	USE: Power transmission lines	emitting lasers	
Overlay networks	BT: Computer networks RT: Network topology Transport protocols NT: Dark Web	P-n junctions	BT: Junctions RT: Light emitting diodes Photodiodes Semiconductor diodes
<i>OWA</i>	USE: Open wireless architecture	<i>P1394</i>	USE: IEEE 1394 Standard
OWL	UF: Web ontology language BT: Markup languages Semantic Web RT: Knowledge representation	<i>P2MP</i>	USE: Point-to-multipoint communications
Oxidation	BT: Chemical processes RT: Antioxidants Materials NT: Combustion Nitrification Redox	<i>P2P</i>	USE: Peer-to-peer computing
Oxygen	BT: Chemical elements Gases RT: Hypoxia Pulse oximetry	<i>P802.11</i>	USE: IEEE 802.11 Standard
Ozonation	UF: Ozone treatment BT: Wastewater treatment RT: Environmental factors Pollution control	<i>PAAS</i>	USE: Platform as a service
<i>Ozone generators</i>	USE: Discharges (electric)	Pacemakers	BT: Biomedical equipment RT: Cardiology
<i>Ozone treatment</i>	USE: Ozonation	Pacific Ocean	BT: Oceans
<i>Ozonizers</i>	USE: Discharges (electric)	<i>Package delivery</i>	USE: Product delivery
		Packaging	BT: Industry applications RT: Filling Leak detection Packaging machines Seals NT: Bagging Bottling Canning Encapsulation Food packaging



JULY 2025 IEEE Thesaurus

	Labeling		Paging systems	
	Multichip modules		UF:	Paging strategies
	Nanopackaging		BT:	Cellular radio
	Plastic packaging		RT:	Wireless communication
	Wrapping			
Packaging machines			Pain	
BT:	Production equipment		BT:	Injuries
RT:	Bagging		NT:	Ischemic pain
	Bottling			Neuropathic pain
	Labeling		Painting	
	Packaging		BT:	Surface finishing
	Wrapping			Surface treatment
			RT:	Coatings
Packet loss				Paints
BT:	Loss measurement			Photorealism
	Packet switching		Paints	
RT:	Data communication		BT:	Chemical products
	Noise measurement			Coatings
<i>Packet radio</i>				Materials
USE:	Packet radio networks		RT:	Ink
				Lacquers
Packet radio networks				Painting
UF:	Packet radio		<i>Pair-wise error probability</i>	
BT:	Radio communication		USE:	Pairwise error probability
Packet switching			<i>Pairwise correlations</i>	
BT:	Communication switching		USE:	Pairwise error probability
RT:	ARPANET		Pairwise error probability	
	Data transfer		UF:	Pair-wise error probability
	IEEE 802.3 Standard			Pairwise correlations
	Next generation networking		BT:	Probability
NT:	Burst switching		<i>Palaeontology</i>	
	Frame relay		USE:	Paleontology
	Multiprotocol label		Paleontology	
switching			UF:	Palaeontology
	Packet loss		BT:	Science - general
<i>Pacs</i>			RT:	Biology
USE:	Picture archiving and			Geology
communication systems				Microorganisms
<i>Paediatrics</i>			Palladium	
USE:	Pediatrics		BT:	Metals
Page description languages			<i>Palletising</i>	
UF:	Postscript		USE:	Pallets
BT:	Markup languages		<i>Palletizing</i>	
RT:	Desktop publishing		USE:	Pallets
	High level languages			
<i>Paging strategies</i>				
USE:	Paging systems			



JULY 2025 IEEE Thesaurus

Pallets

UF: Palletising
Palletizing
BT: Materials handling
RT: Containers
Load management

Palliative care

BT: Medical treatment

Palm print recognition

USE: Palmprint recognition

Palmprint identification

USE: Palmprint recognition

Palmprint recognition

UF: Palm print recognition
Palmprint identification
BT: Biometrics
RT: Identification of persons

Palmtop computers

USE: Personal digital devices

Pancreas

BT: Digestive system
RT: Pancreatic cancer

Pancreatic cancer

BT: Cancer
RT: Pancreas

Pandemics

BT: Epidemics
RT: COVID-19
Coronaviruses
Diseases
Influenza

Pansharpened

USE: Pansharpening

Pansharpening

UF: Pansharpened
BT: Image processing
RT: Image quality

Paper electronics

USE: Organic electronics

Paper industry

USE: Pulp and paper industry

Paper making

BT: Pulp and paper industry
RT: Bleaching
Paper making machines
Paper products
Paper pulp
Paper technology
Pulp manufacturing
Spinning machines

Paper making machines

BT: Production equipment
Pulp and paper industry
RT: Paper making
Paper products
Paper pulp
Paper technology
Pulp manufacturing
Spinning machines

Paper mills

BT: Production facilities
Pulp and paper industry
RT: Industrial plants
Paper products
Paper pulp
Pulp manufacturing
Spinning machines

Paper products

BT: Manufactured products
RT: Paper making
Paper making machines
Paper mills
Paper pulp
Paper technology
Pulp and paper industry

Paper pulp

BT: Manufactured products
Materials
RT: Cellulose
Paper making
Paper making machines
Paper mills
Paper products
Pulp and paper industry
Pulp manufacturing

Paper technology

BT: Industry applications
RT: Paper making
Paper making machines
Paper products
Pulp and paper industry



JULY 2025 IEEE Thesaurus

PAPR

USE: Peak to average power ratio

Paraelectric materials

USE: Dielectric materials

Parallel algorithms

BT: Algorithms
Parallel processing

Parallel architectures

BT: Computer architecture
RT: Parallel machines
Parallel processing
NT: Multicore processing

Parallel computing

USE: Parallel processing

Parallel languages

BT: High level languages
RT: Multiprocessing systems
Parallel processing
Parallel programming

Parallel machines

BT: Computers
RT: Parallel architectures
Parallel processing

Parallel processing

UF: Array processing
Parallel computing
Parallelism
BT: Computers and information processing
RT: Cluster computing
Concurrency control
Digital computers
Parallel architectures
Parallel languages
Parallel machines
Parallel programming
NT: Multiprocessing systems
Multithreading
Parallel algorithms
Pipeline processing
Single instruction multiple

data

Parallel processor interconnection

USE: Multiprocessor interconnection

Parallel programming

BT: Programming
RT: Multiprocessing systems
Parallel languages
Parallel processing
VHDL

Parallel robots

BT: Robots

Parallelism

USE: Parallel processing

Paralysis

BT: Medical conditions
RT: Motor coordination

Paramagnetic materials

BT: Magnetic materials
RT: Paramagnetic resonance
NT: Superparamagnetic iron oxide nanoparticles

Paramagnetic resonance

BT: Magnetic resonance
RT: Paramagnetic materials

Parameter estimation

UF: Parameter identification
BT: Signal analysis
Statistical analysis
RT: Control systems
Power system analysis
computing
Spectral analysis
NT: Amplitude estimation
Direction-of-arrival
estimation
Frequency estimation
Motion estimation
Phase estimation
Time of arrival estimation

Parameter extraction

BT: Electromagnetic measurements
RT: Bipolar transistor circuits
Very large scale integration

Parameter identification

USE: Parameter estimation

Parameter uncertainty

USE: Uncertain systems



JULY 2025 IEEE Thesaurus

Parametric model

USE: Parametric statistics

Parametric statistics

UF: Parametric model

BT: Statistics

Parametric study

BT: Multitasking

RT: Optimization

Parasitic capacitance

BT: Capacitance

Parasitic diseases

BT: Diseases

RT: Mast cells

Parasympathetic nervous system

BT: Autonomic nervous system

Pareto analysis

BT: Statistical analysis

RT: Cause effect analysis

Quality management

NT: Pareto optimization

Pareto optimisation

USE: Pareto optimization

Pareto optimization

UF: Multi-attribute optimization

Multi-objective

programming

Multiobjective programming

Pareto optimisation

Vector optimization

BT: Optimization methods

Pareto analysis

RT: Genetic algorithms

Parietal lobe

BT: Brain

Parity check

USE: Codes

Parity check codes

UF: LDPC

Ldpc codes

Low density parity check

codes

Parity-check codes

BT: Codes

RT: Decoding

NT: Iterative decoding

Parity-check codes

USE: Parity check codes

Parkinson's disease

BT: Diseases

Parotid

USE: Salivary glands

Partial differential equations

BT: Differential equations

RT: Boundary value problems

Fourier transforms

NT: Boundary-element methods

Poisson equations

Partial discharge measurement

BT: Electric variables
measurement

RT: Electrical safety

Insulation life

Insulation testing

Optical fiber sensors

Partial discharges

BT: Dielectric breakdown

RT: Corona

Partial response channels

BT: Communication channels

Partial response signaling

BT: Digital modulation

Partial transmit sequences

BT: OFDM

Particle accelerator

USE: Linear particle accelerator

Particle accelerators

BT: Nuclear and plasma
sciences

RT: Colliding beam devices

Large Hadron Collider

Particle beams

Voltage multipliers

NT: Accelerator magnets

Colliding beam accelerators

Cyclotrons

Electron accelerators

Ion accelerators

Linear accelerators



JULY 2025 IEEE Thesaurus

Photon collider
Plasma accelerators
Proton accelerators
Storage rings
Synchrocyclotrons
Synchrotrons

Particle beam bunching

UF: Beam bunches
BT: Particle beam handling

Particle beam handling

BT: Nuclear and plasma sciences
RT: Particle beams
NT: Particle beam bunching

Particle beam injection

UF: Injected beams
BT: Nuclear and plasma sciences
RT: Particle beams

Particle beam measurements

BT: Measurement
RT: Particle beams

Particle beam optics

UF: Ion optics
BT: Optics
RT: Electrodynamics
Particle beams
NT: Atom optics
Electron optics
Stimulated emission

Particle beams

UF: Accelerator beams
Neutron beams
Proton beams
BT: Beams
Elementary particles
RT: Colliding beam accelerators
Laser theory
Particle accelerators
Particle beam handling
Particle beam injection
Particle beam measurements
Particle beam optics
Storage rings
Synchrotrons
NT: Atomic beams
Electron beams
Ion beams

Particle charging

BT: Electrostatic processes
RT: Semiconductor detectors

Particle collisions

BT: Elementary particles

Particle detectors

USE: Radiation detectors

Particle filters

BT: Filters

Particle measurements

UF: Particulate measurements
BT: Measurement
RT: Current density
High energy physics
instrumentation computing
Position sensitive particle detectors

Particle physics

USE: High energy physics

Particle production

BT: Electrostatic processes
RT: Aerosols
Spraying

Particle scattering

BT: Scattering
RT: Scanning electron microscopy

Particle separators

UF: Separators
BT: Separation processes
RT: Magnetic separation

Particle swarm

USE: Particle swarm optimization

Particle swarm optimization

UF: Particle swarm
Particle-swarm optimization
Swarm intelligence
Swarm optimization
BT: Evolutionary computation
RT: Artificial bee colony
algorithm
Fireworks algorithm
Fish schools
Krill herd algorithm
Metaheuristics



JULY 2025 IEEE Thesaurus

	Stochastic processes		Passive RFID tags	
Particle tracking			BT:	RFID tags
BT:	Nuclear measurements		<i>Passive-optical-network</i>	
RT:	High energy physics		USE:	Passive optical networks
instrumentation computing				
	Tracking		Passwords	
<i>Particle-swarm optimization</i>			BT:	Access control
USE:	Particle swarm optimization			Computer security
			RT:	Authentication
<i>Particles (elementary)</i>			Patch antennas	
USE:	Elementary particles		BT:	Antennas
			RT:	Microstrip antennas
<i>Particulate measurements</i>			Patent law	
USE:	Particle measurements		BT:	Law
Partitioning algorithms			Patents	
BT:	Algorithms		BT:	Legal factors
Passband			RT:	Intellectual property
BT:	Digital communication			US Government agencies
	Radio communication			
RT:	Baseband		Path planning	
Passivation			UF:	piano mover's problem
BT:	Surface treatment		BT:	Motion control
RT:	Corrosion		RT:	Course correction
				Indoor navigation
Passive circuits				Vehicle routing
BT:	Circuits		NT:	Trajectory
				Trajectory planning
Passive filters				Trajectory tracking
BT:	Passive networks		Pathogenesis	
RT:	Filters		BT:	Pathological processes
Passive microwave remote sensing			Pathogens	
BT:	Remote sensing		UF:	Germes
Passive networks			BT:	Diseases
BT:	Telecommunication		RT:	Epidemics
network topology				Microbiome
NT:	Passive filters		<i>Pathological</i>	
Passive optical networks			USE:	Pathology
UF:	PON		Pathological processes	
	Passive-optical-network		BT:	Pathology
BT:	Optical fiber networks		NT:	Cadaver
RT:	EPON			Death
Passive radar				Pathogenesis
BT:	Radar		Pathology	
RT:	Radar detection		UF:	Pathological
	Radar imaging		BT:	Medical specialties
			RT:	Autopsy



JULY 2025 IEEE Thesaurus

	NT:	Diseases Histopathology Neuropathology Pathological processes			Signal detection Signal processing
<i>Patient diagnosis</i>	USE:	Medical diagnosis		Pattern formation	
				BT:	Process design
				RT:	Chaos
					Nonlinear dynamical
<i>Patient identification</i>			systems		
USE:		Medical treatment			Nonlinear optics Spatiotemporal phenomena
Patient monitoring				Pattern matching	
	BT:	Monitoring		BT:	Pattern recognition
	RT:	Assistive robots		RT:	Pattern clustering
		Chemotherapy			Spatiotemporal phenomena
		Electronic medical records		NT:	Image matching
		Fall detection			
		Point of care			
Patient rehabilitation				Pattern recognition	
	BT:	Medical treatment		UF:	Image pattern recognition
	RT:	Aphasia		BT:	Computers and information
		Assistive robots	processing		
	NT:	Neurorehabilitation		RT:	Automatic optical inspection
<i>Patient treatment</i>					Behavior recognition
USE:		Medical treatment			Computer vision
			networks		Feature extraction
					Feedforward neural
Pattern analysis					Hidden Markov models
	BT:	Machine intelligence			Human activity recognition
	RT:	Generative AI			Learning systems
		Kernel machines			Machine vision
		Surface reconstruction			Network motifs
		Trend analysis			Pattern classification
			analysis		Principal component
Pattern classification					Publish subscribe systems
	UF:	Signal classification			Random forests
	BT:	Decision making			Robot vision systems
	RT:	Feature extraction			Shape
		Graph neural networks			Spatiotemporal phenomena
		Logistic regression			Statistical learning
		Nearest neighbor methods			Symbols
		Neural networks		NT:	Active shape model
		Pattern recognition			Activity recognition
		Reinforcement learning			Character recognition
		Semisupervised learning			Clustering methods
		Support vector machines			Data mining
	NT:	Naive Bayes methods			Face recognition
					Fingerprint recognition
Pattern clustering					Gesture recognition
	BT:	Clustering methods			Handwriting recognition
	RT:	Image reconstruction			Nearest neighbor methods
		Nearest neighbor methods			Pattern matching
		Pattern matching			Sound recognition
		Signal analysis			Speech recognition



JULY 2025 IEEE Thesaurus

	Text recognition	<i>Peak signal to noise ratio</i> USE: PSNR
Payloads		
BT:	Military aircraft	<i>Peak signal-to-noise ratio</i> USE: PSNR
	Space technology	
NT:	MODIS	
<i>Pb</i>		Peak to average power ratio UF: PAPR Peak-to-average power ratio
USE: Lead		
<i>PCA</i>		BT: Peak-to-average ratio OFDM
USE: Principal component analysis		
<i>PCC</i>		<i>Peak-to-average power ratio</i> USE: Peak to average power ratio
USE: Point cloud compression		
<i>PCG</i>		<i>Peak-to-average ratio</i> USE: Peak to average power ratio
USE: Phonocardiography		
<i>PCM</i>		Peat BT: Soil
USE: Phase change materials		
<i>PCRAM</i>		Pedestrians BT: Human factors Road traffic RT: Legged locomotion Road safety Road traffic control Vehicle safety
USE: Phase change random access memory		
<i>PD</i>		
USE: Personal digital devices		
PD control		Pediatrics UF: Babies Baby Child Children Infant Infants Newborns Paediatrics Toddler BT: Medical specialties RT: Neonatology
UF: PID control Proportional + derivative		
control	Proportional derivative	
control	Proportional plus derivative	
control	Proportional-derivative	
control	Proportional-integral-derivative	
BT: Control systems		
<i>PDA</i>		<i>Peer to peer communications</i> USE: Peer-to-peer computing
USE: Personal digital devices		
<i>PDF</i>		<i>Peer to peer computing</i> USE: Peer-to-peer computing
USE: Portable document format		
Peace technology		<i>Peer to peer exchange</i> USE: Peer-to-peer computing
BT: Social implications of technology		



JULY 2025 IEEE Thesaurus

Peer to peer network

USE: Peer-to-peer computing

BT: Remuneration
RT: Employee welfare
Termination of employment

Peer-to-peer communications

USE: Peer-to-peer computing

Peer-to-peer computing

UF: File sharing
P2P
Peer to peer

communications

Peer to peer computing
Peer to peer exchange
Peer to peer network
Peer-to-peer

communications

Peer-to-peer exchange
Peer-to-peer network

BT: Computer networks
Distributed computing
RT: Border Gateway Protocol
Cluster computing
Decentralized applications
Distributed ledger
Sidelink
Workstations
NT: InterPlanetary File System

Peer-to-peer exchange

USE: Peer-to-peer computing

Peer-to-peer network

USE: Peer-to-peer computing

Peltier effect

BT: Thermoelectricity

Pelvic bones

BT: Bones

Pelvis

BT: Body regions

Pen test

USE: Penetration testing

Penetration testing

UF: Pen test
BT: Computer security

Pensions

UF: Occupational pensions
Personal pensions
Stakeholder pensions
State pensions

Pentacene

BT: Organic semiconductors

People with disabilities

UF: Disabled people
Disabled persons
BT: Medical conditions
RT: Assistive technologies
Mental disorders
Physiology
Psychology

Peptides

BT: Biochemistry

Perception evolution networks

BT: Neural networks
RT: Unsupervised learning

Perfectly matched layers

BT: Propagation
RT: Finite difference methods
Finite element analysis
Maxwell equations

Performance analysis

UF: Dynamic program analysis
Performance index
BT: Programming
RT: Optimization
NT: Performance gain

Performance evaluation

UF: Performance measurement
BT: Measurement
RT: Benchmark testing
NT: Evaluation models
Key performance indicator
Performance metrics

Performance gain

BT: Performance analysis

Performance index

USE: Performance analysis

Performance loss

BT: Computer performance

Performance measurement

USE: Performance evaluation



JULY 2025 IEEE Thesaurus

Performance metrics

BT: Performance evaluation

Performance optimisation

USE: Optimization

Performance optimization

USE: Optimization

Performance related pay

USE: Incentive schemes

Perineum

BT: Body regions

Periodic media

USE: Nonhomogeneous media

Periodic structures

BT: Materials science and technology

NT: Gratings
Photonic crystals

Peripheral equipment

USE: Computer peripherals

Peripheral nervous system

BT: Nervous system

Permafrost

BT: Soil
RT: Ice
Tundra

Permanent magnet generators

BT: Permanent magnet machines

Permanent magnet machines

UF: Permanent magnet synchronous machines

BT: Electric machines
Rotating machines

RT: Permanent magnet motors
Permanent magnets

NT: Permanent magnet generators

Permanent magnet motors

UF: Permanent magnet synchronous motors

Permanent-magnet generators

Permanent-magnet motors

BT: Motors

RT: Permanent magnet machines

Permanent magnet synchronous machines

USE: Permanent magnet machines

Permanent magnet synchronous motors

USE: Permanent magnet motors

Permanent magnets

BT: Magnets

RT: Magnetic gears
Magnetic levitation vehicles
Permanent magnet

machines

Remanence

Permanent-magnet generators

USE: Permanent magnet motors

Permanent-magnet motors

USE: Permanent magnet motors

Permeability

UF: Magnetic permeability

BT: Electromagnetic analysis

RT: Magnetic materials
Permeability measurement

Permeability measurement

BT: Magnetic variables measurement

RT: Permeability

Permission

UF: Access rights
File system permissions

BT: Computer security

RT: Zero Trust

Permissioned blockchains

USE: Blockchains

Permittivity

BT: Electric variables

RT: Dielectric constant

Dielectric materials

Permittivity measurement

Permittivity measurement

BT: Dielectric measurement

RT: Permittivity



JULY 2025 IEEE Thesaurus

Perovskites

BT: Crystalline materials

Location awareness

Mobile handsets

Personal area networks

Zigbee

Perpendicular magnetic anisotropy

BT: Magnetic anisotropy

Perpendicular magnetic recording

UF: Vertical recording

BT: Magnetic recording

RT: Disk drives

Personal communication services

USE: Personal communication networks

Personal computers

USE: Microcomputers

Perpendicular recording

USE: Magnetic recording

Personal digital assistants

USE: Personal digital devices

Persistent currents

BT: Current

RT: High-temperature

superconductors

Superconducting magnets

Personal digital devices

UF: Blackberry

Digital devices

Hand held computers

Handheld computers

PD

PDA

Palmtop computers

Personal digital assistants

Wireless digital devices

BT: Portable computers

Persistent identifiers

BT: Data structures

RT: Digital systems

Information retrieval

Person identification

USE: Identification of persons

Personal pensions

USE: Pensions

Person re-identification

USE: Identification of persons

Personal protective equipment

BT: Health and safety

RT: Face masks

Protective clothing

NT: Helmets

Personal area networks

UF: Piconets

Scatternets

BT: Radio communication

RT: Computer networks

Data communication

Land mobile radio

Personal communication

networks

Wireless LAN

Zigbee

NT: Bluetooth

Body area networks

Body sensor networks

Wireless personal area

networks

Personal voice assistants

UF: PVA

BT: Speech recognition

Virtual assistants

RT: Natural language

processing

Smart devices

Speech synthesis

Voice activity detection

Personalized medicine

USE: Precision medicine

Personal communication networks

UF: Personal communication

services

BT: Communication systems

RT: Cellular radio

Digital systems

IEEE 802.15 Standard

Personnel

BT: Human resource

management

RT: Appraisal

Bring your own device

Education



JULY 2025 IEEE Thesaurus

	Employment		Water pollution
	Equal opportunities		
	Management	<i>PET</i>	
	Productivity	USE:	Positron emission
	Training	tomography	
NT:	Labor resources		
Persuasive systems		Petascale computing	
BT:	Decision making	BT:	Computers and information
	Social computing	processing	
RT:	Behavioral sciences	RT:	Supercomputers
	Human factors	Petri dishes	
	Human-machine systems	BT:	Biomedical equipment
	Psychology		
Perturbation methods		Petri nets	
UF:	Perturbation techniques	BT:	System analysis and design
BT:	Approximation methods	RT:	Discrete-event systems
NT:	Cavity perturbation	Modeling	
methods		Petrochemicals	
<i>Perturbation techniques</i>		BT:	Chemical products
USE:	Perturbation methods	RT:	Materials
			Chemical industry
Pervasive computing			Chemistry
UF:	Everyware		Fuels
	Ubicomp		Petroleum
BT:	Computers and information		Petroleum industry
processing			Plastic products
	Systems, man, and		Plastics
cybernetics		<i>Petrol</i>	
RT:	Artificial intelligence	USE:	Petroleum
	Context awareness		
	Next generation networking	Petroleum	
NT:	Ubiquitous computing	UF:	Gasoline
	Wearable devices		Petrol
Pest control		BT:	Chemical products
UF:	Insect control		Fuels
	Vermin control	RT:	Fuel processing industries
BT:	Environmental		Oil pollution
management			Oils
RT:	Agriculture		Petrochemicals
	Hazards		Petroleum industry
	Pesticides	NT:	Hydrocarbons
Pesticides		Petroleum industry	
BT:	Agrochemicals	UF:	Oil industry
RT:	Agricultural products	BT:	Industries
	Chemical industry	RT:	Chemical industry
	Chemical products		Fractionation
	Land pollution		Fuel processing industries
	Pest control		Gas industry
	Plant diseases		Natural gas industry
	Soil pollution		Offshore installations
			Oil pollution



JULY 2025 IEEE Thesaurus

		Oils		Pharmacodynamics	
		Petrochemicals		BT:	Pharmacology
		Petroleum		RT:	Biochemistry
		Pipelines			Drug resistance
	NT:	Oil drilling			Drugs
		Oil refineries			Pharmacokinetics
		Well logging		NT:	Drug interactions
<i>PETs</i>				Pharmacokinetics	
	USE:	Privacy enhancing		BT:	Pharmacology
technologies				RT:	Biochemistry
					Drugs
<i>PFD</i>					Pharmacodynamics
	USE:	Phase frequency detectors			
<i>PGA</i>				Pharmacology	
	USE:	Electronics packaging		BT:	Medical specialties
				RT:	Biochemistry
					Biology
					Drugs
pH measurement				NT:	Drug discovery
	BT:	Chemical analysis			Pharmacodynamics
		Measurement			Pharmacokinetics
<i>Phages</i>				Pharynx	
	USE:	Bacteriophages		BT:	Digestive system
Phantoms				RT:	Stomatognathic system
	BT:	Biomedical imaging			
	RT:	Dosimetry		Phase change materials	
		Positron emission		UF:	PCM
tomography				BT:	Materials
		Single photon emission		RT:	Memory
computed tomography					Nuclear thermodynamics
		X-ray applications			Optical materials
		X-ray detection			Phase change memory
		X-ray imaging			Solar heating
Pharmaceutical industry				Phase change memory	
	BT:	Industries		BT:	Memory
	RT:	Drug discovery		RT:	Phase change materials
		Drugs			Resistive RAM
Pharmaceutical technology				NT:	Phase change random
	BT:	Chemical technology		access memory	
	RT:	Biochemistry		<i>Phase change RAM</i>	
		Chemistry		USE:	Phase change random
		Pharmaceuticals		access memory	
Pharmaceuticals				Phase change random access memory	
	BT:	Chemical products		UF:	PCRAM
		Medical treatment			Phase change RAM
	RT:	Biochemistry			Phase-change RAM
		Chemistry			Phase-change random
		Pharmaceutical technology		access memory	
	NT:	Drugs		BT:	Phase change memory
					Random access memory



JULY 2025 IEEE Thesaurus

Phase control

UF: Phase-control
BT: Power electronics
RT: Electric variables control
Optical variables control
Phase transformers

NT: Continuous phase modulation
Cross-phase modulation
Differential phase shift
keying
Phase shift keying

Phase detection

BT: Signal detection
NT: Phase frequency detectors

Phase noise

BT: Noise
Oscillators
RT: Time-domain analysis

Phase distortion

BT: Distortion
RT: Delay effects

Phase shift keying

UF: PSK
Phase-shift keying
Phase-shift-keying
QPSK
BT: Phase modulation
NT: Binary phase shift keying
Quadrature phase shift

Phase estimation

BT: Parameter estimation

Phase frequency detectors

UF: PFD
BT: Phase detection
RT: Frequency measurement
Measurement
Voltage
Voltage control

keying

Phase shifters

BT: Circuits
RT: Butler matrices
NT: Phase transformers

Phase locked loops

UF: PLL
Phase locked-loops
Phase-locked loops
Phase-locked-loops
BT: Linear feedback control
systems
Signal processing
RT: Frequency locked loops
Modulation
Nonlinear filters
Ring oscillators

Phase shifting interferometry

BT: Interferometry

Phase transformations, nuclear

USE: Nuclear phase transformations

Phase transformers

BT: Phase shifters
Transformers
RT: Circuits
Phase control

Phase locked-loops

USE: Phase locked loops

Phase measurement

BT: Measurement
RT: Acoustic measurements
Electric variables
Optical variables

measurement

measurement

Phase transitions, nuclear

USE: Nuclear phase transformations

Phase-change RAM

USE: Phase change random access memory

Phase-change random access memory

USE: Phase change random access memory

Phase modulation

BT: Modulation
RT: Demodulation
Electro-optic modulators

Phase-control

USE: Phase control



JULY 2025 IEEE Thesaurus

Phase-locked loops

USE: Phase locked loops

Phase-locked-loops

USE: Phase locked loops

Phase-shift keying

USE: Phase shift keying

Phase-shift-keying

USE: Phase shift keying

Phased arrays

UF: Antenna phased arrays

BT: Antenna arrays

RT: Optical arrays

NT: Steerable antennas

Phasor measurement units

UF: PMU

PMUs

Synchrophasors

BT: Electric variables

measurement

PHEMTs

UF: Pseudomorphic HEMTs

BT: HEMTs

Phenology

BT: Biology

RT: Biological processes

Chronobiology

Climate change

Phenotypes

BT: Genetics

RT: Genotypes

Philosophical considerations

BT: Social implications of
technology

RT: Econophysics

Ethical aspects

Humanities

Machine ethics

Quantum mechanics

Social factors

Technology

Technology social factors

Phishing

BT: Computer security

Information security

RT: Malware

PHM

USE: Prognostics and health
management

Phonetics

BT: Linguistics

RT: Natural language

processing

Semiotics

Speech processing

NT: Acoustic phonetics

Phonocardiogram

USE: Phonocardiography

Phonocardiography

UF: PCG

Phonocardiogram

BT: Cardiography

RT: Biomedical monitoring

Cardiology

Heart rate measurement

Phonographs

USE: Audio systems

Phonons

BT: Elementary particles

RT: Acoustics

Crystals

Electrons

Indium phosphide

Phosphorescence

BT: Luminescence

RT: Phosphors

Phosphors

BT: Light sources

RT: Phosphorescence

Phosphorus

BT: Chemical elements

Photo-catalysis

USE: Photocatalysis

Photo-cathodes

USE: Photocathodes

Photo-realistic images

USE: Photorealistic images



JULY 2025 IEEE Thesaurus

Photoacoustic effects

UF: Optoacoustic effects
BT: Spectroscopy
RT: Acoustic testing
Laser applications
Photothermal effects
NT: Photoacoustic imaging

BT: Materials
RT: Photoconducting devices
Photoconductivity
Photodetectors
Semiconductor materials

Photoacoustic imaging

BT: Biomedical imaging
Photoacoustic effects

Photoconductivity

UF: Photocurrent
BT: Conductivity
RT: Photoconducting devices
Photoconducting materials

Photobleaching

BT: Photochemistry

Photoconductors

USE: Photoconducting materials

Photocatalysis

UF: Photo-catalysis
BT: Catalysis
Photochemistry
RT: Photocatalysts

Photocurrent

USE: Photoconductivity

Photodarkening

USE: Photochromism

Photocatalysts

BT: Catalysts
RT: Photocatalysis

Photodetector

USE: Photodetectors

Photocathodes

UF: Photo-cathodes
BT: Cathodes
RT: Photomultipliers

Photodetectors

UF: Photodetector
BT: Optoelectronic devices
Radiation detectors
RT: Image sensors
Infrared detectors
Optical signal detection
Photoconducting devices
Photoconducting materials
Photoelectricity
Photon detectors
NT: Photodiodes
Phototransistors
Superconducting

Photochemistry

BT: Chemistry
RT: Water splitting
NT: Photobleaching
Photocatalysis
Photosynthesis

Photochromism

UF: Photodarkening
BT: Photonics
RT: Color

photodetectors

Photocomposition

USE: Text processing

Photodiodes

BT: Photodetectors
RT: Optical transmitters
P-n junctions
NT: Avalanche photodiodes
PIN photodiodes

Photoconducting devices

BT: Optoelectronic devices
RT: Photoconducting materials
Photoconductivity
Photodetectors
Semiconductor devices
NT: Electrophotography

Photoelasticity

BT: Mechanical factors
RT: Optical polarization
Piezooptic effects
Stress

Photoconducting materials

UF: Photoconductors



JULY 2025 IEEE Thesaurus

Photoelectricity

UF: Photoemission
Phototubes
BT: Electricity
Electron devices
RT: Electron emission
Photodetectors
Photomultipliers
Photovoltaic cells
NT: Photovoltaic effects

Photoelectron microscopy

UF: Photoemission electron
microscopy
BT: Electron microscopy

Photoemission

USE: Photoelectricity

Photoemission electron microscopy

USE: Photoelectron microscopy

Photogalvanic effects

USE: Photovoltaic effects

Photogrammetry

BT: Photometry
RT: Electromagnetic
measurements
Image processing
Object detection
Photography

Photography

BT: Imaging
RT: Cameras
Electrophotography
High dynamic range
Image capture
Image storage
Optical filters
Photogrammetry
Photorealistic images
NT: Cinematography
Digital photography
Image forensics
Photomicrography
Photorealism

Photoionisation

USE: Ionization

Photoionization

USE: Ionization

Photolithography

USE: Lithography

Photoluminescence

UF: Electrophotoluminescence
BT: Luminescence
Optics
RT: Chemiluminescence
Judd-Ofelt theory
Microcavities

Photomagnetic devices

USE: Magneto optic devices

Photomagnetic effects

USE: Magneto optic effects

Photometry

BT: Geoscience and remote
sensing
Optical variables
measurement
RT: Light sources
Lighting
Radiometry
NT: Photogrammetry

Photomicrographs

USE: Photomicrography

Photomicrography

UF: Micrographs
Microphotographs
Microphotography
Photomicrographs
Photography
BT: Photography

Photomultipliers

BT: Vacuum technology
RT: Avalanche photodiodes
Electron multipliers
Photocathodes
Photoelectricity

Photon collider

BT: Particle accelerators

Photon crystal fibers

USE: Photonic crystal fibers

Photon crystal fibres

USE: Photonic crystal fibers

Photon detectors

BT: Photonics



JULY 2025 IEEE Thesaurus

RT:	Photodetectors	<i>Photonic crystal fibers</i>	USE:	Photonic crystals
Photonic band gap		Photonic integrated circuits	BT:	Integrated circuits
UF:	Band gap	<i>Photonic metamaterials</i>	USE:	Optical metamaterials
	Band-gap	<i>Photonic-crystal fibers</i>	USE:	Photonic crystal fibers
	Bandgap	<i>Photonic-crystal fibres</i>	USE:	Photonic crystal fibers
	Photonic bandgap			
BT:	Photonic crystals			
RT:	Electromagnetic wave			
polarization				
	Optical diffraction			
<i>Photonic bandgap</i>				
USE:	Photonic band gap			
Photonic bandgap fibers		Photonics	BT:	Lasers and electrooptics
UF:	Photonic bandgap fibres		RT:	Electromagnetic
BT:	Photonic crystal fibers	metamaterials		
<i>Photonic bandgap fibres</i>				Epitaxial growth
USE:	Photonic bandgap fibers			Silicon devices
Photonic crystal fibers				Synapses
UF:	Microstructured fibers	NT:		Biophotonics
	Microstructured fibres			Microwave photonics
	Photon crystal fibers			Nanobiophotonics
	Photon crystal fibres			Nanophotonics
	Photonic crystal fibres			Photochromism
	Photonic-crystal fibers			Photon detectors
	Photonic-crystal fibres			Photothermal effects
BT:	Photonic crystals			Silicon photonics
NT:	Holey fibers			Spontaneous emission
	Photonic bandgap fibers			
<i>Photonic crystal fibres</i>		Photoplethysmography	BT:	Biomedical measurement
USE:	Photonic crystal fibers			Plethysmography
Photonic crystals		Photorealism	BT:	Media
UF:	2-D photonic crystals			Photography
	2D photonic crystals	RT:		Art
	Photonic crystal fibers			Cameras
	Two dimensional photonic			Deepfakes
crystals				Human image synthesis
	Two-dimensional photonic			Painting
crystals		Photorealistic images	UF:	Photo-realistic images
BT:	Periodic structures		BT:	Virtual reality
RT:	Microwave devices		RT:	Computer graphics
	Nonlinear optics			Machine learning
	Optical materials			Photography
	Optical waveguides			
	Spontaneous emission	Photoreceptors	BT:	Neurons
NT:	Photonic band gap			
	Photonic crystal fibers			



JULY 2025 IEEE Thesaurus

Photorefractive effect

BT: Nonlinear optics
RT: Birefringence
Optical refraction
Photorefractive materials
Refractive index

Photorefractive materials

BT: Optical materials
RT: Birefringence
Holography
Optical mixing
Optical refraction
Photorefractive effect

Photoresists

USE: Resists

Photosynthesis

BT: Photochemistry
RT: Biological processes
Chlorophyll

Photothermal effects

UF: Optothermal effects
Thermal wave imaging
BT: Photonics
RT: Photoacoustic effects

Photothyristors

UF: Optothyristors
BT: Thyristors
RT: Optical switches

Phototransistors

BT: Photodetectors
Transistors
RT: Optoelectronic devices
Radiation detectors

Phototubes

USE: Photoelectricity

Photovoltaic cells

UF: Solar cells
BT: Electron devices
Energy conversion
RT: Photoelectricity
Photovoltaic effects
Photovoltaic systems
Solar panels
NT: Light trapping

Photovoltaic effects

UF: Photogalvanic effects
BT: Photoelectricity
RT: Photovoltaic cells
Photovoltaic systems
NT: Shunts (electrical)

Photovoltaic modules

USE: Solar panels

Photovoltaic power systems

USE: Photovoltaic systems

Photovoltaic systems

UF: Photovoltaic power systems
BT: Solar power generation
RT: Hybrid power systems
Photovoltaic cells
Photovoltaic effects
Water pumps
NT: Building integrated
photovoltaics
Fill factor (solar cell)
Solar panels

Phthalates

BT: Chemical products
RT: Plastics

Phylogenetic tree

USE: Phylogeny

Phylogenetics

USE: Phylogeny

Phylogeny

UF: Cladistics
Phylogenetic tree
Phylogenetics
BT: Evolution (biology)

Physical chemistry

BT: Chemistry

Physical design

BT: System analysis and design
Systems engineering and
theory
RT: Integrated circuit layout

Physical distribution management

USE: Logistics



JULY 2025 IEEE Thesaurus

Physical layer

BT: Open systems
NT: Physical layer security

Physical layer security

BT: Physical layer
RT: Hardware security

Physical optics

BT: Optics
NT: Optical refraction
Optical vortices

Physical theory of diffraction

BT: Electromagnetic diffraction

Physical unclonable function

UF: PUF
Physically unclonable

function

BT: Control system security
Semiconductor device

manufacture

RT: Cryptography
Security
Semiconductor devices
Smart devices

Physical vapor deposition

UF: Ionized jet deposition
Physical vapor transport
Physical vapour deposition
Physical vapour transport

BT: Plasma materials

processing

RT: Sputtering

Physical vapor transport

USE: Physical vapor deposition

Physical vapour deposition

USE: Physical vapor deposition

Physical vapour transport

USE: Physical vapor deposition

Physically unclonable function

USE: Physical unclonable

function

Physician

USE: Medical services

Physics

BT: Science - general

RT: Buoyancy
Environmental science
NT: Acoustics

Astrophysics
Beams
Biophysics
Dark energy
Entropy
Fluid flow
Geophysics
High energy physics
Kinetic theory
Levitation
Lorentz covariance
Mechanical factors
Network theory (graphs)
Physics education
Quantum mechanics
Rydberg atoms
Solid-state physics
String theory
Thermal factors
Waves

Physics computing

BT: Computer applications
RT: Multiphysics

Physics education

BT: Engineering education
Physics

Physiology

BT: Biology
RT: Entomology
People with disabilities
NT: Action potentials
External stimuli
Metabolism
Neuromodulation
Somatosensory

PhysiStimuli

USE: External stimuli

Phytoplankton

BT: Plankton

PI control

UF: PI controller
Proportional + integral

control

Proportional-integral control
Proportional-integral

controller



derivative control	Proportional-integral-derivative controller	Control system synthesis
derivative controller	Proportional-integral-derivative controller	Difference equations
BT:	Control systems	Nonlinear control systems
		Piecewise linear
<i>PI controller</i>		<i>Piezoceramics</i>
USE:	PI control	USE:
		Piezoelectric materials
<i>piano mover's problem</i>		Piezoelectric actuators
USE:	Path planning	BT:
		Actuators
Pickling		Piezoelectric devices
BT:	Surface treatment	BT:
RT:	Chemistry	RT:
	Fermentation	Dielectric devices
		Acoustic devices
		Acoustoelectric devices
		Nanogenerators
<i>Pico-hydro</i>		Piezoelectric films
USE:	Picohydro power	Piezoelectric materials
		Piezoelectricity
Picohydro power		Piezoresistive devices
UF:	Pico-hydro	Surface acoustic wave
BT:	Hydroelectric power	
generation		devices
RT:	Appropriate technology	Piezoelectric effect
		BT:
<i>Piconets</i>		Piezoelectricity
USE:	Personal area networks	
		<i>Piezoelectric effects</i>
Picture archiving and communication systems		USE:
UF:	Pacs	Piezoelectricity
BT:	Image communication	
RT:	Biomedical communication	Piezoelectric films
	Biomedical computing	BT:
	Biomedical imaging	Dielectric films
		Films
		Piezoelectric materials
		RT:
		Piezoelectric devices
		Piezoelectricity
<i>Picture phones</i>		Piezoelectric materials
USE:	Videophone systems	UF:
		Piezoceramics
		BT:
		Dielectric materials
<i>Picture processing</i>		RT:
USE:	Image processing	Acoustic materials
		Crystals
		Piezoelectric devices
<i>Picturephones</i>		Piezoelectricity
USE:	Videophone systems	NT:
		Lead zirconate titanate
		Piezoelectric films
<i>PID control</i>		Piezoelectric polarization
USE:	PD control	BT:
		Piezoelectricity
Piecewise linear approximation		Piezoelectric transducers
BT:	Piecewise linear techniques	BT:
		Transducers
Piecewise linear techniques		
BT:	Mathematics	
RT:	Control system analysis	



JULY 2025 IEEE Thesaurus

Piezoelectricity

UF: Piezoelectric effects
 BT: Electricity
 Ultrasonics, ferroelectrics,
 and frequency control
 RT: Electrostriction
 Piezoelectric devices
 Piezoelectric films
 Piezoelectric materials
 Piezoresistance
 Pyroelectricity
 Stress
 Ultrasonic transducers
 NT: Piezoelectric effect
 Piezoelectric polarization

Piezomagnetic effects

USE: Magnetomechanical effects

Piezooptic effects

BT: Acoustooptic effects
 RT: Photoelasticity
 Pressure effects
 Stress

Piezoresistance

UF: Piezoresistive
 BT: Electric variables
 Resistance
 RT: Piezoelectricity
 Piezoresistive devices
 Pressure effects
 Stress

Piezoresistive

USE: Piezoresistance

Piezoresistive devices

UF: Piezoresistors
 BT: Semiconductor devices
 RT: Piezoelectric devices
 Piezoresistance
 Pressure measurement

Piezoresistors

USE: Piezoresistive devices

Pigmentation

BT: Color
 Materials science and
 technology
 NT: Pigments

Pigments

BT: Pigmentation

PIN diodes

USE: PIN photodiodes

Pin grid arrays

USE: Electronics packaging

PIN photodiodes

UF: P-I-N
 PIN diodes
 BT: Photodiodes

Pink noise

USE: 1/f noise

Pins

BT: Plugs

Pions

USE: Mesons

Pipeline processing

UF: Computer pipeline
 processing
 Pipelining
 BT: Parallel processing
 RT: Multiprocessing systems
 Systolic arrays

Pipelines

BT: Fluid flow
 RT: Chemical industry
 Magnetic flux leakage
 Materials handling
 Natural gas industry
 Oils
 Petroleum industry

Pipelining

USE: Pipeline processing

Piracy (software)

USE: Computer crime

Pistons

BT: Machine components
 Mechanical products
 RT: Bellows
 Engine cylinders
 Engines
 Gaskets
 Shafts
 Structural rings



JULY 2025 IEEE Thesaurus

Pitch control (audio)

BT: Audio systems
Variable speed drives

Pitch control (position)

BT: Mechanical variables
control

Pituitary gland

BT: Glands
Nervous system

Pixel

BT: Digital images

PLA

USE: Programmable logic arrays

Placenta

BT: Reproductive system
RT: Pregnancy

Plagiarism

BT: Professional
communication
RT: Copyright protection
Publishing

Planar antennas

USE: Planar arrays

Planar array

USE: Planar arrays

Planar arrays

UF: Planar antennas
Planar array
BT: Antenna arrays

Planar motors

BT: Electric motors

Planar transmission lines

BT: Transmission lines
RT: Spurline
NT: Coplanar transmission lines
Finline
Microstrip
Slot lines
Stripline

Planar waveguides

BT: Electromagnetic
waveguides
RT: Rectangular waveguides

Planarisation

USE: Planarization

Planarization

UF: Chemical mechanical
planarisation
planarization
Chemical mechanical

BT: Planarisation
Surface treatment
RT: Dielectric films
Integrated circuits

Planetary chemistry

USE: Astrochemistry

Planetary composition

USE: Extraterrestrial
measurements AND
Planets

Planetary landers

USE: Land transportation AND
Space vehicles

Planetary oceans

USE: Oceans AND
Planets

Planetary orbits

BT: Orbits

Planets

UF: Planetary composition
Planetary oceans
BT: Solar system
RT: Extraterrestrial phenomena
NT: Asteroids
Comets
Earth
Jupiter
Mars
Mercury (planets)
Pluto
Saturn
Venus

Planing

BT: Machining
RT: Finishing
Surface roughness
Surface treatment



JULY 2025 IEEE Thesaurus

Plankton

BT: Organisms
RT: Eutrophication
NT: Phytoplankton
Zooplankton

Magnetic confinement

Planning

UF: System planning
BT: Engineering management
RT: Decision making
Economics
NT: Meeting planning
Schedules
Strategic planning
Technical planning
Technology planning

Plasma density

BT: Plasma properties

Plasma devices

BT: Plasma applications
RT: Gas discharge devices
Plasmas
NT: Plasma accelerators
Plasma jets
Tokamaks

Plasma diagnostics

BT: Plasmas
RT: Plasma measurements

Plant diseases

BT: Diseases
RT: Pesticides

Plasma display panel

USE: Flat panel displays

Plants (biology)

BT: Organisms
RT: Life sciences
NT: Chlorophyll
Fauna
Flora
Flowering plants
Medicinal plants
Non-flowering plants

Plasma immersion ion implantation

BT: Ion implantation
Plasma applications
RT: Semiconductor impurities

Plants (industrial)

USE: Industrial plants

Plasma jets

BT: Plasma devices
RT: Propulsion

Plasma accelerators

BT: Particle accelerators
Plasma devices

Plasma materials processing

BT: Materials processing
RT: Plasma applications
NT: Chemical vapor deposition
Ignition
Physical vapor deposition
Spark Plasma sintering

Plasma applications

BT: Plasmas
RT: Low-temperature plasmas
Plasma materials

Plasma measurements

BT: Measurement
RT: Plasma diagnostics
Plasmas

processing

NT: Plasma devices
Plasma immersion ion

Plasma pressure compaction

USE: Spark Plasma sintering

implantation

Plasma welding
Tokamaks

Plasma properties

BT: Plasmas
RT: Electron mobility
Stability analysis
NT: Dusty plasmas
Plasma chemistry
Plasma density
Plasma sheaths
Plasma stability
Plasma temperature

Plasma chemistry

BT: Plasma properties

Plasma confinement

BT: Plasmas
NT: Inertial confinement



JULY 2025 IEEE Thesaurus

	Plasmons		Plasma welding
			Relativistic effects
Plasma sheaths		NT:	Atmospheric-pressure
BT:	Plasma properties	plasmas	
Plasma simulation			Low-temperature plasmas
BT:	Plasmas		Microwave plasmas
RT:	Modeling		Plasma applications
	Numerical simulation		Plasma confinement
	Tokamaks		Plasma diagnostics
Plasma sources			Plasma properties
BT:	Plasmas		Plasma simulation
RT:	Ion implantation		Plasma sources
	Ion sources	combustion	Plasma transport processes
Plasma stability		<i>Plasmon</i>	Plasma-assisted
BT:	Plasma properties	USE:	Plasmons
Plasma temperature		<i>Plasmonic solar cells</i>	
BT:	Plasma properties	USE:	Light trapping
Plasma transport processes		<i>Plasmonics</i>	
BT:	Plasmas	USE:	Plasmons
Plasma waves		Plasmons	
BT:	Waves	UF:	Plasmon
RT:	Plasmas		Plasmonics
Plasma welding		BT:	Plasma properties
BT:	Plasma applications	RT:	Nanoantennas
RT:	Joining processes		Optical antennas
	Materials processing	NT:	Nanoplasmonics
	Plasmas		Surface plasmons
Plasma x-ray sources		<i>Plastic bottles</i>	
BT:	X-ray imaging	USE:	Plastic products
RT:	X-ray lasers	<i>Plastic containers</i>	
Plasma-assisted combustion		USE:	Plastic products
BT:	Combustion	Plastic films	
	Plasmas	BT:	Films
Plasmas			Plastics
BT:	Nuclear and plasma	RT:	Plastic insulation
sciences			Plastic insulators
RT:	Arc discharges	<i>Plastic IC packaging</i>	
	Discharges (electric)	USE:	Plastic integrated circuit
	Ionization	packaging	
	Ionosphere	Plastic insulation	
	Optical emission	BT:	Insulation
spectroscopy		RT:	Dielectric materials
	Plasma devices		Plastic films
	Plasma measurements		Plastic insulators
	Plasma waves		



JULY 2025 IEEE Thesaurus

Plastic insulators

BT: Insulators
RT: Fiber reinforced plastics
Plastic films
Plastic insulation
Plastic packaging

Plastic packaging
Plastic products
Plastics industry
Polymers
Resins
NT: Epoxy resins
Fiber reinforced plastics
Plastic films
Plastic optical fiber
Plastic waste

Plastic integrated circuit packaging

UF: Plastic IC packaging
BT: Integrated circuit packaging

Plastic optical fiber

BT: Optical fibers
Plastics

Plastics industry

BT: Manufacturing industries
RT: Chemical industry
Plastic products
Plastics

Plastic packaging

BT: Packaging
RT: Bagging
Electronics packaging
Encapsulation
Integrated circuit packaging
Plastic insulators
Plastics

Platform as a service

UF: PAAS
BT: Cloud computing

Platform virtualization

BT: Computers and information processing
RT: Virtual machine monitors

Plastic pollution

USE: Plastic waste

Plastic pollution waste

USE: Plastic waste

Plating

BT: Materials processing
NT: Chrome plating

Plastic products

UF: Plastic bottles
Plastic containers
BT: Manufactured products
RT: Bottling
Chemical industry
Chemical products
Chemistry
Consumer products
Petrochemicals
Plastics
Plastics industry

Platinum

BT: Metals
NT: Platinum alloys

Platinum alloys

BT: Platinum
RT: Alloying

Plethysmography

BT: Biomedical measurement
Medical diagnosis
NT: Photoplethysmography

Plastic waste

UF: Plastic pollution
Plastic pollution waste
BT: Plastics
Waste materials

PLL

USE: Phase locked loops

Plastics

BT: Chemical products
Materials
RT: Chemicals
Petrochemicals
Phthalates

Plug-in electric vehicles

BT: Electric vehicles

Plug-in hybrid electric vehicles

BT: Hybrid electric vehicles
RT: Charging stations

Plugboard

USE: Breadboard



JULY 2025 IEEE Thesaurus

Plugs

BT: Connectors
NT: Keyways
Pins

Plumbago

USE: Graphite

Pluto

BT: Planets

Plutonium

BT: Chemical elements

pMOSFETs

USE: MOSFET

PMU

USE: Phasor measurement units

PMUs

USE: Phasor measurement units

PNAs

USE: Presence network agents

Pneumatic actuators

BT: Actuators

Pneumatic systems

BT: Control systems
RT: Bellows
Fluidics
Mechanical systems

Pneumology

USE: Pulmonology

Pneumonia

BT: Pulmonary diseases
RT: Asthma
Chronic obstructive

pulmonary disease

Emphysema

Pnictide superconductors

USE: Superconducting materials

Pockels readout optical modulator

USE: Electro-optic modulators

Podcast

USE: Digital audio broadcasting

Poincare group

USE: Poincare invariance

Poincare invariance

UF: Poincare group
BT: Transforms

Point cloud compression

UF: PCC
BT: Data compression
Visual databases
RT: Three-dimensional displays

Point of care

BT: Documentation
Medical services
RT: Biomedical communication
Clinical diagnosis
Patient monitoring
Smart healthcare

Point-to-multipoint communications

UF: P2MP
PTMP
BT: Wireless communication
RT: Internet
Internet telephony

Poisons

USE: Toxicology

Poisson equation

USE: Poisson equations

Poisson equations

UF: Poisson equation
BT: Partial differential equations
RT: Electrostatics

Polar codes

BT: Block codes
Linear codes
RT: Channel coding
Error correction codes
Reed-Muller codes

Polar cyclones

USE: Cyclones

Polarimetric synthetic aperture radar

BT: Synthetic aperture radar



JULY 2025 IEEE Thesaurus

Polarimetry

UF: Solar polarimetry
BT: Electromagnetic measurements
RT: Ellipsometry
Optical retarders

Newton method
Polynomials

Polarisation

USE: Polarization

Polaritons

BT: Energy states
RT: Quantum materials
NT: Surface plasmon polaritons

Polarization

UF: Circular polarisation
Circular polarization
Polarisation
BT: Electromagnetic scattering

Polarization mode dispersion

UF: Polarization-mode dispersion
BT: Optical fiber polarization

Polarization shift keying

BT: Optical polarization

Polarization-maintaining optical fibers

USE: Optical fiber polarization

Polarization-mode dispersion

USE: Polarization mode dispersion

Poles & zeros

USE: Poles and zeros

Poles and towers

UF: Pylons
Towers
Wood poles
BT: Transmission lines
RT: Power distribution lines
Power transmission lines
NT: Telephone poles

Poles and zeros

UF: Poles & zeros
Roots
Zeros
BT: Transfer functions
RT: Circuits
Control systems

Police

USE: Law enforcement

Polishing machines

BT: Production equipment
RT: Deburring
Rough surfaces
Surface finishing
Surface roughness

Pollination (plants)

BT: Flowering plants
Seeds (agriculture)

Pollution

BT: Environmental factors
RT: Contamination
Design for disassembly
Environmental degradation
Environmental economics
Green products
Occupational health
Pollution control
Pollution measurement
Sewage treatment
Toxicology
Waste disposal
NT: Acidification
Agricultural pollution
Air pollution
Emissions trading
Industrial pollution
Land pollution
Oil pollution
Radioactive pollution
Thermal pollution
Urban pollution
Water pollution

Pollution control

BT: Environmental management
RT: Carbon emissions
Decontamination
Electrostatic precipitators
Environmental monitoring
Greenhouse effect
Ozonation
Pollution
Pollution measurement
Sewage treatment
Sludge treatment



JULY 2025 IEEE Thesaurus

	Waste management		NT:	Azobenzene
NT:	Soil remediation			Biopolymers
Pollution measurement				Cellulose
BT:	Measurement			Elastomers
RT:	Environmental monitoring			Hydrogels
	Pollution			Liquid crystal polymers
	Pollution control			Optical polymers
Polonium				Polycaprolactone
BT:	Chemical elements			Polyethylene
				Polyimides
				Polymer fibers
Polycaprolactone		Polynomials		
BT:	Polymers	BT:	Equations	
RT:	Smart materials	RT:	Poles and zeros	
Polyethylene		<i>PON</i>		
BT:	Polymers	USE:	Passive optical networks	
NT:	Thermoplastic polyethylene			
Polyimides		Population density		
BT:	Polymers	BT:	Demography	
			Density measurement	
<i>Polymer coatings</i>		Porcelain		
USE:	Polymer films	BT:	Ceramics	
		RT:	Ceramic products	
Polymer fibers			Ceramics industry	
BT:	Polymers	Porous silicon		
RT:	Cellulose	BT:	Silicon	
Polymer films		Portable computers		
UF:	Polymer coatings	UF:	Laptops	
BT:	Films		Portable PCs	
RT:	Dielectric thin films	BT:	Microcomputers	
		NT:	Personal digital devices	
Polymer foams		Portable document format		
BT:	Materials	UF:	PDF	
RT:	Insulation	BT:	Document handling	
	Insulators	RT:	Document image	
	Metal foam			
	Resins			
Polymer gels		processing		
BT:	Materials	Portable media players		
RT:	Intelligent materials	UF:	MP3	
			Portable Multimedia players	
<i>Polymer led</i>			Portable video players	
USE:	Organic light emitting		iPOD	
diodes		BT:	Audio systems	
			Digital communication	
Polymers			Home automation	
UF:	Electroactive polymers	RT:	Digital audio broadcasting	
BT:	Materials		Tablet computers	
RT:	Colloidal lithography			
	Plastics			



JULY 2025 IEEE Thesaurus

Portable Multimedia players

USE: Portable media players

Portable PCs

USE: Portable computers

Portable video players

USE: Portable media players

Portals

BT: Management information systems
RT: Information retrieval
Web sites

Portfolios

UF: Electronic portfolios
BT: Professional communication

Ports (computers)

UF: Computer ports
BT: Computer interfaces
RT: Computer networks
Hardware
Information exchange

Pose estimation

BT: Estimation
RT: Computer vision

Position control

UF: Orientation control
BT: Mechanical variables
control
RT: Admittance control
Attitude control
Capacitive transducers
Manipulators
Mechanical guides
Medical robotics
Servosystems
NT: Nanopositioning

Position measurement

UF: Attitude determination
Orientation determination
Orientation measurement
Source location
BT: Mechanical variables
measurement
RT: Direction-of-arrival
estimation
Distance measurement
Gaze tracking

Geodesy
Location awareness
Navigation
Tracking
NT: Odometry

Position sensitive particle detectors

BT: Ionizing radiation sensors
RT: High energy physics
instrumentation computing
Nuclear measurements
Particle measurements
Semiconductor counters

Positive train control

BT: Control systems
Rail transportation
RT: Feedback
Railway accidents
Railway safety

Positron emission tomography

UF: PET
BT: Tomography
RT: Biomedical applications of radiation
Medical diagnostic imaging
Nuclear medicine
Phantoms
Tumors
NT: Whole-body PET

Positrons

BT: Elementary particles

Possibility theory

BT: Probability
RT: Fuzzy logic
Nonlinear dynamical systems

Post human

USE: Posthuman

Post-filtering algorithm

USE: Filtering algorithms

Post-human

USE: Posthuman

Post-wall waveguides

USE: Substrate integrated waveguides



JULY 2025 IEEE Thesaurus

Postal services

UF: Mail
BT: Message systems
RT: Electronic mail

Posterior probability

BT: Probability
RT: Bayes methods

Posthuman

UF: Post human
Post-human
BT: Systems, man, and
cybernetics
RT: Artificial intelligence
Transhuman

Postscript

USE: Page description languages

Potassium

BT: Chemical elements

Potassium nitrate

USE: Nitrogen compounds

Potential energy

BT: Energy conservation
RT: Kinetic energy
Mechanical energy

Potential transformers

USE: Voltage transformers

Potential well

UF: Potential wells
Quantum confinement
BT: Energy conversion

Potential wells

USE: Potential well

Potentiometers

BT: Meters
RT: Resistors
Voltage measurement

POTS

USE: Landline

Powders

BT: Coatings
RT: Ceramics
Spark Plasma sintering

Power amplifiers

UF: Radio frequency power
amplifiers
Radiofrequency power
amplifiers
BT: Amplifiers
NT: High power amplifiers
Predistortion

Power and energy standards

UF: IEEE Arc Flash Standards
IEEE Electric Machinery
Standards
IEEE Power Substations
Standards
IEEE Surge Protective
Devices Standards
BT: Standards categories

Power cable insulation

BT: Cable insulation
RT: Power cables

Power cables

BT: Cables
Power transmission lines
RT: Conductors
Power cable insulation
Power distribution lines
NT: Underground power cables

Power capacitors

BT: Capacitors
NT: Supercapacitors

Power combiners

BT: Waveguide components
RT: Microstrip components
Power dividers
Stripline components

Power conditioning

BT: Power electronics
RT: Power conversion
Pulse width modulation
converters
NT: Power smoothing

Power consumption

USE: Power demand

Power control

BT: Electric variables control
RT: Electric current control
Power factor correction



JULY 2025 IEEE Thesaurus

converters	Pulse width modulation	Power distribution	UF: Distribution of electric
Power conversion		power	BT: Power systems
BT:	Converters	RT:	Electricity supply industry
RT:	Choppers (circuits)		Energy Internet
	Maximum power point		Industrial power systems
trackers			Load shedding
	Nonlinear circuits		Power demand
	Power conditioning		Transactive energy
	Power electronics	NT:	DC distribution systems
	Power semiconductor		Electrical power distribution
devices			Power distribution control
	Power supplies		Power distribution faults
converters	Pulse width modulation		Power distribution lines
			Power distribution networks
	Regulators		Power distribution planning
	Switched systems		Power distribution reliability
NT:	AC-AC converters		Simultaneous wireless
	AC-DC power converters	information and power transfer	
	DC-AC power converters	Power distribution control	
	DC-DC power converters	BT: Power distribution	
	Grid forming	RT: Voltage control	
	Inverter-based resource		
	Matrix converters	Power distribution faults	
	Power conversion	BT: Power distribution	
harmonics	Voltage-source converters	Power distribution lines	
Power conversion harmonics		UF: Overhead distribution lines	
BT: Power conversion		BT: Power distribution	
RT: Harmonic distortion		RT: Conductors	
Power demand			Poles and towers
UF: Power consumption			Power cables
BT: Power supplies		Power distribution networks	
	Power system planning	BT: Power distribution	
RT: Electricity supply industry		RT: Microgrids	
	Energy conservation		Power grids
	Energy resources		Smart grids
	Load management	NT: Active distribution networks	
	Load modeling		
	Power distribution	Power distribution planning	
NT: Demand response		BT: Power distribution	
	Load forecasting		Power system planning
Power dissipation		Power distribution reliability	
BT: Circuits		BT: Power distribution	
RT: CMOS logic circuits			Power system reliability
	MOSFET circuits	<i>Power distribution transformers</i>	
	Nanotechnology	USE: Power transformers	
	Power transmission		
	System-on-chip		



JULY 2025 IEEE Thesaurus

Power dividers

BT: Waveguide components
RT: Microstrip components
Power combiners
Stripline components

Power electronics

UF: Electric power
RT: High-voltage techniques
Matrix converters
Power conversion
Power filters
Pulse width modulation

converters

Rectifiers
Resonant inverters
Switching converters
Voltage-source converters
NT: Converters
Current limiters
Gate drivers
Inverters
Phase control
Power conditioning
Power semiconductor

devices

switches

Power semiconductor
Snubbers
Three-phase electric power

Power engineering

BT: Power engineering and
energy
RT: Power engineering
education
NT: Electrification
Ferroresonance
High-voltage techniques
Power engineering

computing

Power system simulation

Power engineering and energy

RT: Electrochemical devices
NT: Electric variables control
Energy
Power engineering
Power generation
Power systems

Power engineering computing

BT: Computer applications
Power engineering
RT: Energy Internet

Power system analysis
computing
Virtual power plants

Power engineering education

BT: Engineering education
RT: Power engineering

Power exchange

USE: Power markets

Power factor

USE: Reactive power

Power factor correction

BT: Electric current control
Load flow control
RT: Power control
Power transmission
Voltage control

Power filters

UF: Power line filters
BT: Filters
RT: Power electronics
NT: Spurline

Power flow

USE: Load flow

Power flow analysis

USE: Load flow analysis

Power flow control

USE: Load flow control

Power generation

UF: Generation of electric
power
Output power
Power plants
Power stations
BT: Power engineering and
energy
RT: Batteries
Electrification
Energy Internet
Feed in tariff
Fuel cells
Generators
Levelized cost of energy
Microgrids
Power generation

economics

Power supplies



JULY 2025 IEEE Thesaurus

control NT: Pulsed power systems
Space power stations
Automatic generation

generation Cogeneration
Distributed power

generation Geothermal power

generation Hydroelectric power

power generation Magnetohydrodynamic

Nuclear power generation
Power generation control
Power generation dispatch
Power generation planning
Power generation reliability
Solar power generation
Trigeneration
Turbomachinery
Wind energy generation
Wind power generation

Power generation control

BT: Automatic control
Power generation

Power generation dispatch

BT: Power generation

Power generation economics

BT: Economics
RT: Power generation
NT: Electricity supply industry

deregulation

Power generation planning

BT: Power generation

Power generation reliability

BT: Power generation
RT: Capacity factor

Power grids

UF: Electricity grids
BT: Power systems
RT: Energy Internet
Power distribution networks
Wind energy integration
NT: Microgrids
Smart grids

Power harmonic filters

BT: Power system harmonics

Power harvesting

USE: Energy harvesting

Power industry

UF: Electric utilities
BT: Industries
RT: Offshore installations
Power system faults
Telecontrol equipment
NT: Electrical equipment

industry

Electricity supply industry
Nuclear facility regulation
Power system

interconnection

Power injection molding

USE: Injection molding

Power injection moulding

USE: Injection molding

Power integrated circuits

BT: Circuits
Integrated circuits
RT: Power semiconductor

devices

Power lasers

BT: Lasers
RT: Power semiconductor

devices

Power line communications

BT: Transmission lines

Power line filters

USE: Power filters

Power management

USE: Power system management

Power markets

UF: Electricity markets
Electricity trading
Power exchange
Power pools
Power trading
Power wheeling
BT: Electricity supply industry
deregulation
RT: Emissions trading
Power transmission
Transactive energy



JULY 2025 IEEE Thesaurus

Power measurement

BT: Electric variables
measurement
RT: Wattmeters
NT: Dynamometers

Power MOSFET

BT: MOSFET circuits
RT: Power semiconductor
devices

Power outages

USE: Power system reliability

Power overhead lines

BT: Power transmission lines
RT: Railway electrification

Power plants

USE: Power generation

Power pools

USE: Power markets

Power quality

UF: Power supply quality
Voltage sags
BT: Power supplies
RT: Electricity supply industry
Power system harmonics
Power system transients

Power semiconductor devices

BT: Power electronics
Semiconductor devices
RT: Power MOSFET
Power conversion
Power integrated circuits
Power lasers
NT: Power transistors

Power semiconductor switches

BT: Power electronics
Semiconductor devices
NT: Bipolar transistors
Thyristors

Power smoothing

BT: Power conditioning

Power spectra

USE: Spectral analysis

Power stations

USE: Power generation

Power stations (space)

USE: Space power stations

Power stations (substations)

USE: Substations

Power steering

BT: Automotive engineering

Power supplies

BT: Power systems
RT: Power conversion
Power generation
Pulsed power systems
Uninterruptible power
systems
NT: Battery chargers
Charging stations
Current supplies
Emergency power supplies
Inductive charging
Islanding
Power demand
Power quality
Power system restoration
Switched mode power
supplies

Traction power supplies
Umbilical cable

Power supplies to apparatus

USE: Umbilical cable

Power supply industry

USE: Electricity supply industry

Power supply quality

USE: Power quality

Power system analysis computing

BT: Computer applications
Power systems
RT: Digital simulation
Modeling
Parameter estimation
Power engineering

computing

Software packages

Power system control

BT: Electric variables control
RT: Control system security
Energy Internet
Load monitoring
Power systems



JULY 2025 IEEE Thesaurus

NT: Virtual power plants
Bidirectional power flow
Load flow control
SCADA systems

Power system dynamics

BT: Power systems

Power system economics

BT: Power systems
RT: Electricity supply industry
deregulation

NT: Transactive energy
Low carbon economy

Power system faults

BT: Power systems
RT: Electricity supply industry
Error correction
Fuzzy set theory
Power industry
Power system protection
Signal analysis

Power system harmonics

BT: Power systems
RT: Power quality
NT: Power harmonic filters

Power system interconnection

BT: Power industry
RT: Energy Internet
Power systems
Power transmission

Power system management

UF: Power management
Telecommunication power
management

BT: Power systems
RT: Energy Internet
Microgrids
Monitoring
Preventive maintenance
Virtual power plants
NT: Load flow

Power system measurements

BT: Power systems
RT: Load monitoring
NT: Capacity factor
Levelized cost of energy
Meter reading

Power system modeling

BT: Modeling
RT: Power systems
NT: Load modeling

Power system planning

BT: Power systems
RT: Demand side management
Electricity supply industry
NT: Power demand
Power distribution planning

Power system protection

BT: Power systems
Product safety engineering
RT: Arresters
Circuit breakers
Fuses
Grounding
Power system faults
Power system transients
Protective relaying
NT: Electrical safety
Substation protection
Surge protection

Power system relaying

BT: Relays
RT: Power systems
Protective relaying

Power system reliability

UF: Power outages
BT: Power systems
RT: Microgrids
Power system stability
Reliability
NT: Power distribution reliability

Power system restoration

BT: Power supplies
RT: Electricity supply industry
Power systems

Power system security

BT: Security
RT: Hardware security
Load flow analysis
Power systems
Reactive power control

Power system simulation

BT: Power engineering
RT: Power systems



JULY 2025 IEEE Thesaurus

Power system stability

BT: Power systems
RT: Power system reliability

Transformers
Uninterruptible power
Wind energy integration

Power system transients

BT: Electromagnetic transients
RT: Arresters
Power quality
Power system protection
NT: Transient analysis

Power Systems Computer Aided Design
USE: PSCAD

Power trading
USE: Power markets

Power systems

UF: Electric power
BT: Power engineering and
energy
RT: Civil engineering
transmission Mechanical power
interconnection Power system control
Power system
Power system modeling
Power system relaying
Power system restoration
Power system security
Power system simulation
Skin effect
Telecontrol equipment
Time-frequency analysis
Voltage fluctuations
NT: Data center power
Energy Internet
Hybrid power systems
Industrial power systems
PSCAD
Power distribution
Power grids
Power supplies
Power system analysis
computing Power system dynamics
Power system economics
Power system faults
Power system harmonics
Power system management
Power system
measurements Power system planning
Power system protection
Power system reliability
Power system stability
Power transmission
Pulsed power systems
Reactive power
Substations

Power transformer insulation

BT: Power transformers
RT: Insulation

Power transformers

UF: Power distribution
transformers
BT: Transformers
RT: Transformer cores
Windings
NT: On load tap changers
Power transformer
insulation

Power transistors

BT: Power semiconductor
devices
RT: Driver circuits

Power transmission

UF: Transmission of electric
power
BT: Power systems
RT: Electric current control
Energy Internet
Load flow analysis
Magnetic gears
Power dissipation
Power factor correction
Power markets
Power system
interconnection
NT: Power transmission lines
AC power transmission
Common Information Model
(electricity)
DC power transmission
Flexible AC transmission
systems
HVDC transmission
Inductive power
transmission
Static VAr compensators
Transmission lines



JULY 2025 IEEE Thesaurus

transmission	Wireless power	BT:	Precollege engineering Educational programs
Power transmission lines		Preamplifiers	
lines	UF: Overhead transmission	BT:	Amplifiers
	BT: Transmission lines	Precipitation	
	RT: Conductors	BT:	Meteorology
	DC distribution systems		Water cycle
	Poles and towers	NT:	Rain
	Power transmission		Snow
	Superconducting	Precision agriculture	
transmission lines	NT: Gas insulated transmission	BT:	Agriculture
lines	Power cables	RT:	Management
	Power overhead lines		Farming
			Internet of Things
			Smart agriculture
			Sustainable development
<i>Power wheeling</i>		Precision engineering	
USE:	Power markets	BT:	Engineering - general
<i>Powered armor</i>		RT:	Industrial engineering
USE:	Wearable robots		Mechanical engineering
<i>Powered exoskeleton</i>		Precision medicine	
USE:	Wearable robots	UF:	Personalized medicine
<i>Powertrain</i>		BT:	Medical treatment
USE:	Mechanical power	Precoding	
transmission		BT:	Encoding
<i>Praeseodymium</i>		<i>Precollege engineering</i>	
USE:	Praseodymium	USE:	Pre-college engineering
Pragmatics		Predator prey systems	
	BT: Linguistics	UF:	Predator-prey models
	Semiotics		Predator-prey systems
	RT: Communication symbols	BT:	Biology
	Context		Mathematics
	Natural language	RT:	Chaos
processing	Professional		Differential equations
communication			Game theory
			Nonlinear dynamical
<i>Prairie</i>		systems	Stability
USE:	Grasslands	<i>Predator-prey models</i>	
Praseodymium		USE:	Predator prey systems
	UF: Praeseodymium	<i>Predator-prey systems</i>	
	BT: Chemical elements	USE:	Predator prey systems
Pre-college engineering		Prediction algorithms	
	UF: Elementary school	BT:	Algorithms
engineering	High school engineering		



JULY 2025 IEEE Thesaurus

Prediction methods

BT: Artificial intelligence
 RT: Estimation
 Forecasting
 Gaussian processes
 Hindcasting
 Kalman filters
 Prediction theory
 Signal processing
 Spectral analysis
 Speech processing
 NT: Linear predictive coding
 Predictive coding
 Predictive encoding
 Predictive models

Prediction theory

BT: Statistics
 RT: Artificial intelligence
 Estimation
 Prediction methods

Predictive analysis

USE: Predictive analytics

Predictive analytics

UF: Predictive analysis
 BT: Statistical analysis
 RT: Data mining
 Machine learning
 Predictive models
 NT: Concept drift

Predictive coding

BT: Prediction methods

Predictive control

UF: Model predictive control
 Model-predictive control
 BT: Process control
 RT: Control engineering

Predictive encoding

BT: Prediction methods

Predictive maintenance

BT: Maintenance engineering

Predictive models

BT: Prediction methods
 RT: Ensemble learning
 Fish schools
 Predictive analytics
 NT: Temporal difference

learning

Predistortion

UF: Inverse distortion
 BT: Power amplifiers
 RT: Nonlinear distortion

Prefabricated buildings

USE: Prefabricated construction

Prefabricated construction

UF: Prefabricated buildings
 BT: Construction
 Construction industry
 RT: Building materials
 Buildings
 Modular construction

Prefetching

BT: Instruction sets

Preforms

BT: Assembly

Pregnancy

UF: Pregnant
 BT: Medical conditions
 RT: Gestational diabetes
 Infertility
 Obstetrics
 Placenta

Pregnancy test

BT: Medical tests

Pregnant

USE: Pregnancy

Presence network agents

UF: PNAs
 BT: Communications

technology

Presses

BT: Machine tools
 RT: Dies
 Pressing

Pressing

BT: Materials processing
 RT: Presses

Pressure control

BT: Control systems



JULY 2025 IEEE Thesaurus

Pressure effects

BT: Mechanical factors
RT: Meteorology
Piezooptic effects
Piezoresistance

Pressure gauges

BT: Instruments
RT: Atmospheric
measurements
Density measurement
Fluid flow measurement
Force measurement
Geophysical measurements
Pressure measurement
Pressure sensors
Torque measurement

Pressure measurement

BT: Measurement
RT: Piezoresistive devices
Pressure gauges
Pressure sensors
Tactile sensors
NT: Altimetry
Tire pressure

Pressure sensors

BT: Sensors
RT: Pressure gauges
Pressure measurement
Wearable sensors

Pressure vessels

BT: Mechanical products
RT: Concrete
Fission reactors
Mechanical engineering
Steel

Prevention and mitigation

BT: Disaster management
Risk management
RT: Risk minimization
Risk mitigation

Preventive maintenance

BT: Maintenance engineering
RT: Accident prevention
Power system management
Reliability
Safety
NT: Condition monitoring

Pricing

BT: Financial management
RT: Emissions trading
Feed in tariff

Primary motor cortex

BT: Brain

Principal component analysis

UF: PCA
BT: Statistical analysis
RT: Feature extraction
Independent component

analysis

Linear systems
Operations research
Pattern recognition
Transform coding

Print readers

USE: Character recognition

Printed circuit boards

USE: Printed circuits

Printed circuits

UF: Circuit boards
Printed circuit boards
BT: Circuits
RT: Electronics packaging
Integrated circuit layout
Substrates
Wiring
NT: Flexible printed circuits
Memory modules
Surface mount technology

Printers

BT: Computer peripherals
RT: Printing
NT: Laser printers

Printing

BT: Information technology
RT: Character generation
Color gamut
Ink
Lithography
Printers
Printing machinery
Publishing
Typesetting
NT: Digital printing
Ink jet printing
Teleprinting



JULY 2025 IEEE Thesaurus

	Three-dimensional printing	<i>Privacy preserving data mining</i>	USE: Data privacy
Printing machinery		Privacy-invasive software	
UF:	Printing presses	UF:	Invasive software
BT:	Machinery	BT:	Software
RT:	Printing	RT:	Computer crime
<i>Printing presses</i>			Computer security
USE:	Printing machinery		Unsolicited e-mail
		NT:	Spyware
Privacy		<i>Private blockchains</i>	
BT:	Technology social factors	USE:	Blockchains
RT:	Authorization		
	Communication system	<i>Privatisation</i>	
security		USE:	Privatization
	Computer security	Privatization	
	Cryptography	UF:	Privatisation
	Cyberbullying	BT:	Macroeconomics
	Cyberethics	RT:	Industrial economics
	Data privacy		
	Data protection	Probabilistic computing	
	Data security	BT:	Computers and information
	Decentralized identity		processing
	Differential privacy	Probabilistic logic	
	Digital policy	BT:	Logic
	General Data Protection	RT:	Mixture models
Regulation		Probability	
	Homomorphic encryption	BT:	Mathematics
	Information diffusion	RT:	Belief propagation
	Information leakage		Decision theory
	Malware		Distribution functions
	Network intrusion		Fourier transforms
	Session hijacking		Gamma distribution
	Trust management		Information geometry
NT:	Eavesdropping		Maximum likelihood
	Internet privacy		
	Privacy breach		Mean field theory
	Privacy enhancing		Monte Carlo methods
technologies		detection	Naive Bayes methods
Privacy breach			Random processes
BT:	Information security		Statistical analysis
	Privacy		Statistics
RT:	Data breach		Stochastic processes
	Data security		Stochastic systems
Privacy enhancing technologies			Viterbi algorithm
UF:	PETs		Weibull distribution
BT:	Privacy	NT:	Ant colony optimization
RT:	Computer security		Bayes methods
	Data collection		Error probability
	Data privacy		Forecasting
	Encryption		Hindcasting



JULY 2025 IEEE Thesaurus

	Memoryless systems		Production control
	Multi-armed bandit problem		Soft sensors
	Pairwise error probability	NT:	Predictive control
	Possibility theory		Three-term control
	Posterior probability		Two-term control
	Probability distribution		
	Random variables	Process design	
	Statistical distributions	BT:	Design methodology
	Total variance	RT:	Chemical engineering
	Uncertainty		Design for disassembly
Probability computing			Design for quality
BT:	Computers and information processing		Process control
Probability density function			Process mining
BT:	Integral equations	NT:	Process planning
RT:	Distribution functions		Product design
			Service computing
			Pattern formation
			Process modeling
Probability distribution		Process mining	
BT:	Probability	BT:	Data mining
NT:	Exponential distribution	RT:	Process design
	Heavily-tailed distribution		Process planning
	Kurtosis		
	Lightly-tailed distribution	Process modeling	
	Log-normal distribution	BT:	Modeling
	Maxwell-Boltzmann		Process design
distribution		RT:	Process control
	Nakagami distribution		
Probes		Process monitoring	
BT:	Instruments	BT:	Monitoring
		RT:	Soft sensors
Problem-solving		Process planning	
BT:	Cognitive science	BT:	Management
RT:	Human factors		Production
			Production management
<i>Procedural content generation</i>			Production planning
USE:	Procedural generation	RT:	Process control
			Process design
Procedural generation			Process mining
UF:	Procedural content	NT:	Business process
generation		integration	
BT:	Algorithms		Business process
	Games	management	
			Cause effect analysis
Process control			Root cause analysis
BT:	Industrial control	Process virtual machines	
RT:	Bleaching	BT:	Virtual machines
	Chemical reactions		
	Continuous production	Processor scheduling	
	Manufacturing automation	UF:	Multiprocessor scheduling
	Process design	BT:	Concurrency control
	Process modeling		Multiprocessing systems
	Process planning		



JULY 2025 IEEE Thesaurus

RT: Microprocessors
Optimization methods
NT: Scheduling algorithms

Processors (program)

USE: Program processors

Procurement

BT: Supply chain management
RT: Contracts
Logistics
Proposals
Supply chains

Product codes

BT: Codes
RT: Decoding
Error correction
QR codes
Radiofrequency

identification

NT: Bar codes

Product customisation

USE: Product customization

Product customization

UF: Product customisation
BT: Product development
RT: Customer satisfaction
Manufactured products
Product design

Product delivery

UF: Delivery of goods
Package delivery
BT: Commerce and trade
RT: Electronic commerce

Product design

BT: Design methodology
RT: Concurrent engineering
Design for disassembly
Design for quality
Design tools
Digital twins
Group technology
Manufactured products
Process design
Product customization
Product development
Prototypes
Requirements engineering

Product development

BT: Crowdsourcing
Engineering management
RT: Brand management
Manufactured products
Product design
Quality function deployment
Rapid prototyping
Reverse engineering
Social manufacturing
Virtual prototyping
NT: Graphical user interfaces
Product customization
Product lifecycle

management

Software product lines
Time to market

Product liability

BT: Legal factors
RT: Consumer products
Product safety
Quality assurance
Quality management
NT: Warranties

Product life cycle management

USE: Product lifecycle

management

Product lifecycle management

UF: Product life cycle
management
System lifecycle
management
BT: Product development
RT: Release engineering
NT: Life cycle assessment
Prognostics and health

management

Product safety

BT: Safety
RT: Accidents
Consumer products
Product liability

Product safety engineering

RT: Software safety
NT: Consumer protection
Power system protection
Safety
Vehicle crash testing



JULY 2025 IEEE Thesaurus

Product warranties

USE: Warranties

Product warranty

USE: Warranties

Production

BT: Industry applications

RT: Containers

Wheels

Wire drawing

NT: Ball milling

Compression molding

Embossing

Food products

Group technology

Injection molding

Materials processing

Mechanical products

Process planning

Production control

Production engineering

Production equipment

Production facilities

Production management

Production materials

Production systems

Productivity

Shafts

Springs

Transfer molding

Production control

BT: Industrial control

Production

RT: Adaptive scheduling

Cellular manufacturing

Group technology

Inventory control

Manufacturing

Process control

Production systems

Supply chain management

NT: Continuous production

Lot sizing

Optimized production

technology

Scheduling

Production economics

USE: Industrial economics

Production engineering

BT: Engineering - general

Production

RT: Industrial engineering

Inventory management

Manufacturing

Manufacturing systems

Production equipment

Production management

Production materials

NT: Production planning

Production equipment

BT: Production

RT: Gears

Machinery

Materials handling

equipment

Production engineering

NT: Applicators

Clamps

Cutting tools

Fixtures

Machine tools

Mining equipment

Molding equipment

Packaging machines

Paper making machines

Polishing machines

Soldering equipment

Production facilities

UF: Factories

Manufacturing facilities

BT: Production

RT: Manufacturing

Warehousing

NT: Foundries

Greenhouses

Industrial facilities

Industrial plants

Machine shops

Paper mills

Production management

UF: Manufacturing

management

BT: Management

Production

RT: Continuous improvement

Continuous production

Industrial engineering

Inventory control

Lean production

Mass production

Production engineering

Productivity



JULY 2025 IEEE Thesaurus

management	Research and development	Steering systems
	Social manufacturing	Productivity
	Technology management	UF: Labor productivity
	Waste management	Labour productivity
NT:	Control charts	BT: Production
	Inventory management	RT: Business
	Lead time reduction	Human factors
	Logistics	Incentive schemes
	Process planning	Industrial psychology
	Production planning	Management
Production materials		Manufacturing
BT:	Materials	Personnel
	Production	Production management
RT:	Additives	Profitability
	Cast iron	
	Chemical products	Professional aspects
	Hydraulic fluids	BT: Engineering profession
	Production engineering	RT: Subject matter experts
NT:	Abrasives	
	Aerospace materials	Professional communication
	Automotive materials	UF: Technical communication
	Inhibitors	RT: Cooperative communication
	Ink	Federated learning
	Joining materials	Pragmatics
	Lubricants	Semantics
	Retardants	Semiotics
Production planning		Syntactics
BT:	Production engineering	NT: Collaboration
	Production management	Communication aids
RT:	Demand forecasting	Communication
	Lead time reduction	
	Optimized production	effectiveness
technology		Communication symbols
NT:	Capacity planning	Context
	Materials requirements	Databases
planning		Global communication
	Process planning	Grammar
Production systems		Inclusive language
BT:	Production	Information analysis
RT:	Discrete-event systems	Information integrity
	Industrial plants	Information resources
	Manufacturing	Information retrieval
	Optimized production	Information science
technology		Information services
NT:	Production control	Information systems
	Assembly systems	Information technology
	Exhaust systems	Manuals
	Intelligent manufacturing	Meetings
systems		Oral communication
	Lean production	Plagiarism
	Manufacturing systems	Portfolios
		Professional societies
		Public speaking
		Rhetoric
		Writing



JULY 2025 IEEE Thesaurus

Professional societies

BT: Professional
communication
RT: Non-governmental
organizations

Profit sharing schemes

USE: Incentive schemes

Profitability

BT: Economics
RT: Cost accounting
Econometrics
Financial management
Productivity

Progenitor cells

BT: Cells (biology)
RT: Stem cells

Prognostics and health management

UF: PHM
BT: Product lifecycle
management

Program generators

USE: Automatic programming

Program management

UF: Programme management
BT: Management
RT: Project management
Technical management

Program processors

UF: Assemblers (program)
Compilers (program)
Interpreters (program)
Multi-threaded systems
Multi-threading systems
Multithreaded systems
Multithreading systems
Processors (program)
BT: System software
RT: Input-output programs
Manycore processors
Operating systems
NT: Application specific
processors
Graphics processing units
Instruction sets
Optimizing compilers

Program profiling

USE: Programming

Programmable circuits

BT: Circuits
NT: Field programmable analog
arrays
Programmable logic arrays
Programmable logic
devices

Programmable control

BT: Digital control
RT: Industrial control
Manufacturing automation
NT: Flow graphs

Programmable logic arrays

UF: PLA
BT: Circuits
Logic arrays
Logic circuits
Programmable circuits
RT: Programmable logic
devices

Programmable logic controllers

USE: Programmable logic
devices

Programmable logic devices

UF: Programmable logic
controllers
BT: Circuits
Logic devices
Programmable circuits
RT: High level synthesis
Programmable logic arrays

Programmable read only memory

USE: PROM

Programme management

USE: Program management

Programmed instruction

USE: Educational technology

Programming

UF: Computer programming
Program profiling
BT: Computer science
RT: Aerospace and electronic
systems
Digital computers
Flowcharts
Null value
Programming environments



JULY 2025 IEEE Thesaurus

	Runtime		Lead time reduction
	Self-assembly		Program management
	Software		Requirements engineering
	Software debugging		Requirements management
	Software tools		Research and development
	Structured Query Language	management	
	Syntactics		Scrum (Software
NT:	Answer set programming	development)	
	Augmented reality		System integration
	Automatic programming		Technology management
	Concatenated codes	NT:	Agile project management
	Functional programming		Proposals
	Granular computing		Turnkey project
	Integer linear programming		
	Logic programming	Projectiles	
	Microprogramming	BT:	Weapons
	Object oriented methods		
	Object oriented	Projection algorithms	
programming		BT:	Algorithms
	Opportunistic software		
systems development	Parallel programming	Projective geometry	
	Performance analysis	BT:	Geometry
	Programming profession		
	Robot programming	<i>Projective shadowing</i>	
		USE:	Shadow mapping
Programming environments		<i>projectors (optical)</i>	
BT:	Software engineering	USE:	Optical projectors
RT:	Computer aided software		
engineering	Programming	PROM	
	Software debugging	UF:	Programmable read only
	Software tools	memory	
		BT:	Read only memory
		NT:	EPROM
<i>Programming languages</i>		Promethium	
USE:	Computer languages	BT:	Chemical elements
Programming profession		Promotion - marketing	
UF:	Computer programming	UF:	Sales promotion
profession		BT:	Marketing management
BT:	Programming	RT:	Public relations
RT:	Employment		
	Engineering profession		
Project engineering		Prompt engineering	
BT:	Engineering management	BT:	Generative AI
NT:	Scheduling	RT:	Chatbots
	Turnkey project		Large language models
Project management		Proof of stake	
BT:	Management	UF:	Proof-of-stake
RT:	Building information	BT:	Blockchains
management			Protocols
	Concurrent engineering	RT:	Cryptocurrency
	Crowdfunding		



JULY 2025 IEEE Thesaurus

Proof of Work

UF: proof-of-work
BT: Computer security
Protocols
RT: Blockchains
Denial-of-service attack

Proof-of-stake

USE: Proof of stake

proof-of-work

USE: Proof of Work

Propagation

UF: Wave equations
Wave propagation
BT: Waves
RT: Damping
Electromagnetic

waveguides

NT: Attenuation
Electromagnetic

propagation

Insertion loss
Nonlinear wave

propagation

Perfectly matched layers
Reflection
Scattering
Transient response

Propagation constant

BT: Electromagnetic

propagation

Propagation delay

BT: Delay effects

Propagation loss

USE: Propagation losses

Propagation losses

UF: Propagation loss
BT: Electromagnetic

propagation

Propellants

BT: Chemical products

Propellers

BT: Aircraft propulsion
RT: Aircraft
Blades
Engines
Impellers

Marine vehicles

Shafts

Propioception

UF: proprioceptive
BT: Robot sensing systems
RT: Robot kinematics

Proportional + derivative control

USE: PD control

Proportional + integral control

USE: PI control

Proportional control

BT: Control systems

Proportional derivative control

USE: PD control

Proportional plus derivative control

USE: PD control

Proportional-derivative control

USE: PD control

Proportional-integral control

USE: PI control

Proportional-integral controller

USE: PI control

Proportional-integral-derivative

USE: PD control

Proportional-integral-derivative control

USE: PI control

Proportional-integral-derivative controller

USE: PI control

Proposals

UF: Technical proposals
BT: Project management
RT: Contracts
Procurement
Technical requirements
Writing

proprioceptive

USE: Propioception

Propulsion

BT: Vehicular and wireless
technologies



JULY 2025 IEEE Thesaurus

RT:	Engines	Protection	
	Plasma jets	BT:	Safety
	Traction motors	RT:	Circuit breakers
	Vehicle-to-grid		Fuses
NT:	Aerospace propulsion		Galvanizing
	Aircraft propulsion		Grounding
	Electromagnetic launching		Hazardous areas
	Electrothermal launching		Occupational safety
	Rockets		Security
			Uninterruptible power
<i>Prosencephalon</i>		systems	
USE:	Forebrain	NT:	Electrostatic discharge
Prostate cancer		protection	
BT:	Cancer		Explosion protection
			Lightning protection
			Radiation protection
<i>Prosthesis</i>		Protection switching	
USE:	Prosthetics	UF:	Automatic protection
Prosthetic hand		switching	
BT:	Prosthetics	BT:	Optical fiber networks
Prosthetic limbs		Protective clothing	
BT:	Prosthetics	BT:	Clothing
			Safety devices
Prosthetics		RT:	Clothing industry
UF:	Hip joint replacements		Eye protection
	Knee joint replacements		Occupational health
	Neural prostheses		Occupational safety
	Prosthesis		Personal protective
BT:	Medical services	equipment	
RT:	Assistive technologies		Safety
	Bioceramics	NT:	Face masks
	Biological control systems	Protective relaying	
	Biomedical equipment	UF:	Distance relays
	Medical control systems		Protective relays
	Orthotics	BT:	Relays
	Sensory aids	RT:	Instrument transformers
	Wearable robots		Power system protection
NT:	Artificial biological organs		Power system relaying
	Artificial limbs		
	Knee replacement	<i>Protective relays</i>	
	Myoelectric control	USE:	Protective relaying
	Neuroprostheses	Protein engineering	
	Prosthetic hand	BT:	Biomedical engineering
	Prosthetic limbs	Protein sequence	
	Visual prosthesis	BT:	Proteins
Protactinium		Proteins	
BT:	Chemical elements	BT:	Biochemistry
		RT:	Monoclonal antibodies
Protected areas		NT:	Enzymes
UF:	Conservation areas		
BT:	Land use planning		



JULY 2025 IEEE Thesaurus

	Protein sequence	<i>Proton beams</i>	
		USE:	Particle beams
Proteomics			
BT:	Molecular biomarkers	Proton effects	
		UF:	Biological effects of protons
Protocols			Proton beam effects
UF:	Communication protocols	BT:	Electrothermal effects
BT:	Communication systems		Quantum mechanics
RT:	Ad hoc networks	RT:	Elementary particle
	Bluetooth	exchange interactions	
	Concurrency control		Elementary particles
	Frame relay		High energy physics
	IEEE 802.11 Standard	instrumentation computing	
	IEEE 802.11e Standard		Protons
	IEEE 802.11g Standard		Radiation effects
	IEEE 802.11n Standard		Space vehicles
	IPTV		Thermal factors
	Internet of Things	NT:	Proton radiation effects
	Local area networks		Single event latchup
	Metropolitan area networks		
	Multicarrier code division	Proton radiation effects	
multiple access		BT:	Proton effects
	Software defined	RT:	Bipolar transistors
networking			Ion radiation effects
	TCPIP		Protons
	Wide area networks		Radiation effects
NT:	Access protocols		Semiconductor devices
	Asynchronous transfer		Silicon-on-insulator
mode			
	Border Gateway Protocol	Proton therapy	
	Consensus protocol	BT:	Medical treatment
	Cryptographic protocols	RT:	Biological effects of
	HTTP	radiation	
	InterPlanetary File System		
	LoRaWAN	Protons	
	Main-secondary	BT:	Elementary particles
	Multicast protocols	RT:	Cosmic rays
	Multiprotocol label		Ions
switching			Proton accelerators
	Proof of Work		Proton effects
	Proof of stake		Proton radiation effects
	Routing protocols		
	Smart contracts	Prototypes	
	Transport protocols	BT:	Design methodology
	Wireless application	RT:	Laser sintering
protocol			Product design
	Zero knowledge proof		Stereolithography
			Virtual prototyping
Proton accelerators		NT:	Breadboard
BT:	Particle accelerators		Rapid prototyping
RT:	Ion accelerators		
	Protons	Proximity effects	
<i>Proton beam effects</i>		UF:	Current crowding
USE:	Proton effects	BT:	Electromagnetics
		RT:	Conductors



JULY 2025 IEEE Thesaurus

	Lithography
<i>Pry and Bean model</i>	
USE:	Bean model
PSCAD	
UF:	Power Systems Computer Aided Design
BT:	Design automation Power systems Software packages
RT:	EMTDC
<i>Pseudobinary semiconductors</i>	
USE:	Semiconductor materials
<i>Pseudomorphic HEMTs</i>	
USE:	PHEMTs
<i>Pseudonoise coded communication</i>	
USE:	Spread spectrum communication
<i>Pseudonoise coded radar</i>	
USE:	Spread spectrum radar
<i>Pseudorandom sequences</i>	
USE:	Random sequences
<i>PSK</i>	
USE:	Phase shift keying
PSNR	
UF:	Peak signal to noise ratio Peak signal-to-noise ratio
BT:	Signal to noise ratio
Psoriasis	
BT:	Medical conditions
RT:	Dermatology Skin
<i>pSPICE</i>	
USE:	SPICE
<i>PSTN</i>	
USE:	Communication networks
Psychiatry	
BT:	Behavioral sciences Medical specialties
RT:	Depression Medical treatment
NT:	Mental disorders

Psychoacoustic models	
BT:	Auditory system
NT:	Masking threshold
Psychoacoustics	
BT:	Acoustics
RT:	Auditory system
Psychology	
BT:	Behavioral sciences Social sciences
RT:	Affective computing Behavioral economics Cognition Cognitive science Digital intelligence Emotion recognition Employee welfare People with disabilities Persuasive systems Social engineering
(security)	
NT:	Active perception Crowd dynamics Emotional responses Industrial psychology Mental health Mood Neuropsychology Psychometric testing Psychophysics
Psychometric testing	
BT:	Psychology
RT:	Industrial psychology
Psychophysics	
BT:	Psychology
<i>PTMP</i>	
USE:	Point-to-multipoint communications
<i>Public blockchains</i>	
USE:	Blockchains
Public domain software	
BT:	Open Access Software
RT:	Copyright protection Open data Open source software
NT:	Python R language



JULY 2025 IEEE Thesaurus

Public finance

UF: Government borrowing
Government expenditure
BT: Governmental factors
RT: Financial management
Government
Macroeconomics

Public health

USE: Public healthcare

Public healthcare

UF: Public health
BT: Medical services
RT: Epidemiology
NT: Contact tracing

Public infrastructure

BT: Asset management
RT: Electricity supply industry
Environmental

management

Government policies
Public policy
Rural areas
Urban areas
Urban planning
NT: Critical infrastructure

Public key

UF: Digital certificates
BT: Cryptography
NT: Public key cryptography

Public key cryptography

UF: Public key cryptosystems
BT: Public key
RT: Homomorphic encryption
NT: Elliptic curve cryptography
Identity-based encryption

Public key cryptosystems

USE: Public key cryptography

Public policy

BT: Government policies
RT: Public infrastructure

Public relations

BT: Management
RT: Customer relationship

management

Marketing management
Promotion - marketing

Public safety

USE: Public security

Public security

UF: Public safety
BT: Safety
RT: Security
Terrorism
Threat assessment

Public speaking

UF: Speechmaking
BT: Oral communication
Professional

communication

RT: Meetings

Public switched telephone network

USE: Communication networks

Public transportation

UF: Subways
Taxi
Trolley cars
BT: Transportation
RT: Light rail systems
Rail transportation
Urban areas

Publish subscribe systems

UF: Publish-subscribe systems
Publish/subscribe systems
BT: Message systems
RT: Content management
Middleware
Pattern recognition
Queueing analysis

Publish-subscribe

BT: Distributed information
systems

Publish-subscribe systems

USE: Publish subscribe systems

Publish/subscribe systems

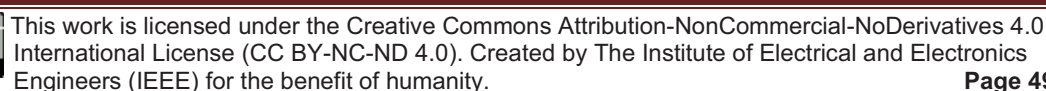
USE: Publish subscribe systems

Publishing

BT: Computer applications
RT: Bibliographies
Copyright protection
Digital printing
Document handling
Guidelines



		Plagiarism		Pulp manufacturing
		Printing		Spinning machines
		Systematic literature review		Wood industry
		Text processing	NT:	Paper making
	NT:	Bibliometrics		Paper making machines
		Desktop publishing		Paper mills
		Electronic publishing		
		Journalism	Pulp manufacturing	
		Open Access	BT:	Manufacturing systems
		Scientific publishing	RT:	Paper making
				Paper making machines
<i>PUF</i>				Paper mills
	USE:	Physical unclonable		Paper pulp
function				Pulp and paper industry
				Wood industry
Pulleys				
	BT:	Materials handling	Pulse amplifiers	
equipment	RT:	Freight handling	BT:	Amplifiers
		Lifting equipment		
		Loading	Pulse circuits	
			UF:	Bistable multivibrator
			BT:	Circuits
Pulmonary diseases			RT:	Digital circuits
	UF:	Lung diseases	NT:	Flip-flops
		Respiratory diseases		
	BT:	Diseases	Pulse compression methods	
	RT:	Lungs	BT:	Signal processing
		Respiratory system	NT:	Optical pulse compression
		Spirometry		
	NT:	Asthma	Pulse generation	
		Chronic obstructive	UF:	Impulse generation
pulmonary disease				Pulse generators
		Emphysema	BT:	Signal generators
		Pneumonia	RT:	Electromagnetic pulses
			NT:	Optical pulse generation
<i>Pulmonary semilunar valves</i>				
	USE:	Heart valves	<i>Pulse generators</i>	
			USE:	Pulse generation
Pulmonology			Pulse inverters	
	UF:	Chest medicine	UF:	Logic inverters
		Pneumology	BT:	Inverters
		Respiratory medicine	RT:	Logic circuits
		Respirology		
	BT:	Medical specialties	Pulse measurements	
	RT:	Lungs	UF:	Impulse measurements
		Respiratory system	BT:	Measurement
	NT:	Spirometry	RT:	Electric variables
Pulp and paper industry			measurement	
	UF:	Paper industry	Pulse modulation	
	BT:	Manufacturing industries	BT:	Modulation
	RT:	Forestry	RT:	Demodulation
		Paper products		
		Paper pulp		
		Paper technology		



JULY 2025 IEEE Thesaurus

Pulse oximeter

BT: Biomedical equipment
Biomedical measurement
RT: Noninvasive treatment
Pulse oximetry

Pulse oximetry

BT: Instrumentation and
measurement
RT: Noninvasive treatment
Biomedical measurement
Oxygen
Pulse oximeter
Remote sensing

Pulse shaping

USE: Pulse shaping methods

Pulse shaping methods

UF: Pulse shaping
BT: Signal processing
NT: Optical pulse shaping

Pulse transformers

BT: Transformers

Pulse width modulated power converters

USE: Pulse width modulation
converters

Pulse width modulation

UF: PWM
Pulsewidth modulation
Pulsewidth-modulation
BT: Modulation
RT: AC generators
AC machines
AC motors
Converters
DC generators
DC machines
DC motors
Pulse width modulation

converters

NT: Pulse width modulation

inverters

Space vector pulse width

modulation

Pulse width modulation converters

UF: PWM converters
PWM convertors
Pulse width modulated

power converters

convertors

converters

convertors

BT: Converters
RT: Power conditioning
Power control
Power conversion
Power electronics
Pulse width modulation
Voltage-source converters

Pulse width modulation converters

USE: Pulse width modulation
converters

Pulse width modulation inverters

UF: PWM inverters
PWM invertors
Pulse width modulation

invertors

BT: Pulse width modulation
RT: AC motors
AC-DC power converters
Converters
DC motors
DC-DC power converters

Pulse width modulation invertors

USE: Pulse width modulation
inverters

Pulsed electric current sintering

USE: Spark Plasma sintering

Pulsed electroacoustic methods

BT: Acoustoelectric effects
RT: Acoustoelectric devices
Charge measurement
Insulation testing
Space charge

Pulsed laser deposition

UF: Laser deposition
BT: Chemical vapor deposition
RT: Laser cladding
Vapor deposition

Pulsed lasers

USE: Laser pulses

Pulsed power supplies

BT: Pulsed power systems



JULY 2025 IEEE Thesaurus

Pulsed power systems

BT: Power systems
RT: Energy storage
High-voltage techniques
Power generation
Power supplies
NT: Pulsed power supplies

Pulsewidth modulation

USE: Pulse width modulation

Pulsewidth modulation converters

USE: Pulse width modulation
converters

Pulsewidth modulation convertors

USE: Pulse width modulation
converters

Pulsewidth-modulation

USE: Pulse width modulation

Pump lasers

BT: Lasers

Pumping of lasers

USE: Laser excitation

Pumps

BT: Machinery
RT: Bellows
Compressors
Impellers
Turbomachinery
NT: Fuel pumps
Heat pumps
Insulin pumps
Micropumps
Water pumps

Punching

BT: Materials processing
RT: Sheet metal processing

Pupils

BT: Eyes
RT: Ophthalmology

Purification

BT: Cleaning
RT: Air cleaners
Decontamination
Refining
Sugar refining

Pursuit algorithms

BT: Algorithms

PVA

USE: Personal voice assistants

PWM

USE: Pulse width modulation

PWM converters

USE: Pulse width modulation
converters

PWM convertors

USE: Pulse width modulation
converters

PWM inverters

USE: Pulse width modulation
inverters

PWM invertors

USE: Pulse width modulation
inverters

Pylons

USE: Poles and towers

Pyroelectric devices

BT: Dielectric devices
RT: Pyroelectricity

Pyroelectricity

BT: Electricity
Ultrasonics, ferroelectrics,
and frequency control
RT: Ferroelectric materials
Piezoelectricity
Pyroelectric devices
Thermal factors

Python

BT: Computer languages
Public domain software
RT: Functional programming
Object oriented
programming
Software libraries

PZT

USE: Lead zirconate titanate

Q factor

USE: Q-factor



JULY 2025 IEEE Thesaurus

<i>Q learning</i>		RT:	Product codes
USE:	Q-learning		
Q measurement		<i>QSM</i>	
BT:	Electric variables	USE:	Quantitative susceptibility mapping
measurement			
RT:	Q-factor	<i>Quad flat packs</i>	
		USE:	Electronics packaging
Q-factor		<i>Quadcopters</i>	
UF:	Q factor	USE:	Quadrotors
	Quality factor		
BT:	Electric variables		
RT:	Capacitors	Quadratic programming	
	Q measurement	BT:	Optimization methods
Q-learning		Quadrature amplitude modulation	
UF:	Q learning	UF:	QAM
BT:	Reinforcement learning	BT:	Amplitude modulation
RT:	Markov processes		
	Stochastic processes	Quadrature phase shift keying	
<i>QAM</i>		BT:	Phase shift keying
USE:	Quadrature amplitude modulation	NT:	Differential quadrature phase shift keying
<i>qbit</i>		Quadrotors	
USE:	Qubit	UF:	Quadcopters
		BT:	Helicopters
<i>QCD vacuum</i>		RT:	Autonomous aerial vehicles
USE:	Elementary particle vacuum		Drones
<i>QFD</i>		Quadrupedal robots	
USE:	Quality function deployment	UF:	Quadrupeds
		BT:	Robots
<i>QFP</i>		<i>Quadrupeds</i>	
USE:	Electronics packaging	USE:	Quadrupedal robots
<i>QoE</i>		Qualifications	
USE:	Quality of experience	BT:	Training
<i>QoS</i>		RT:	Continuing professional development
USE:	Quality of service		Standards
<i>QoT</i>		Quality assessment	
USE:	Quality of transmission	BT:	Quality management
<i>Qox</i>		Quality assurance	
USE:	Quality of experience	BT:	Quality management
<i>QPSK</i>		RT:	Consumer protection
USE:	Phase shift keying		Data integrity
			Design for quality
QR codes			IEEE 802.11e Standard
UF:	Quick response codes		Product liability
BT:	Bar codes		Quality awards
			Quality control



JULY 2025 IEEE Thesaurus

	Quality function deployment	Quality awards	
	Six sigma	Quality control	
	Total quality management	Quality function deployment	
NT:	Best practices	Total quality management	
Quality awards		Quality of experience	
BT:	Quality management	UF:	QoE
RT:	Continuous improvement		Qox
	Quality assurance	BT:	Communication systems
	Quality function deployment		Customer satisfaction
	Total quality management	RT:	Quality of service
			Quality of transmission
			User experience
Quality control		Quality of service	
BT:	Quality management	UF:	QoS
RT:	Contamination		Quality-of-service
	Coordinate measuring	BT:	Communication systems
			Customer satisfaction
machines	Data integrity	RT:	Conformance testing
	Design for quality		IEEE 802.11e Standard
	Failure analysis		IP networks
	IEEE 802.11e Standard		Next generation networking
	Quality assurance		Quality of experience
	Quality function deployment		Service level agreements
	Reliability		Spatial diversity
	Six sigma		Telecommunication
	Total quality management		
Quality factor		computing	
USE:	Q-factor	NT:	Admission control
			Quality of transmission
Quality function deployment		Quality of transmission	
UF:	QFD	UF:	QoT
BT:	Quality management	BT:	Quality of service
RT:	Concurrent engineering	RT:	Delays
	Product development		Jitter
	Quality assurance		Quality of experience
	Quality awards		Throughput
	Quality control		
Quality management		Quality-of-service	
UF:	ISO 9000	USE:	Quality of service
BT:	Management		
RT:	Control charts	Quantisation	
	Customer relationship	USE:	Quantization (signal)
management	Customer satisfaction	Quantitative susceptibility mapping	
	Data governance	UF:	QSM
	Design for quality	BT:	Magnetic resonance
	ISO Standards	imaging	
	Pareto analysis	Quantization (signal)	
	Product liability	UF:	Quantisation
	Reliability		Quantization effects
	System improvement		Quantization errors
NT:	Quality assessment		Signal quantisation
	Quality assurance		



JULY 2025 IEEE Thesaurus

	Signal quantization	Quantum communication
BT:	Signal processing	Quantum computing
RT:	Analog-digital conversion	Quantum information
	Data compression	
	Digital representation	science
	Encoding	
	Finite wordlength effects	Quantum communication
	Granular computing	BT: Communication systems
	Signal sampling	RT: Channel capacity
NT:	Vector quantization	Information theory
		Optical fiber communication
		Teleportation
<i>Quantization effects</i>		NT: Quantum circuit
USE:	Quantization (signal)	Quantum networks
<i>Quantization errors</i>		
USE:	Quantization (signal)	Quantum computing
		BT: Computers and information
Quantum advantage		processing
UF:	Quantum supremacy	Electron devices
BT:	Quantum computing	RT: Coherence time
		Trapped ions
		NT: Quantum advantage
Quantum algorithm		Quantum algorithm
BT:	Quantum computing	Quantum annealing
		Quantum cellular automata
Quantum annealing		Quantum chemistry
BT:	Metaheuristics	Quantum circuit
	Quantum computing	Quantum networks
RT:	Annealing	Quantum simulation
		Qubit
Quantum capacitance		
BT:	Capacitance	<i>Quantum confinement</i>
	Quantum mechanics	USE: Potential well
RT:	CNTFETs	
Quantum cascade lasers		Quantum cryptography
UF:	Cascade lasers	BT: Cryptography
BT:	Quantum well lasers	Quantum mechanics
RT:	Quantum mechanics	
Quantum cellular automata		<i>Quantum dash</i>
BT:	Quantum computing	USE: Quantum dots
Quantum channels		Quantum decoherence
BT:	Communication channels	BT: Quantum mechanics
	Quantum information	RT: Coherence
science		
RT:	Qubit	Quantum dot lasers
		UF: Quantum-dot lasers
Quantum chemistry		BT: Semiconductor lasers
BT:	Chemistry	RT: Quantum dots
	Quantum computing	Quantum mechanics
RT:	Molecular computing	Quantum well lasers
Quantum circuit		
BT:	Circuits	Quantum dots
		UF: Quantum dash
		Quantum-dot
		Quantum-dots



JULY 2025 IEEE Thesaurus

BT:	Semiconductor devices		Quantum information
RT:	Nanocrystals	science	
	Quantum dot lasers		Quantum key distribution
	Quantum mechanics		Quantum materials
Quantum entanglement			Quantum optics
UF:	Entangled states		Quantum sensing
BT:	Quantum mechanics		Quantum sensors
RT:	Quantum radar		Quantum simulation
	Quantum repeaters		Quantum state
	Quantum state		Quantum system
	Teleportation	mechanics	Relativistic quantum
Quantum information science			Schrodinger equation
BT:	Information science		Stationary state
	Quantum mechanics		Teleportation
NT:	Quantum channels		Tunneling
	Quantum circuit		
Quantum key distribution		Quantum networks	
BT:	Communication system	BT:	Quantum communication
security		NT:	Quantum computing
	Quantum mechanics		Quantum repeaters
RT:	Cryptography	Quantum optics	
Quantum materials		BT:	Quantum mechanics
BT:	Materials	NT:	Optical squeezing
	Quantum mechanics	Quantum radar	
RT:	Excitons	BT:	Radar
	Polaritons		Remote sensing
	Topological insulators	RT:	Lighting
			Quantum entanglement
Quantum mechanics		Quantum repeaters	
UF:	Quantum theory	BT:	Quantum networks
BT:	Physics	RT:	Quantum entanglement
RT:	Lagrangian functions	Quantum sensing	
	Laser theory	BT:	Quantum mechanics
	Nanotechnology		Sensors
	Philosophical	Quantum sensors	
considerations		BT:	Quantum mechanics
	Quantum cascade lasers		Sensors
	Quantum dot lasers	Quantum simulation	
	Quantum dots	BT:	Quantum computing
	Quantum well devices		Quantum mechanics
	Quantum well lasers		Simulation
	Resonant frequency	Quantum state	
	Solid-state physics	BT:	Quantum mechanics
	String theory	RT:	Quantum entanglement
NT:	Coherence time	<i>Quantum supremacy</i>	
	Density functional theory	USE:	Quantum advantage
	Proton effects		
	Quantum capacitance		
	Quantum cryptography		
	Quantum decoherence		
	Quantum entanglement		



JULY 2025 IEEE Thesaurus

Quantum system

BT: Quantum mechanics

Quantum teleportation

USE: Teleportation

Quantum theory

USE: Quantum mechanics

Quantum vacuum

USE: Elementary particle vacuum

Quantum well devices

UF: Quantum-well devices
Quantumwell devices
BT: Electron devices
RT: Electro-optic modulators
Quantum mechanics
Resonant tunneling devices
Tunneling
NT: Quantum well lasers
Quantum wells
Two dimensional hole gas

Quantum well lasers

UF: Quantum-well lasers
BT: Lasers
Quantum well devices
Semiconductor devices
Semiconductor lasers
Solid lasers
RT: Quantum dot lasers
Quantum mechanics
Quantum wells
Semiconductor optical

amplifiers

Surface emitting lasers
Two dimensional hole gas
NT: Quantum cascade lasers

Quantum wells

UF: Semiconductor quantum
wells
BT: Electrons
Quantum well devices
RT: Quantum well lasers
Surface emitting lasers
Two dimensional hole gas

Quantum-dot

USE: Quantum dots

Quantum-dot lasers

USE: Quantum dot lasers

Quantum-dots

USE: Quantum dots

Quantum-well devices

USE: Quantum well devices

Quantum-well lasers

USE: Quantum well lasers

Quantumwell devices

USE: Quantum well devices

Quarter-wave plates

USE: Optical retarders

Quartz crystals

BT: Crystals

Quasi Fermi level

USE: Quasi-Fermi level

Quasi-Fermi level

UF: Fermi energy
Imref
Quasi Fermi level
BT: Energy states
Thermodynamics
RT: Fermi level

Quasi-resonant inverters

USE: Resonant inverters

Quasi-resonant invertors

USE: Resonant inverters

Quaternions

BT: Mathematics

Qubit

UF: qbit
BT: Quantum computing
RT: Coherence time
Quantum channels
NT: Spin qubits

Query evaluation

USE: Query processing

Query languages

USE: Database languages

Query optimisation

USE: Query processing



JULY 2025 IEEE Thesaurus

Query optimization

USE: Query processing

Query pipeline

USE: Query processing

Query process

USE: Query processing

Query processing

UF: Query evaluation
Query optimisation
Query optimization
Query pipeline
Query process
Query routing
BT: Database systems
RT: Cross modal retrieval
Data retrieval
Linked data
NoSQL databases
Semantic search

Query routing

USE: Query processing

Question answering (information retrieval)

BT: Natural language
processing
RT: Chatbots
Question generation

Question generation

UF: Automatic question
generation
BT: Natural language
processing
RT: Chatbots
Question answering
(information retrieval)

Queueing analysis

UF: Queueing theory
BT: Traffic control
RT: Publish subscribe systems
Scheduling

Queueing theory

USE: Queueing analysis

Quick response codes

USE: QR codes

R & D management

USE: Research and development
management

R language

BT: Computer languages
Public domain software
RT: Data analysis
Data mining
Data visualization
Statistical analysis

Rabbits

BT: Animals

Racetrack memory

UF: Domain wall memory
Domain-wall memory
BT: Nonvolatile memory

Rad hardened

USE: Radiation hardening
(electronics)

Rad-hard

USE: Radiation hardening
(electronics)

Radar

UF: Microwave radar
BT: Electromagnetic
compatibility and interference
RT: Microwave technology
Radar detection
Radar scattering
Airborne radar
Bistatic radar
Cognitive radar
Doppler radar
Ground penetrating radar
High frequency radar
Laser radar
Meteorological radar
Millimeter wave radar
Multistatic radar
Passive radar
Quantum radar
Radar applications
Radar clutter
Radar cross-sections
Radar equipment
Radar theory
Spaceborne radar
Spread spectrum radar
Synthetic aperture radar



JULY 2025 IEEE Thesaurus

	Ultra wideband radar		
Radar antennas		Radar imaging	
BT:	Antennas	BT:	Radar applications
		RT:	Ground penetrating radar
			Landmine detection
Radar applications			Meteorological radar
BT:	Radar		Passive radar
RT:	Oceanographic techniques		Remote sensing
NT:	Radar countermeasures		Synthetic aperture radar
	Radar detection		Ultra wideband radar
	Radar imaging	Radar interferometry	
	Radar measurements	BT:	Interferometry
	Radar polarimetry	NT:	Synthetic aperture radar
	Radar remote sensing		interferometry
	Radar tracking	Radar measurements	
Radar clutter		BT:	Radar applications
BT:	Radar	RT:	Remote sensing
RT:	Jamming	NT:	Radar cross-sections
Radar countermeasures			
BT:	Electronic warfare	<i>Radar meteorology</i>	
	Radar applications	USE:	Meteorological radar
RT:	Adaptive arrays	Radar polarimetry	
	Electronic countermeasures	UF:	SAR imaging
	Jamming		Synthetic aperture radar
	Spread spectrum radar		imaging
<i>Radar cross section</i>		BT:	Radar applications
USE:	Radar cross-sections	Radar remote sensing	
<i>Radar cross sections</i>		BT:	Radar applications
USE:	Radar cross-sections	RT:	Spaceborne radar
<i>Radar cross-section</i>		Radar scattering	
USE:	Radar cross-sections	BT:	Electromagnetic scattering
Radar cross-sections		RT:	Radar
UF:	Radar cross section	Radar signal processing	
	Radar cross sections	BT:	Signal processing
	Radar cross-section	Radar theory	
BT:	Radar	BT:	Radar
	Radar measurements	Radar tracking	
	Reflection	BT:	Radar applications
Radar detection		RT:	Target tracking
BT:	Radar applications	Radial basis function networks	
	Signal detection	UF:	RBF networks
RT:	Ground penetrating radar		Radial basis function neural
	Passive radar		networks
	Radar	BT:	Neural networks
	Ultra wideband radar	RT:	Artificial intelligence
Radar equipment			Computer networks
BT:	Radar		Cybernetics



JULY 2025 IEEE Thesaurus

	Interpolation		High energy physics
		instrumentation computing	
<i>Radial basis function neural networks</i>			Proton effects
USE:	Radial basis function		Proton radiation effects
networks			Radiation monitoring
			Radiation protection
<i>Radiation counters</i>			Safety
USE:	Radiation detectors	NT:	Biological effects of
		radiation	
<i>Radiation detection</i>			EMP radiation effects
USE:	Radiation detectors		Gamma-ray effects
			Ion radiation effects
Radiation detector circuits			Neutron radiation effects
BT:	Circuits		Scintillators
RT:	Counting circuits		Single event latchup
	Radiation detectors		Space radiation
			Terahertz radiation
			Total ionizing dose
Radiation detectors		Radiation hardening (electronics)	
UF:	Counters	UF:	Rad hardened
	Particle detectors		Rad-hard
	Radiation counters	BT:	Electronic equipment
	Radiation detection	manufacture	
	Ratemeters		Nuclear and plasma
BT:	Ionizing radiation sensors		
RT:	Atomic measurements	sciences	
	Dosimetry	RT:	Ionizing radiation
	Nuclear measurements		Satellite communications
	Phototransistors		Total ionizing dose
	Radiation detector circuits		
	Radiation monitoring	Radiation imaging	
	Radiofrequency exposure	BT:	Imaging
	Spectroscopy	RT:	Biomedical imaging
	X-ray detectors	NT:	Radionuclide imaging
NT:	Bolometers		
	Gamma-ray detectors		
	Infrared detectors	Radiation monitoring	
	Photodetectors	UF:	Health physics
	Semiconductor radiation	BT:	Monitoring
detectors			Nuclear and plasma
	Silicon radiation detectors	sciences	
		RT:	Dosimetry
Radiation dosage			Radiation detectors
BT:	Radiation monitoring		Radiation effects
			Radiation protection
<i>Radiation dosimetry</i>			Radioactive pollution
USE:	Dosimetry		Reactor instrumentation
		NT:	Radiation dosage
Radiation effects			
UF:	Irradiation	<i>Radiation pattern</i>	
BT:	Nuclear and plasma	USE:	Antenna radiation patterns
sciences			
RT:	Biomedical applications of	Radiation protection	
radiation		UF:	Radiation shielding
	Brachytherapy		Radiological protection
		BT:	Protection



JULY 2025 IEEE Thesaurus

radiation	RT:	Radiation safety Biological effects of	BT:	Antennas and propagation Astronomy
		Contamination Dosimetry Fission reactors Radiation effects Radiation monitoring Radioactive pollution	RT:	Reflector antennas Telescopes
	Radiation safety		Radio broadcasting	
	BT:	Nuclear and plasma	BT:	Broadcasting Radio communication
	sciences		RT:	Digital multimedia
	NT:	Safety Radiation protection Radiofrequency safety	broadcasting	Journalism Frequency modulation Radio networks
<i>Radiation shielding</i>			Radio communication	
USE:	Radiation protection		BT:	Communication systems
Radiation therapy			RT:	Bandwidth Convolutional codes Cross layer design Diversity methods Film bulk acoustic
UF:	Radiotherapy		resonators	IEEE 802.11 Standard IEEE 802.11g Standard IEEE 802.11n Standard IEEE 802.15 Standard Intercell interference MIMO Mobile communication NOMA Radio access networks Radio communication
BT:	Biomedical applications of			
radiation		Oncology Cancer treatment		
RT:				
Radiative recombination				
BT:	Spontaneous emission			
RT:	Semiconductor materials			
<i>Radiators (automotive)</i>				
USE:	Automotive components		equipment	
Radio access networks				
UF:	RAN			Radio propagation SIMO SISO Wireless LAN
BT:	Telecommunications			Baseband Bluetooth Cellular technology Indoor radio communication Land mobile radio LoRa Millimeter wave
RT:	3G mobile communication 4G mobile communication Aerial computing Land mobile radio Radio communication Telecommunication		NT:	
services				
NT:	Cloud radio access		communication	
networks		Open RAN		
Radio access technologies				
UF:	RATS			
BT:	Communication networks			
NT:	New Radio		countermeasures	
Radio astronomy				
UF:	Radio telescopes			Radio frequency Radio links



JULY 2025 IEEE Thesaurus

management
Radio spectrum
Satellite communications
Satellite ground stations
Software radio
Zigbee

Radio communication countermeasures

BT: Communication system
security
Radio communication
RT: Adaptive arrays
Electronic countermeasures
Electronic warfare
Jamming
Spread spectrum

communication

Radio communication equipment

BT: Communication equipment
RT: Antennas
Radio communication
Telephone equipment
NT: Base stations
Ham radios
Land mobile radio
equipment
Radio transceivers
Transponders

Radio control

BT: Control systems

Radio frequency

UF: RF
Radio-frequency
Radiofrequency
BT: Radio communication
RT: Electrosurgery
Light fidelity
Wireless fidelity
NT: High frequency
Radiofrequency exposure
Radiofrequency safety

Radio frequency exposure

USE: Radiofrequency exposure

Radio frequency identification

USE: Radiofrequency
identification

Radio frequency integrated circuits

USE: Radiofrequency integrated
circuits

Radio frequency interference

USE: Radiofrequency
interference

Radio frequency power amplifiers

USE: Power amplifiers

Radio frequency safety

USE: Radiofrequency safety

Radio interference

USE: Electromagnetic
interference

Radio interferometry

UF: Radiowave interferometry
BT: Interferometry

Radio LAN

USE: Wireless LAN

Radio links

BT: Radio communication
RT: Transport protocols

Radio navigation

UF: Loran
BT: Navigation
RT: Air traffic control
Indoor navigation
Satellite navigation systems
Transponders

Radio networks

BT: Radio broadcasting

Radio propagation

BT: Electromagnetic
propagation
RT: Fading channels
Multipath channels
Radio communication
Radiowave propagation
Rayleigh channels

Radio receivers

USE: Receivers

Radio resource management

USE: Resource management

Radio spectrum management

UF: Frequency allocation
Spectrum management



JULY 2025 IEEE Thesaurus

BT: Radio communication
 RT: Communication standards
 NT: Direct sequence spread
 spectrum communication
 White spaces

Radio telescopes

USE: Radio astronomy

Radio transceivers

BT: Radio communication
 equipment

Transceivers
 NT: Dynamic spectrum access

Radio transmitters

BT: Transmitters

Radio-frequency

USE: Radio frequency

Radio-frequency identification

USE: Radiofrequency
 identification

Radio-frequency interference

USE: Radiofrequency
 interference

Radio-frequency safety

USE: Radiofrequency safety

Radioactive decay

BT: Radioactive materials

Radioactive label

USE: Radiotracer

Radioactive materials

UF: Alphavoltaic power sources
 Betavoltaic power sources
 Radioisotopes
 BT: Materials
 RT: Isotopes
 Neutrino sources
 Occupational health
 Occupational safety
 Radioactive pollution
 Safety
 NT: Radioactive decay
 Radioactive waste

Radioactive pollution

UF: Nuclear wastes
 BT: Pollution

RT: Hazardous areas
 Incineration
 Industrial pollution
 Land pollution
 Radiation monitoring
 Radiation protection
 Radioactive materials
 Radioactive waste
 Radioactive waste disposal
 Safety
 Waste materials

Radioactive tracer

USE: Radiotracer

Radioactive waste

BT: Radioactive materials
 Waste materials
 RT: Hazardous areas
 Hazardous materials
 Incineration
 Materials handling
 Nuclear energy
 Nuclear facility regulation
 Radioactive pollution
 Waste disposal
 Waste management
 NT: Radioactive waste disposal

Radioactive waste disposal

BT: Radioactive waste
 Waste disposal
 RT: Incineration
 Materials handling
 Radioactive pollution
 Vitrification
 Waste handling

Radiofrequency

USE: Radio frequency

Radiofrequency amplifiers

UF: Radiofrequency power
 amplifiers
 BT: Amplifiers

Radiofrequency exposure

UF: RF exposure
 Radio frequency exposure
 BT: Radio frequency
 RT: Electromagnetic pulses
 Electromagnetic radiation
 Radiation detectors



JULY 2025 IEEE Thesaurus

Radiofrequency identification

UF: RF identification
RFID
Radio frequency
identification
Radio-frequency
identification
BT: Sensor systems and
applications
RT: Internet of Things
Product codes
Radiofrequency integrated
circuits
NT: RFID tags

Radiofrequency integrated circuits

UF: RFIC
Radio frequency integrated
circuits
BT: Integrated circuits
RT: MIMICs
MMICs
Radiofrequency
identification

Radiofrequency interference

UF: Radio frequency
interference
Radio-frequency
interference
BT: Electromagnetic
interference
RT: NOMA
Superconducting filters
NT: Intercell interference

Radiofrequency micro-electro-mechanical systems

USE: Radiofrequency
microelectromechanical systems

Radiofrequency micro-electromechanical systems

USE: Radiofrequency
microelectromechanical systems

Radiofrequency microelectromechanical systems

UF: RF micro-electro-
mechanical systems
RF microelectromechanical
systems
Radiofrequency micro-
electro-mechanical systems

Radiofrequency micro-
electromechanical systems
BT: Microelectromechanical
systems

Radiofrequency power amplifiers

USE: Power amplifiers AND
Radiofrequency amplifiers

Radiofrequency safety

UF: RF safety
Radio frequency safety
Radio-frequency safety
BT: Radiation safety
Radio frequency
RT: Electromagnetic radiation

Radiographic image enhancement

BT: Biomedical image
processing

Radiography

BT: Imaging
RT: Biomedical applications of
radiation
Medical diagnosis
Nuclear imaging
X-ray detection
X-ray imaging
NT: Diagnostic radiography

Radioisotope thermoelectric generators

BT: Generators

Radioisotopes

USE: Radioactive materials

Radiological protection

USE: Radiation protection

Radiology

BT: Biomedical image
processing
Medical specialties
NT: Neuroradiology

Radiometers

BT: Meters
Radiometry
NT: Spectroradiometers

Radiometry

BT: Electromagnetic
measurements



JULY 2025 IEEE Thesaurus

sensing
 RT: Geoscience and remote
 Imaging
 Photometry
 Remote sensing
 Temperature measurement
 NT: Microwave radiometry
 Radiometers

Radiomics

BT: Biomedical image
 processing
 RT: Machine learning

Radionuclide imaging

UF: Radionuclide scanning
 Radionuclide scans
 BT: Medical diagnostic imaging
 Radiation imaging

Radionuclide scanning

USE: Radionuclide imaging

Radionuclide scans

USE: Radionuclide imaging

Radiotherapy

USE: Radiation therapy

Radiotracer

UF: Radioactive label
 Radioactive tracer
 BT: Chemical compounds

Radiowave interferometry

USE: Radio interferometry

Radiowave propagation

BT: Electromagnetic
 propagation
 RT: Radio propagation
 NT: NVIS

Radium

BT: Chemical elements

Radomes

BT: Antenna accessories

Radon

BT: Chemical elements

RAG

USE: Retrieval augmented
 generation

Rail guns

USE: Railguns

Rail line

USE: Rail transportation

Rail lines

USE: Rail transportation

Rail to rail amplifiers

BT: Rail to rail operation
 RT: Amplifiers
 MOSFET circuits
 Rail to rail inputs
 Rail to rail outputs

Rail to rail inputs

UF: RRI
 BT: Rail to rail operation
 RT: Nonlinear circuits
 Rail to rail amplifiers

Rail to rail operation

BT: Circuits
 RT: Amplifiers
 CMOSFET circuits
 MOSFET circuits
 NT: Rail to rail amplifiers
 Rail to rail inputs
 Rail to rail outputs

Rail to rail outputs

UF: RRO
 BT: Rail to rail operation
 RT: Nonlinear circuits
 Rail to rail amplifiers

Rail traffic

USE: Rail transportation

Rail transportation

UF: Rail line
 Rail lines
 Rail traffic
 Rail ways
 Railways
 BT: Land transportation
 RT: Block signalling
 Land vehicles
 Magnetic levitation
 Public transportation
 High-speed rail
 NT: Light rail systems
 Magnetic levitation vehicles



JULY 2025 IEEE Thesaurus

	Positive train control
	Railway communication
	Railway electrification
<i>Rail ways</i>	
USE:	Rail transportation
<i>Rail-gun</i>	
USE:	Railguns
Railguns	
UF:	Rail guns
	Rail-gun
BT:	Electromagnetic launching
RT:	Rails
Rails	
BT:	Structural shapes
RT:	Flanges
	Railguns
Railway accidents	
UF:	Derailments
BT:	Accidents
RT:	Positive train control
	Railway engineering
	Railway safety
<i>Railway bridges</i>	
USE:	Structural panels
Railway communication	
BT:	Rail transportation
	Telecommunications
NT:	Block signalling
	GSM-R
Railway electrification	
BT:	Rail transportation
RT:	Power overhead lines
Railway engineering	
BT:	Civil engineering
RT:	Railway accidents
NT:	Railway safety
Railway safety	
BT:	Railway engineering
RT:	Positive train control
	Railway accidents
	Safety devices
<i>Railways</i>	
USE:	Rail transportation

Rain	
UF:	Rainfall
BT:	Precipitation
RT:	Floods
	Monsoons
	Stormwater
<i>Rain fades</i>	
USE:	Rain fading
Rain fading	
UF:	Rain fades
BT:	Interference
<i>Rain forests</i>	
USE:	Rainforests
<i>Rainfall</i>	
USE:	Rain
Rainforests	
UF:	Rain forests
BT:	Ecosystems
RT:	Deforestation
	Forestry
RAKE receivers	
BT:	Receivers
RT:	Signal to noise ratio
<i>Raleigh fading</i>	
USE:	Rayleigh channels
<i>Raleigh fading channels</i>	
USE:	Rayleigh channels
<i>RAM</i>	
USE:	Random access memory
<i>Raman effect</i>	
USE:	Raman scattering
Raman scattering	
UF:	Raman effect
	Raman spectroscopy
BT:	Electromagnetic scattering
	Nonlinear optics
<i>Raman spectroscopy</i>	
USE:	Raman scattering
<i>RAN</i>	
USE:	Radio access networks
AND	
	Regional area networks



JULY 2025 IEEE Thesaurus

Random access communication

USE: Multiaccess communication

Cryptography

Random number

generation

Random access memory

UF: RAM
Random access storage
BT: Memory
RT: Buffer storage
NT: DRAM chips
Phase change random

access memory

Resistive RAM
SDRAM
SRAM cells
SRAM chips

Random access storage

USE: Random access memory

Random forests

BT: Machine learning
Random processes
RT: Decision trees
Fish schools
Pattern recognition
Regression analysis

Random media

UF: Turbulent media
BT: Media
RT: Chaos
Nonhomogeneous media

Random number generation

BT: Cryptography
RT: Random sequences
Stochastic processes
White noise

Random processes

BT: Mathematics
RT: Algorithms
Mean field theory
Probability
Signal processing
Statistical analysis
Time series analysis
NT: Brownian motion
Conditional random fields
Random forests

Random sequences

UF: Pseudorandom sequences
BT: Sequences
RT: Chaotic mapping

Random variables

BT: Probability
RT: Stochastic processes
Stochastic systems
NT: Nonce

Ranging

USE: Distance measurement

Ranking (statistics)

BT: Statistics
RT: Information retrieval
Ontologies
Search methods
Semantic Web
Vocabulary

Ransomware

BT: Malware

Rapid eye movement sleep

UF: REM sleep
BT: Sleep

Rapid prototyping

BT: Prototypes
RT: CAD/CAM
Design methodology
Manufacturing processes
Product development
Software engineering
Three-dimensional printing
Virtual prototyping

Rapid thermal annealing

BT: Annealing
RT: Semiconductor devices

Rapid thermal processing

BT: High-temperature
techniques
RT: Heating systems

Rare earth metals

UF: Rare-earth metals
BT: Metals

Rare-earth metals

USE: Rare earth metals

Rate distortion



JULY 2025 IEEE Thesaurus

USE: Rate-distortion

Rate distortion theory

BT: Information theory
 RT: Audio coding
 Channel coding
 Channel spacing
 Distortion
 Image coding
 Signal analysis
 Signal processing
 Source coding
 Speech coding
 Video coding
 NT: Channel rate control

Rate-distortion

UF: Rate distortion
 BT: Information theory
 RT: Data compression

Ratemeters

USE: Radiation detectors

RATS

USE: Radio access technologies

Rats

BT: Animals

Raw materials

BT: Materials
 RT: Mining industry

Ray tracing

UF: Ray-tracing
 BT: Geometrical optics
 Optics
 RT: Computer graphics
 Stray light

Ray-tracing

USE: Ray tracing

Rayleigh channels

UF: Raleigh fading
 Raleigh fading channels
 Rayleigh-fading
 BT: Fading channels
 RT: Radio propagation

Rayleigh scattering

BT: Electromagnetic scattering

Rayleigh-Benard convection

USE: Convection

Rayleigh-fading

USE: Rayleigh channels

RBF networks

USE: Radial basis function networks

RDF

USE: Resource description framework

Re-configurable devices

USE: Reconfigurable devices

Reachability analysis

BT: Graph theory

Reactive power

UF: Power factor
 VAR
 BT: Power systems
 RT: Reactive power control
 Static VAR compensators

Reactive power control

BT: Electric variables control
 RT: Power system security
 Reactive power
 Voltage control

Reactor instrumentation

BT: Nuclear and plasma sciences
 RT: Radiation monitoring

Reactors

USE: Inductors

Read only memory

UF: ROM
 BT: Memory
 RT: Read-write memory
 NT: PROM

Read-write memory

BT: Memory
 RT: Read only memory

Readability formulas

USE: Readability metrics



JULY 2025 IEEE Thesaurus

Readability metrics

UF: Readability formulas
Readability tests
BT: Writing

Readability tests

USE: Readability metrics

Readout electronics

BT: Displays
RT: Detectors
SQUIDS

Real estate industry

BT: Industries

Real time

USE: Real-time systems

Real time control

USE: Real-time systems

Real time monitoring

USE: Real-time systems

Real time processing

USE: Real-time systems

Real time systems

USE: Real-time systems

Real-time control

USE: Real-time systems

Real-time monitoring

USE: Real-time systems

Real-time processing

USE: Real-time systems

Real-time systems

UF: Real time
Real time control
Real time monitoring
Real time processing
Real time systems
Real-time control
Real-time monitoring
Real-time processing
BT: Computers and information
processing
RT: Control systems
Endomicroscopy
Hardware-in-the-loop

simulation

High energy physics
instrumentation computing
Networked control systems
YOLO
NT: Telexistence
WebRTC

Reasoning

USE: Cognition AND
Cognitive systems

reasoning about programs

USE: Commonsense reasoning

Rebreathers

USE: Rebreathing equipment

Rebreathing equipment

UF: Rebreathers
BT: Underwater equipment

Receive antennas

USE: Receiving antennas

Received signal strength indicator

UF: RSSI
BT: Communication system

signaling

Signal processing

Receivers

UF: Radio receivers
BT: Communication equipment
RT: Demodulation
Optical antennas
Signal detection
NT: Optical receivers
RAKE receivers
Receiving antennas

Receiving antennas

UF: Receive antennas
BT: Antennas
Receivers
RT: Spatial diversity
Transmitting antennas

Receptor (biochemistry)

BT: Biochemistry

Recommendation systems

USE: Recommender systems



JULY 2025 IEEE Thesaurus

Recommender systems

UF: Music recommendation
Recommendation systems
BT: Information filtering
RT: Collaborative filtering
Graph neural networks

Disk recording
Flight recording
Magnetic recording
Optical recording
Video recording

Reconfigurable architectures

BT: Computer architecture
NT: Reconfigurable intelligent

surfaces

Reconfigurable devices

UF: Re-configurable devices
BT: Hardware
RT: Field programmable gate

arrays

Reconfigurable intelligent surfaces

UF: Intelligent reconfigurable

surface

RIS

BT: Reconfigurable

architectures

Reconfigurable logic

BT: Logic design

Reconfigurable radio

USE: Software radio

Reconnaissance

BT: Military communication
Security
RT: Remote sensing
Surveillance

Reconstruction algorithm

USE: Reconstruction algorithms

Reconstruction algorithms

UF: Reconstruction algorithm
Reconstruction methods
BT: Tomography
RT: Image processing
Three-dimensional displays

Reconstruction methods

USE: Reconstruction algorithms

Recording

BT: Signal processing
RT: Memory
NT: Audio recording
Digital recording

Recruitment

BT: Human resource
management
RT: Equal opportunities
Job specification
Labor resources

Rectangular waveguides

BT: Electromagnetic
waveguides
RT: Planar waveguides

Rectennas

BT: Antennas
Microwave communication
RT: Converters

Rectifiers

BT: Circuits
RT: Bridge circuits
Power electronics
Voltage multipliers

Rectifying circuits

BT: AC-DC power converters

Recurrent neural nets

USE: Recurrent neural networks

Recurrent neural networks

UF: RNN
Recurrent neural nets
BT: Neural networks
RT: Backpropagation through

time

Deep learning
Large language models
Reservoir computing
NT: Bidirectional long short term

memory

Echo state networks
Gated recurrent units
Hopfield neural networks

Recursive estimation

BT: Bayes methods
RT: Least squares

approximations



JULY 2025 IEEE Thesaurus

Recycle

USE: Recycling

Recycling

UF: Recycle

BT: Environmental

management

RT: Circular economy

Food waste

Green energy

NT: Composting

Red blood cells

BT: Blood

RT: Anemia

Reddit

USE: Social networking (online)

AND

Web sites

Redox

UF: Reduction-oxidation

BT: Chemical reduction

Oxidation

Reduced instruction set computing

UF: RISC

BT: Instruction sets

Reduced order model

USE: Reduced order systems

Reduced order systems

UF: Model reduction

Reduced order model

Reduced-order model

Reduced-order systems

BT: Systems engineering and

theory

RT: Estimation

Simulation

Reduced-order model

USE: Reduced order systems

Reduced-order systems

USE: Reduced order systems

Reduction-oxidation

USE: Redox

Redundancy

BT: Fault tolerance

RT: Codes

Reliability

Redundancy (employment)

USE: Termination of employment

Reed Solomon codes

USE: Reed-Solomon codes

Reed-Muller codes

BT: Error correction codes

RT: Polar codes

Reed-Solomon codes

UF: Reed Solomon codes

BT: Error correction codes

Refining

BT: Materials processing

RT: Chemical technology

Cleaning

Purification

Smelting

Sugar refining

Reflectance

USE: Reflectivity

Reflection

BT: Propagation

RT: Mirrors

Scattering

NT: Acoustic reflection

Backscatter

Electromagnetic reflection

Fresnel reflection

Radar cross-sections

Reflection coefficient

BT: Optical variables

measurement

Waveguide discontinuities

RT: Amplitude estimation

Reflective binary codes

UF: Gray codes

Grey codes

BT: Binary codes

Reflectivity

UF: Reflectance

BT: Waves

RT: Geometrical optics

Light trapping

Optical reflection

Sonar detection



JULY 2025 IEEE Thesaurus

NT: Telecommunications
spectroscopy Diffuse reflectance

Reflectometry

BT: Measurement
RT: Electromagnetic
measurements Electromagnetic reflection
Optical reflection
Optical variables
measurement

Reflector antennas

BT: Antennas
RT: Aperture antennas
Radio astronomy

Reflow soldering

BT: Soldering

Reforestation

BT: Forestry
RT: Deforestation

Refractive index

UF: Refractivity
BT: Optical variables
measurement
RT: Birefringence
Cross-phase modulation
Dispersion
Gain measurement
Laser beams
Metamaterials
Optical refraction
Photorefractive effect
Semiconductor device
Semiconductor lasers

Refractivity

USE: Refractive index

Refractoring

USE: Code refractoring

Refrigerants

BT: Coolants
RT: Heat pumps
Space cooling
NT: Liquid nitrogen

Refrigeration

BT: Cooling

Refrigerators

BT: Home appliances
Home automation

Refuse

USE: Waste materials

Refuse incineration

USE: Incineration

Regeneration engineering

BT: Tissue engineering
RT: Circular economy

Regional area networks

UF: RAN
BT: Communication systems
RT: IEEE 802.22 Standard
Local area networks
Metropolitan area networks
Wireless communication
NT: WRAN

Register transfer level

UF: RTL
Register-transfer level
BT: Circuit synthesis
RT: Digital circuits

Register-transfer level

USE: Register transfer level

Registers

BT: Memory
NT: Shift registers

Regression analysis

BT: Statistical analysis
RT: Correlation coefficient
Econometrics
Nearest neighbor methods
Random forests
NT: Linear regression
Logistic regression
Multivariate regression

Regression tree analysis

BT: Decision trees

Regulation

BT: Government policies
NT: Tariffs



JULY 2025 IEEE Thesaurus

Regulators

BT: Control equipment
RT: Current control
Electric variables control
Power conversion
Voltage control

Rehabilitation robotics

USE: Assistive robots

Rehabilitation robots

USE: Assistive robots

Reinforcement learning

BT: Machine learning
RT: Artificial intelligence
Bayes methods
Deep learning
Multi-armed bandit problem
Neural networks
Pattern classification
Semisupervised learning
Support vector machines
Unsupervised learning
NT: Deep reinforcement

learning

Q-learning
Temporal difference

learning

Relational databases

BT: Databases
RT: Structured Query Language
Triples (Data structure)

Relativistic effects

BT: Nuclear physics
RT: Electron beams
Free electron lasers
Klystrons
Magnetrons
Masers
Plasmas
NT: Optical flow

Relativistic quantum mechanics

BT: Quantum mechanics

Relaxation methods

BT: Numerical analysis
RT: Simulated annealing

Relaxor ferroelectrics

BT: Ferroelectric materials

Relay networks

BT: Communication networks
Relays

Relays

BT: Switchgear
RT: Switching circuits
NT: Digital relays
Microrelays
Power system relaying
Protective relaying
Relay networks
Road side unit

Release engineering

UF: Releng
BT: Software engineering
RT: Product lifecycle

management

Software development

management

Source coding

Releng

USE: Release engineering

Relevance vector machines

BT: Classification algorithms
Machine learning
RT: Bayes methods
Support vector machines

Reliability

UF: Reliability management
System reliability
RT: Aging
Dependability management
Electron traps
Failure analysis
Life testing
Power system reliability
Preventive maintenance
Quality control
Quality management
Redundancy
Risk analysis
System improvement
System recovery
Thermal management
NT: Availability
Fault diagnosis
Fault tolerance
Fluctuations
Integrated circuit reliability
Maintenance



JULY 2025 IEEE Thesaurus

reliability

- Maldistribution
- Materials reliability
- Reliability engineering
- Reliability theory
- Robustness
- Semiconductor device

- Software reliability
- Stability
- Telecommunication

network reliability

Reliability engineering

- BT: Reliability
- RT: Weibull distribution

Reliability management

- USE: Management AND Reliability

Reliability theory

- BT: Reliability

Reluctance generators

- BT: Synchronous generators

Reluctance machines

- BT: Rotating machines
- Synchronous machines
- NT: Reluctance motors

Reluctance motors

- BT: Reluctance machines
- Synchronous motors
- NT: Switched reluctance motors

REM sleep

- USE: Rapid eye movement sleep

Remaining life assessment

- BT: Testing
- RT: Failure analysis
- Maintenance engineering

Remanence

- BT: Magnetism
- RT: Magnetic fields
- Magnetic flux
- Magnetic hysteresis
- Permanent magnets

Remote control

- BT: Control equipment

Remote handling

- UF: Manipulators (nonrobotic)
- BT: Materials handling
- RT: Remote handling

equipment

Telecontrol equipment

Remote handling equipment

- BT: Materials handling

equipment

- RT: Remote handling
- Telerobotics
- Waste handling equipment

Remote laboratories

- BT: Laboratories

Remote learning

- USE: Distance learning

Remote monitoring

- BT: Monitoring
- Remote sensing
- RT: Internet of Medical Things
- Machine-to-machine

communications

Remote piloted aircraft

- USE: Remotely piloted aircraft

Remote sensing

- BT: Geoscience and remote

sensing

- RT: Atmospheric

measurements

Earth

Geologic measurements

Geophysical measurement

techniques

Geophysical measurements

Imaging

Infrared imaging

Land surface temperature

Landmine detection

Meteorology

Microwave imaging

Oceanographic techniques

Optical imaging

Pulse oximetry

Radar imaging

Radar measurements

Radiometry

Reconnaissance

Sea measurements

Soil measurements

Sonar measurements



JULY 2025 IEEE Thesaurus

Surveillance
Terrain mapping
Vegetation mapping
Water resources
NT: Hyperspectral sensors
Passive microwave remote

sensing

Quantum radar
Remote monitoring

Remote working

UF: Distance work
Hybrid office
Hybrid working
Mobile office
Telecommuting
Teleworking
Virtual office

BT: Systems, man, and
cybernetics

Remotely controlled aerial vehicles

USE: Remotely piloted aircraft

Remotely controlled vehicles

USE: Remotely guided vehicles

Remotely guided underwater vehicles

BT: Remotely guided vehicles
Underwater vehicles

Remotely guided vehicles

UF: Automated guided vehicles
Remotely controlled

vehicles

automobiles

Remotely operated

Remotely operated cars
Remotely operated vehicles

BT: Vehicles

NT: Drones

Remotely guided

underwater vehicles

Remotely piloted aircraft

Remotely operated automobiles

USE: Remotely guided vehicles

Remotely operated cars

USE: Remotely guided vehicles

Remotely operated vehicles

USE: Remotely guided vehicles

Remotely piloted aircraft

UF: RPA
Remote piloted aircraft
Remotely controlled aerial

vehicles

BT: Unmanned air vehicles
Remotely guided vehicles

Remuneration

BT: Human resource
management
RT: Employee welfare
NT: Incentive schemes
Pensions

Renal calculi

USE: Kidney stones

Rendering (computer graphics)

BT: Computer graphics
RT: Image synthesis

Renewable Electricity Standard

USE: Renewable Portfolio
Standard

Renewable energy

USE: Renewable energy sources

Renewable energy payments

USE: Feed in tariff

Renewable energy resources

USE: Renewable energy sources

Renewable energy sources

UF: Alternative energy
resources
Alternative energy sources
Clean energy
Renewable energy
Renewable energy

resources

BT: Renewable-energy
Renewables
Energy conservation
Environmental

management

RT: Anaerobic digestion
Circular economy
Electrification
Feed in tariff
Green communications
Low carbon economy
Solar panels



JULY 2025 IEEE Thesaurus

NT: Wave power
Biomass
Green energy
Green hydrogen
Hydroelectric power
generation
Renewable Portfolio
Standard
Tidal energy

Renewable Portfolio Standard

UF: RES
RPS
Renewable Electricity
Standard
BT: Renewable energy sources
Standards
RT: Biomass
Electricity supply industry
Geothermal energy
Solar power generation
Wind power generation

Renewable-energy
USE: Renewable energy sources

Renewables
USE: Renewable energy sources

Repair
USE: Maintenance engineering

Repeaters

UF: Optical regenerators
BT: Communication equipment

Replica molding
USE: Soft lithography

Replica moulding
USE: Soft lithography

Replicability

BT: Measurement

Report writing
USE: Writing

Representation learning

UF: Feature learning
BT: Machine learning
NT: Disentangled
representation learning

Representational state transfer

BT: Software architecture

Reproducibility of results

UF: Reproducible research
BT: Measurement

Reproducible research

USE: Reproducibility of results

Reproductive cloning

USE: Cloning

Reproductive system

UF: Genital system
BT: Urogenital system
NT: Placenta
Uterus

Requirements engineering

BT: Systems engineering and
theory
RT: Product design
Project management
Requirements management
Software engineering
Stakeholders
NT: Technical requirements

Requirements management

BT: Management
Systems engineering and
theory
RT: Project management
Requirements engineering

ReRAM

USE: Resistive RAM

RES

USE: Renewable Portfolio
Standard

Rescue robots

UF: Search and rescue robots
BT: Robots
RT: Emergency services
Hazards
Marine robots

Research & development

USE: Research and development



JULY 2025 IEEE Thesaurus

Research and development

UF: Research & development
BT: Engineering - general
RT: Electrical engineering
Engineering profession
Industrial engineering
International collaboration
Laboratories
Museums
Research and development

management

Reverse engineering
Science - general
Technology
Virtual enterprises
Virtual manufacturing
Virtual prototyping

NT: Translational research

Research and development management

UF: R & D management
BT: Engineering management
Management
RT: Concurrent engineering
Engineering profession
Production management
Project management
Research and development
Technology management
Venture capital
NT: Innovation management

Research initiatives

BT: Engineering management
RT: Systematic literature review

Reservoir computing

BT: Computation theory
RT: Recurrent neural networks

Reservoirs

BT: Water resources
Water storage
RT: Dams
Lakes
Land use planning
Water

Residual networks

USE: Residual neural networks

Residual neural networks

UF: Residual networks
BT: Artificial neural networks

Residual stress

USE: Residual stresses

Residual stresses

UF: Residual stress
BT: Stress

Resilience

UF: Resiliency
Resilient systems
BT: Material properties

Resiliency

USE: Resilience

Resilient systems

USE: Resilience

Resin transfer molding

USE: Transfer molding

Resin transfer moulding

USE: Transfer molding

Resins

BT: Materials
RT: Plastics
Polymer foams
NT: Epoxy resins

Resistance

BT: Electric variables
RT: Electrical resistance
measurement
Resistance heating
Skin effect
NT: Electric resistance
Piezoresistance
Surface resistance
Thermal resistance
Viscosity

Resistance heating

UF: Electric heating
BT: Heating systems
RT: Electrothermal actuators
Resistance

Resistive RAM

UF: RRAM
ReRAM
BT: Random access memory
RT: Memristors
Phase change memory



JULY 2025 IEEE Thesaurus

Resistive transducers

BT: Transducers

Resistivity

USE: Conductivity

Resistivity measurement

USE: Conductivity measurement

Resistors

BT: Electronic components

RT: Electrical ballasts

Potentiometers

NT: Memristors

Switched capacitor

networks

Varistors

Resists

UF: Photoresists

BT: Materials

Resonance

RT: Cavity resonators

Dielectric resonator

antennas

Film bulk acoustic

resonators

Microstrip resonators

Optical resonators

Resonant inverters

Resonant tunneling devices

Resonator filters

Resonators

Vibrations

NT: Ferroresonance

Magnetic resonance

Resonance light scattering

Stochastic resonance

Resonance frequency

USE: Resonant frequency

Resonance light scattering

BT: Resonance

Spectroscopy

RT: Light scattering

Resonant circuits

USE: RLC circuits

Resonant converters

BT: Converters

Resonant frequency

UF: Resonance frequency

BT: Frequency

RT: Oscillators

Quantum mechanics

NT: Magnetic resonance

Resonant inverters

UF: Quasi-resonant inverters

Quasi-resonant invertors

Resonant invertors

BT: Inverters

RT: Power electronics

Resonance

Resonant invertors

USE: Resonant inverters

Resonant tunneling devices

UF: Resonant tunnelling

devices

Resonant-tunneling devices

Resonant-tunnelling

devices

BT: Tunneling

RT: Quantum well devices

Resonance

Single electron devices

Resonant tunnelling devices

USE: Resonant tunneling devices

Resonant-tunneling devices

USE: Resonant tunneling devices

Resonant-tunnelling devices

USE: Resonant tunneling devices

Resonator filters

BT: Filters

RT: Resonance

Resonators

BT: Amplifiers

RT: Acoustics

Resonance

Ring oscillators

Tuners

NT: Cavity resonators

Split ring resonators

Resource allocation

USE: Resource management



JULY 2025 IEEE Thesaurus

Resource description framework

UF: RDF
BT: Semantic Web

Resource distribution

USE: Resource management

Resource management

UF: Allocation
Radio resource
Resource allocation
Resource distribution
Resource sharing
Resource utilisation
Resource utilization
Resources management

BT: Management
RT: Business process

integration Business process

management

Cluster computing
Edge computing
Environmental engineering
Forestry
Multi-armed bandit problem
Operations research
System integration
NT: Circular economy
Elastic computing
Network resource

management

Resource virtualization
Serverless computing

Resource sharing

USE: Resource management

Resource utilisation

USE: Resource management

Resource utilization

USE: Resource management

Resource virtualization

BT: Resource management

Resources management

USE: Resource management

Respiratory diseases

USE: Pulmonary diseases

Respiratory medicine

USE: Pulmonology

Respiratory system

UF: Bronchi
BT: Anatomy
RT: Intubation
Pulmonary diseases
Pulmonology
Ventilators
NT: Larynx
Lungs
Trachea

Respirology

USE: Pulmonology

Response surface methodology

BT: Surface fitting
RT: Optimization methods

Restful API

BT: Application programming
interfaces Software architecture

Resumes

BT: Writing

Retail price index

USE: Economic indicators

Retardants

BT: Production materials
RT: Inhibitors
NT: Flame retardants

Retina

UF: Retinal
BT: Eyes
RT: Ophthalmology
NT: Retinal vessels

Retinal

USE: Retina

Retinal vessels

BT: Retina
RT: Diabetic retinopathy

Retinopathy

BT: Eye diseases
NT: Diabetic retinopathy



JULY 2025 IEEE Thesaurus

Retirement

BT: Human resource management

Retrieval augmented generation

UF: RAG
Retrieval-augmented generation
BT: Artificial intelligence

Retrieval-augmented generation

USE: Retrieval augmented generation

Retroreflectors

UF: Corner cube prisms
Corner-cube prisms
BT: Optical devices
RT: Road safety

Reverberation

BT: Acoustics

Reverberation chambers

BT: Electromagnetic compatibility

Reverse engineering

BT: Engineering - general
RT: Inverse design
Product development
Research and development

Reverse game theory

USE: Mechanism design

Reverse logistics

BT: Logistics

Reverse osmosis

BT: Chemical processes
RT: Desalination

Reverse teaching

USE: Education AND
Online services

Reversible computing

BT: Computational modeling
Time complexity

Reviews

BT: Writing
NT: Systematic literature review

RF

USE: Radio frequency

RF exposure

USE: Radiofrequency exposure

RF identification

USE: Radiofrequency identification

RF interference

USE: Electromagnetic interference

RF micro-electro-mechanical systems

USE: Radiofrequency microelectromechanical systems

RF microelectromechanical systems

USE: Radiofrequency microelectromechanical systems

RF safety

USE: Radiofrequency safety

RF signals

BT: Signal processing

RFIC

USE: Radiofrequency integrated circuits

RFID

USE: Radiofrequency identification

RFID tags

BT: Radiofrequency identification
NT: Active RFID tags
Chipless RFID
Passive RFID tags

Rhenium

BT: Chemical elements

Rheology

BT: Fluid dynamics
RT: Viscosity

Rhetoric

BT: Professional communication



JULY 2025 IEEE Thesaurus

Rheumatology

BT: Medical specialties
RT: Immune system
Musculoskeletal system

Rhodium

BT: Chemical elements

Rhombencephalon

USE: Hindbrain

Rhythm

BT: Music

Ribonucleic acid

USE: RNA

Ribs

BT: Thorax

Riccati equations

BT: Equations

Rician channels

UF: Rician fading
Rician fading channels
BT: MIMO

Rician fading

USE: Rician channels

Rician fading channels

USE: Rician channels

Ride hailing

UF: Didi
Ride-hailing
Uber
BT: Transportation
RT: Mobile applications
Mobility as a service
Shared transport

Ride-hailing

USE: Ride hailing

Ridesharing

USE: Shared transport

Rigidity

BT: Material properties

Ring generators

BT: Automatic testing
Testing

Ring lasers

BT: Lasers
RT: Gyroscopes
NT: Fiber lasers

Ring oscillators

BT: Oscillators
RT: Frequency control
Jitter
Klystrons
Logic gates
Masers
Phase locked loops
Resonators
Tuning
Voltage-controlled

oscillators

Ring resonators

USE: Optical ring resonators

RIS

USE: Reconfigurable intelligent surfaces

RISC

USE: Reduced instruction set computing

Risk analysis

BT: Management
RT: Accident prevention
Accidents
Decision making
Occupational health
Occupational safety
Reliability
Safety
Technology social factors
Venture capital
NT: Fault trees
Risk management
Threat assessment

Risk assessment

USE: Risk management

Risk handling

USE: Risk management

Risk management

UF: Risk assessment
Risk handling
BT: Risk analysis
RT: Contract management



JULY 2025 IEEE Thesaurus

NT:	Prevention and mitigation Risk minimization Risk mitigation	<i>Road bridges</i> USE:	Structural panels
<i>Risk minimisation</i> USE:	Risk minimization	Road safety BT:	Roads
		RT:	Automated highways Automotive engineering Lane detection Pedestrians Retroreflectors Road accidents Vehicle-to-everything Lane departure warning
Risk minimization UF:	Risk minimisation	NT:	
BT:	Risk management	systems	
RT:	Prevention and mitigation	Road side unit UF:	Roadside unit
Risk mitigation BT:	Risk management	BT:	Relays Vehicular ad hoc networks
RT:	Prevention and mitigation	Road traffic BT:	Road traffic control
Rivers BT:	Geoscience	NT:	Pedestrians
RT:	Aquatic ecosystems Excavation Floods Lakes Sediments Stormwater Water Water pollution Water resources Watersheds Wetlands	Road traffic control BT:	Road transportation Traffic control
		RT:	Automotive control Pedestrians
		NT:	Road traffic
RLC circuits UF:	Resonant circuits	Road transportation UF:	Highways
BT:	Circuits	BT:	Land transportation
devices	Tunable circuits and	RT:	Civil engineering Global Positioning System
<i>RMS</i> USE:	Root mean square	NT:	Road traffic control Roads Traffic congestion
RNA UF:	Ribonucleic acid	Road vehicles BT:	Land vehicles
BT:	Biological cells	RT:	Automotive control Road accidents Roads
RT:	Codons Nucleic acids Transcriptomics	NT:	Automobiles Motorcycles
<i>RNN</i> USE:	Recurrent neural networks	Roadmaps (technology planning) BT:	Strategic planning Technology forecasting
Road accidents BT:	Accidents	<i>ROADMS</i> USE:	Optical add-drop multiplexers
RT:	Road safety Road vehicles		



JULY 2025 IEEE Thesaurus

Roads

BT: Road transportation
RT: Civil engineering
Excavation
Road vehicles
NT: Road safety

5-DOF
6-DOF

Roadside unit

USE: Road side unit

Roaming

BT: Wireless communication
RT: Dual band
GSM

Robot assisted surgery

USE: Medical robotics

Robot automobiles

USE: Autonomous automobiles

Robot cars

USE: Autonomous automobiles

Robot control

UF: Robotic control
BT: Control systems
Robots
RT: Force control
Formation control
Motion planning
Odometry
Trajectory tracking
NT: Robot motion

Robot kinematics

BT: Robots
RT: Myoelectric control
Propioception
NT: Motion analysis

Robot learning

BT: Machine learning
Robots
RT: Artificial intelligence

Robot localization

BT: Motion analysis
RT: Robot sensing systems

Robot motion

UF: Robotic motion
BT: Robot control
NT: 2-DOF
3-DOF

Robot operating systems

USE: Operating systems

Robot programming

UF: Robotic programming
BT: Programming
Robots

Robot sensing systems

UF: Manipulator sensing
systems
Mobile robot sensing
systems
BT: Robot sensor networks
Robots
Sensor systems and
applications
RT: Multisensor systems
Robot localization
NT: Propioception
Robot vision systems
Simultaneous localization
and mapping
Stereognosis
Tactile sensors

Robot sensor networks

USE: Robot sensing systems

Robot vision systems

UF: Manipulator vision systems
Mobile robot vision systems
BT: Robot sensing systems
RT: Image sensors
Imaging
Intelligent robots
Object detection
Object recognition
Pattern recognition
Stereo vision
NT: Visual servoing

Robot-assisted surgery

USE: Medical robotics AND
Surgery

Robot-based assembly

USE: Robotic assembly

Robotic assembly

UF: Assembly robots
Robot-based assembly



JULY 2025 IEEE Thesaurus

	BT:	Assembly systems		Evolutionary robotics	
	RT:	Robotics and automation		Humanoid robots	
				Industrial robots	
Robotic control				Intelligent robots	
	USE:	Robot control		Manipulators	
				Marine robots	
Robotic motion				Medical robotics	
	USE:	Robot motion		Military robotics	
				Mobile robots	
Robotic process automation				Orbital robotics	
	USE:	Intelligent automation		Parallel robots	
				Quadrupedal robots	
Robotic programming				Rescue robots	
	USE:	Robot programming		Robot control	
				Robot kinematics	
Robotics and automation				Robot learning	
	RT:	Image motion analysis		Robot programming	
		Industrial Internet of Things		Robot sensing systems	
		Robotic assembly		Service robots	
	NT:	Animatronics		Snake robots	
		Automation		Social robots	
		Autonomous systems		Soft robotics	
		Cloud robotics		Telerobotics	
		Multi-robot systems		Visual odometry	
		Robots		Wearable robots	
Robots			Robust control		
	BT:	Robotics and automation		UF:	Active disturbance rejection
	RT:	Assembly systems	control		
		Botnet		BT:	System analysis and design
		Control equipment		RT:	Disturbance observers
		Control systems			
		Cybernetics	Robust stability		
		Industrial control		BT:	Stability
		Manufacturing automation			
		Materials handling	Robustness		
		Mechanical variables		BT:	Reliability
control				RT:	Control systems
		Mechatronics			Sensitivity
		Nonlinear systems			Stability
		Servosystems			Uncertain systems
		Underactuated surface			
vessels			Rockets		
	NT:	Agricultural robots		BT:	Propulsion
		Amphibious robots		RT:	Engines
		Androids			Ground support
		Aquatic robots			
		Automata	Rocks		
		Autonomous robots		BT:	Geology
		Bio-inspired robotics		RT:	Aquifers
		Cognitive robotics			Continental crust
		Collaborative robots			Oceanic crust
		Computer vision			Stratigraphy
		Continuum robots			Tectonics
		Educational robots		NT:	Lava



JULY 2025 IEEE Thesaurus

	Magma	Root mean square	UF: RMS
Rodents			Root mean square error
BT: Animals			Root mean square value
Roentgenium		BT: Mathematics	Statistics
BT: Chemical elements			
Role playing games		<i>Root mean square error</i>	
UF: Role-playing games		USE: Root mean square	
BT: Video games			
Role transfer		<i>Root mean square value</i>	
BT: Organizational aspects		USE: Root mean square	
<i>Role-playing games</i>			
USE: Role playing games		Rootkit	
<i>Roller bearings</i>		UF: Root kit	
USE: Rolling bearings		BT: Malware	
Rolling bearings		<i>Roots</i>	
UF: Roller bearings		USE: Poles and zeros	
Rolling contact bearings			
Rolling element bearings		Rotating machines	
BT: Mechanical bearings		BT: Electric machines	
RT: Ball bearings		RT: Brushes	
<i>Rolling contact bearings</i>			Coils
USE: Rolling bearings			DC generators
<i>Rolling element bearings</i>			Synchronous motors
USE: Rolling bearings			Windings
Rollover		NT: Generators	
BT: Vehicle dynamics		Hysteresis motors	
<i>ROM</i>		Induction machines	
USE: Read only memory		Induction motors	
<i>Roof mounted photovoltaics</i>		Micromotors	
USE: Building integrated photovoltaics		Permanent magnet	
<i>Roof mounted solar cell arrays</i>		machines	
USE: Building integrated photovoltaics		Reluctance machines	
Root cause analysis		Servomotors	
BT: Process planning		Standby generators	
RT: Failure analysis			
<i>Root kit</i>		Rotation measurement	
USE: Rootkit		UF: Rotation representation	
		BT: Mechanical variables	
		measurement	
		<i>Rotation representation</i>	
		USE: Rotation measurement	
		<i>Rotational measurement</i>	
		USE: Velocity control	
		<i>Rotational speed</i>	
		USE: Velocity control	
		Rotors	
		BT: Electric machines	
		Machine components	



JULY 2025 IEEE Thesaurus

Rough sets

BT: Set theory

Rough surfaces

BT: Surfaces
RT: Polishing machines
Surface roughness
Terrain factors
NT: Corrugated surfaces

Round robin

BT: Scheduling algorithms

Roundoff errors

BT: Finite wordlength effects
RT: Error analysis
Noise

Routing

BT: Communication systems
RT: Multicast communication
Network function

virtualization

Routing protocols
Soft switching
Virtual links
NT: Wavelength routing

Routing protocols

BT: Protocols
RT: Border Gateway Protocol
Internet
Land mobile radio
Mobile communication
Multicast protocols
Multiprotocol label

switching

Routing
Wireless access points
NT: Virtual links

RPA

USE: Remotely piloted aircraft

RPI

USE: Economic indicators

RPS

USE: Renewable Portfolio

Standard

RRAM

USE: Resistive RAM

RRI

USE: Rail to rail inputs

RRO

USE: Rail to rail outputs

RSSI

USE: Received signal strength indicator

RTL

USE: Register transfer level

Rubber

BT: Insulators
RT: Rubber industry
Rubber products

Rubber industry

BT: Manufacturing industries
RT: Chemical industry
Rubber
Rubber products

Rubber products

BT: Manufactured products
RT: Hoses
Rubber
Rubber industry
Wastewater treatment
NT: Tires

Rubidium

BT: Chemical elements

Rule based systems

USE: Knowledge based systems

Runtime

BT: Software engineering
RT: Programming
NT: Dynamic compiler
Runtime environment

Runtime environment

BT: Runtime

Runtime library

BT: Formal languages

Rural areas

BT: Geography
RT: Macrocell networks
Public infrastructure



JULY 2025 IEEE Thesaurus

Ruthenium				Explosion protection
BT:	Chemical elements			Fire safety
Rydberg atoms				Food safety
UF:	Rydberg sensors			Hazards
BT:	Electric variables			Health and safety
measurement				Marine safety
	Physics			Product safety
<i>Rydberg sensors</i>				Protection
USE:	Rydberg atoms			Public security
S Box				Radiation safety
UF:	S-Box			Safety devices
	Substitution box			Safety management
BT:	Cryptography	Safety devices		Vehicle safety
RT:	Ciphers	BT:	Safety	
<i>S parameters</i>		RT:	Accident prevention	
USE:	Scattering parameters		Alarm systems	
<i>S-Box</i>			Helmets	
USE:	S Box		Railway safety	
<i>S-parameters</i>			Smoke detectors	
USE:	Scattering parameters	NT:	Eye protection	
<i>S/N</i>			Fire extinguishers	
USE:	Signal to noise ratio		Protective clothing	
<i>SaaS</i>				
USE:	Software as a service	<i>Safety in the home</i>		
Safety		USE:	Domestic safety	
BT:	Industry applications	Safety management		
	Product safety engineering	BT:	Management	
RT:	Alarm systems		Safety	
	Control system security	RT:	Dependability management	
	Electric shock			
	Environmental factors	<i>SAGIN</i>		
	Explosions	USE:	Space-air-ground	
	Eye protection	integrated networks		
	Fires	Sagnac interferometers		
	Hazardous areas	BT:	Interferometry	
	Occupational health	<i>Sales promotion</i>		
	Preventive maintenance	USE:	Promotion - marketing	
	Protective clothing	Saliency detection		
	Radiation effects	BT:	Image processing	
	Radioactive materials	RT:	Feature detection	
	Radioactive pollution		Feature extraction	
	Risk analysis		Visual systems	
NT:	Aerospace safety	Salinity (geophysical)		
	Disasters	BT:	Soil measurements	
	Domestic safety	RT:	Geochemistry	
	Emergency services		Ocean salinity	
			Sea measurements	
			Sea surface salinity	



JULY 2025 IEEE Thesaurus

Salivary glands

UF: Parotid
BT: Glands
Stomatognathic system

Lightweight structures
Sheet materials
Structural panels
Thin wall structures

Salmonella

BT: Bacteria

Sanitary engineering

BT: Engineering - general
RT: Environmental

Salt

BT: Chlorine compounds
Minerals

management

Sewage treatment
Waste disposal
Waste management
Waste materials
Wastewater
Wastewater treatment
Water pollution

Samarium

BT: Metals
NT: Samarium alloys
Samarium compounds

Samarium alloys

UF: Samarium cobalt
BT: Samarium

SAR

USE: Specific absorption rate

AND

Synthetic aperture radar

Samarium cobalt

USE: Samarium alloys

SAR imaging

USE: Radar polarimetry

Samarium compounds

BT: Samarium

SAS

USE: Synthetic aperture sonar

Sampled data circuits

UF: Sampled-data circuits
BT: Circuits

Satellite antennas

BT: Antennas

Sampled data systems

BT: Discrete-time systems

Satellite born radar

USE: Spaceborne radar

Sampled-data circuits

USE: Sampled data circuits

Satellite borne radar

USE: Spaceborne radar

Sampling methods

BT: Statistics
RT: Signal sampling
Surveys
NT: Compressed sensing
Nonuniform sampling
Synthetic data

Satellite broadcasting

UF: DBS
Direct broadcast satellites
Satellite broadcasts
BT: Broadcasting
Satellite communications
RT: Global Positioning System

SAN

USE: Storage area networks

Satellite broadcasts

USE: Satellite broadcasting

Sandblasting

BT: Surface treatment
RT: Surface roughness

Satellite communications

UF: Communication satellites
BT: Communication systems
Radio communication
RT: Artificial satellites
Convolutional codes
Global Positioning System

Sandwich structures

BT: Structural shapes
RT: Honeycomb structures



JULY 2025 IEEE Thesaurus

Handover
Radiation hardening
(electronics)
integrated networks
Space-air-ground
Transponders
NT: Downlink
Satellite broadcasting
Satellite ground stations
Uplink

Satellite constellations

UF: Starlink
BT: Satellite navigation systems

Satellite ground stations

BT: Communication systems
Radio communication
Satellite communications
RT: Communication equipment

Satellite images

UF: Aerial photography
Earth observation images
Satellite photography
Spaceborne photography
BT: Earth Observing System

Satellite navigation systems

BT: Navigation
RT: Radio navigation
Time dissemination
NT: Global Positioning System
Global navigation satellite

system

Satellite constellations

Satellite photography

USE: Satellite images

Satellite-terrestrial integrated networks

USE: Space-air-ground
integrated networks

Satellite-terrestrial networks

USE: Space-air-ground
integrated networks

Satellites

BT: Solar system
RT: Artificial satellites
NT: GOSAT
Geostationary satellites
Moon
Small satellites

Saturation detection

USE: Feedback

Saturation magnetisation

USE: Saturation magnetization

Saturation magnetization

UF: Saturation magnetisation
BT: Magnetization processes
RT: Magnetic fields
Magnets

Saturn

BT: Planets

Savanna

USE: Grasslands

SAW

USE: Weighted sum model

SAW filters

BT: Electromechanical devices

Sawing

BT: Machining
RT: Sawing machines

Sawing machines

BT: Machine tools
RT: Sawing

SCADA systems

UF: Supervisory control and
data acquisition systems
Supervisory control and
data-acquisition systems
BT: Control systems
Power system control
Supervisory control
RT: Load monitoring
Substation automation

Scalability

BT: System analysis and design
RT: Extensibility

Scalp

BT: Head

Scandium

BT: Chemical elements

Scanning electron microscopy

UF: SEM



JULY 2025 IEEE Thesaurus

BT: Electron microscopy
RT: Electron backscatter
diffraction
Electron beam applications
Particle scattering

Scanning microwave microscopy

BT: Microscopy
RT: Atomic force microscopy

Scanning probe data storage

BT: Memory

Scanning probe microscopy

BT: Microscopy
NT: Scanning thermal
microscopy

Scanning thermal microscopy

BT: Scanning probe microscopy

Scattering

UF: Backscattering
Wave scattering
BT: Propagation
RT: Reflection
Scattering parameters
NT: Acoustic scattering
Brillouin scattering
Electromagnetic scattering
Light scattering
Particle scattering

Scattering parameters

UF: S parameters
S-parameters
BT: System analysis and design
RT: Circuits
Scattering

Scatternets

USE: Personal area networks

Scenario generation

UF: Scenario generators
BT: Stochastic processes
RT: Autonomous driving

Scenario generators

USE: Scenario generation

Scene analysis

USE: Image analysis

Scene classification

BT: Image classification

Schedules

BT: Planning
RT: Scheduling

Scheduling

BT: Organizational aspects
Production control
Project engineering
Materials requirements
RT: Scheduling

planning

Queueing analysis
Schedules
Statistics
Synchronization
NT: Adaptive scheduling
Dynamic scheduling
Job shop scheduling
Single machine scheduling

Scheduling algorithms

BT: Optical fiber communication
Processor scheduling
NT: Round robin

Schizophrenia

BT: Diseases
RT: Mental disorders

Scholarships

BT: Educational programs

Schools

USE: Educational institutions

Schottky barriers

UF: Schottky contacts
BT: Semiconductor-metal
interfaces
RT: MESFETs
Schottky diodes

Schottky contacts

USE: Schottky barriers

Schottky diode

USE: Schottky diodes

Schottky diodes

UF: Schottky diode
BT: Diodes
Semiconductor devices
Semiconductor diodes
RT: Schottky barriers



JULY 2025 IEEE Thesaurus

interfaces Semiconductor-metal

Schottky FETs
USE: MESFETs

Schottky gate FET
USE: Schottky gate field effect transistors

Schottky gate field effect transistors
UF: Schottky gate FET
BT: Field effect transistors

Schrodinger equation
BT: Quantum mechanics
RT: Electrons

Science - general
RT: Econophysics
Neurophysiology
Research and development
STEM
NT: Astronomy
Atmospheric science
Biology
Chemistry
Electricity
Environmental science
Epidemiology
Geoscience
Life sciences
Metrology
Neuroscience
Paleontology
Physics
Social sciences
Thermodynamics

science technology engineering and math
USE: STEM

Science technology engineering mathematics
USE: STEM

science, technology, engineering, and math
USE: STEM

Scientific computing
UF: Computational science
BT: Computer applications

Scientific publishing
BT: Publishing
RT: Systematic literature review

Scintillation counters
BT: Measurement
Nuclear and plasma

sciences
NT: Solid scintillation detectors

Scintillators
BT: Radiation effects
RT: Luminescence

SCM supply chains
USE: Supply chain management

Scoliosis
BT: Medical conditions
Spine

Scooters
USE: Motorcycles

SCR
USE: Thyristors

Screws
USE: Fasteners

Scrubbers
USE: Materials handling

Scrum (Software development)
BT: Agile software development
RT: Agile project management
Feedback
Project management
Software development

management

SDH
USE: Synchronous digital

hierarchy

SDHTs
USE: MODFETs

SDN
USE: Software defined

networking

SDRAM
UF: Synchronous DRAM
Synchronous dynamic
random access memory
BT: Random access memory



JULY 2025 IEEE Thesaurus

Sea animals

USE: Marine animals

Sea coast

BT: Oceans

Sea floor

UF: Seafloor
BT: Oceans
RT: Aquatic ecosystems
Sediments
NT: Bathymetry
Sea floor roughness

Sea floor roughness

BT: Sea floor

Sea ice

BT: Ice
RT: Oceans

Sea jellies

USE: Jellyfish

Sea level

BT: Oceans
RT: Ocean circulation
NT: Sea level rise

Sea level rise

BT: Sea level
RT: Global warming

Sea lions

USE: Marine animals

Sea measurements

(water) UF: Current measurement
BT: Geophysical measurements
RT: Oceans
Remote sensing
Salinity (geophysical)
Sonar measurements
Storm surge
NT: Geoacoustic inversion

Sea ports

USE: Seaports

Sea state

BT: Measurement
Ocean waves
RT: Marine navigation
Sea surface roughness

Sea surface

BT: Oceans
RT: Surface waves
Wind
NT: Sea surface roughness
Sea surface salinity

Sea surface roughness

BT: Sea surface
RT: Sea state

Sea surface salinity

BT: Sea surface
RT: Salinity (geophysical)

Sea surface temperature

UF: Ocean surface temperature
BT: Ocean temperature
RT: El Nino
El Nino-Southern

Oscillation

Sea vegetation

USE: Marine vegetation

Seafloor

USE: Sea floor

Sealants

USE: Sealing materials

Sealing materials

UF: Sealants
BT: Joining materials
RT: Seals

Seals

BT: Mechanical products
RT: Packaging
Sealing materials
Structural rings
NT: Gaskets
Hermetic seals

Seaports

UF: Sea ports
BT: Industrial facilities
Transportation
RT: Freeports
Marine transportation
Marine vehicles

Search and rescue robots

USE: Rescue robots



JULY 2025 IEEE Thesaurus

Search engines

UF: Google
BT: Information retrieval

Search methods

BT: Information retrieval
RT: Cross modal retrieval
Genetic algorithms
Gradient methods
Nearest neighbor methods
Optimization methods
Ranking (statistics)
NT: Keyword search
Metasearch
Search problems
Semantic search
Web search

Search problems

BT: Search methods
RT: Artificial bee colony

algorithm

Metaheuristics

Seat belts

USE: Belts

Seaweed

UF: Seaweeds
BT: Algae
Marine vegetation

Seaweeds

USE: Seaweed

Sebaceous glands

USE: Sebaceous glands

Sebaceous glands

UF: Sebaceous glands
BT: Glands
Skin

Second Life

BT: Social networking (online)

Secondary cells

USE: Batteries

Secondary electron emission

USE: Electron emission

Secondary generated hot electron injection

UF: Secondary generated hot-electron injection

BT: Hot carrier injection

Secondary generated hot-electron injection

USE: Secondary generated hot electron injection

Secondary ion emission

USE: Ion emission

Secure storage

BT: Material storage
RT: Security

Security

BT: Industry applications
RT: Anti-virus software
Biometric authentication
Biometrics
Bring your own device
Business continuity
Identification of persons
Information leakage
Malware
Physical unclonable

function

Protection
Public security
Secure storage
Surveillance
NT: Access control
Alarm systems
Capability-based security
Computer security
Control system security
Cryptography
Data security
Digital signatures
Food security
Hardware security
Information security
Network security
Power system security
Reconnaissance
Security management
Terrorism
Watermarking
Zero Trust

Security information and event management

UF: SIEM
BT: Security management
RT: Cyberattack
Data security
Event detection
Information security



JULY 2025 IEEE Thesaurus

Threat assessment

Security management

BT: Management
Security

RT: Hardware security

NT: Security information and
event management

Security of data

USE: Data security

Security of hardware

USE: Hardware security

Sedimentation

BT: Geological processes

RT: Erosion
Sediments

Sediments

UF: Mud

BT: Geoscience

RT: Lakes
Rivers
Sea floor
Sedimentation
Soil

Seebeck effect

USE: Thermoelectricity

Seeds (agriculture)

BT: Crops

RT: Agriculture
Botany
Ecology
Food products
Genetic engineering
Soil

NT: Pollination (plants)

Seismic measurements

UF: Seismic visualization

BT: Geophysical measurements

RT: Acoustic measurements
Seismology

Seismic retrofitting

USE: Earthquake engineering

Seismic visualization

USE: Seismic measurements

Seismic waves

BT: Waves

RT: Acoustic waves
Earthquakes
Elastodynamics
Explosions
Seismology
Shock waves

Seismology

BT: Geophysics

RT: Earthquake engineering
Earthquakes
Seismic measurements
Seismic waves
Well logging

Selective laser sintering

USE: Laser sintering

Selectively doped heterojunction transistors

USE: MODFETs

Selenium

BT: Chemical elements

Self managing systems

USE: Autonomous systems

Self organising feature maps

USE: Self-organizing feature
maps

Self organizing feature maps

USE: Self-organizing feature
maps

Self organizing maps

USE: Self-organizing feature
maps

Self organizing networks

USE: Self-organizing networks

Self replicating machines

USE: Self-replicating machines

Self service

USE: Self-service

Self supervised learning

USE: Self-supervised learning

Self testing

USE: Automatic testing



JULY 2025 IEEE Thesaurus

Self-assembly

BT: Bio-inspired materials
Nanotechnology
RT: Biological cells
Programming
Semiconductor device

manufacture

Thin films
NT: Electrostatic self-assembly

Self-aware

BT: Cognition

Self-consistent field theory

USE: Mean field theory

Self-driving automobiles

USE: Autonomous automobiles

Self-driving car

USE: Autonomous automobiles

Self-dynamic voltage scaling

USE: Dynamic voltage scaling

Self-managing systems

USE: Autonomous systems

Self-organizing feature maps

UF: Kohonen maps
SOM
Self organising feature

maps

Self organizing feature

maps

Self organizing maps
Self-organizing maps
BT: Artificial neural networks
RT: Feedforward neural

networks

Knowledge acquisition

Self-organizing maps

USE: Self-organizing feature

maps

Self-organizing networks

UF: Self organizing networks
BT: Wireless networks

Self-replicating machines

UF: Self replicating machines
BT: Nanotechnology

Self-service

UF: Self service
BT: Consumer behavior
Customer services

Self-study courses

BT: Educational programs

Self-supervised learning

UF: Self supervised learning
BT: Learning systems
RT: Large language models
Supervised learning
Unsupervised learning
NT: Contrastive learning

Self-testing

USE: Built-in self-test

Self-tuning regulators

USE: Adaptive control

SEM

USE: Scanning electron
microscopy

Semantic communication

BT: Communication systems
Information retrieval
Semantics

Semantic search

BT: Search methods
Semantics
RT: Context awareness
Natural language

processing

Ontologies
Query processing
Semantic Web

Semantic segmentation

BT: Image segmentation
RT: Deep learning
Instance segmentation

Semantic technology

BT: Information technology
Semantics
RT: Data models
Encoding
Natural language

generation

Natural language

processing



JULY 2025 IEEE Thesaurus

	Semantic Web	<i>Semiconductor charge carriers</i>
<i>Semantic triple</i>		USE: Charge carrier processes
USE:	Triples (Data structure)	<i>Semiconductor controlled rectifiers</i>
		USE: Thyristors
Semantic Web		Semiconductor counters
UF:	Web 3.0	UF: Junction detectors
BT:	Internet	BT: Semiconductor devices
RT:	Artificial intelligence	RT: Position sensitive particle
	Content management	detectors
	Data models	
	Decentralized identity	Semiconductor detectors
	Distributed computing	BT: Detectors
	Document handling	Semiconductor devices
	Knowledge management	RT: Absorption
	Linked data	Particle charging
	Markup languages	
	Ontologies	
	Open data	Semiconductor device breakdown
	Ranking (statistics)	BT: Failure analysis
	Semantic search	RT: Semiconductor device
	Semantic technology	reliability
NT:	OWL	Semiconductor device
	Resource description	testing
framework		Tolerance analysis
Semantics		Semiconductor device doping
BT:	Semiotics	UF: Semiconductor doping
RT:	Multilingual	BT: Semiconductor device
	Natural language	manufacture
processing		RT: Doping
	Professional	Semiconductor materials
communication		
	Sign language	Semiconductor device manufacture
	Translation	UF: Semiconductor
NT:	Semantic communication	manufacturing
	Semantic search	BT: Electronic equipment
	Semantic technology	manufacture
		RT: Fiducial markers
<i>Semi-duplex systems</i>		Gettering
USE:	Half-duplex system	Ion implantation
		Microassembly
<i>Semi-insulating materials</i>		Micromachining
USE:	Semiconductor materials	Nanotechnology
		Self-assembly
<i>Semi-supervised learning</i>		Semiconductor devices
USE:	Semisupervised learning	Surface cleaning
		Surface contamination
Semiconductivity		NT: Diffusion processes
BT:	Conductivity	Flip-chip devices
	Electron devices	High-k gate dielectrics
RT:	Charge carriers	Physical unclonable
		function
<i>Semiconductor alloys</i>		Semiconductor device
USE:	Semiconductor materials	doping



JULY 2025 IEEE Thesaurus

layers	Semiconductor epitaxial	RT:	Semiconductor device
	Semiconductor growth	breakdown	Semiconductor device
	Silicidation	measurement	
	Wafer bonding		
Semiconductor device measurement		Semiconductor devices	
BT:	Measurement	UF:	SIS devices
RT:	Depth measurement	(semiconductor)	Semiconductor-insulator-
	Refractive index	semiconductor devices	
	Semiconductor device	BT:	Electron devices
noise		RT:	Contacts
	Semiconductor device		Epitaxial growth
reliability			Field effect transistors
	Semiconductor device		Heterojunction bipolar
testing		transistors	
			Hot carriers
Semiconductor device modeling			Integrated circuits
UF:	Semiconductor device		Molecular beam
models		applications	
BT:	Modeling		Photoconducting devices
	Semiconductor devices		Physical unclonable
RT:	Semiconductor device	function	
noise			Proton radiation effects
			Rapid thermal annealing
<i>Semiconductor device models</i>			Semiconductor device
USE:	Semiconductor device	manufacture	
modeling		packaging	Semiconductor device
			Silicon-on-insulator
Semiconductor device noise			Varistors
BT:	Semiconductor devices	NT:	Flip-chip devices
RT:	Integrated circuit noise		Gunn devices
	Semiconductor device		Hall effect devices
measurement			Junctions
	Semiconductor device		MIS devices
modeling			MONOS devices
			P-i-n diodes
Semiconductor device packaging			Piezoresistive devices
BT:	Components, packaging,		Power semiconductor
and manufacturing technology		devices	
RT:	Integrated circuit packaging		Power semiconductor
	Semiconductor devices	switches	
			Quantum dots
Semiconductor device reliability			Quantum well lasers
BT:	Reliability		SONOS devices
RT:	Electrostatic discharge		Schottky diodes
protection			Semiconductor counters
	Semiconductor device		Semiconductor detectors
breakdown			Semiconductor device
	Semiconductor device	modeling	
measurement			Semiconductor device
		noise	
Semiconductor device testing			Semiconductor diodes
BT:	Testing		Semiconductor lasers



JULY 2025 IEEE Thesaurus

Semiconductor waveguides
Semiconductor-insulator
interfaces
Silicon devices
Superluminescent diodes
Surface emitting lasers
Thermistors
Transistors

Semiconductor diodes

BT: Semiconductor devices
RT: Diodes
Magnetic field induced

strain

NT: P-n junctions
P-i-n diodes
Schottky diodes
Semiconductor-metal

interfaces

Superluminescent diodes
Varactors

Semiconductor doping

USE: Semiconductor device
doping

Semiconductor electronics industry

USE: Electronics industry

Semiconductor epitaxial layers

UF: Silicon epitaxial layers
BT: Semiconductor device
manufacture
RT: Bipolar transistors

Semiconductor films

BT: Films
RT: Buffer layers
Dielectric thin films
Magnetic field induced
strain
Semiconductor growth
Semiconductor materials
Thick films
Thin films

Semiconductor growth

BT: Semiconductor device
manufacture
RT: Buffer layers
Crystal growth
Epitaxial layers
Semiconductor films
Semiconductor materials

Semiconductor impurities

BT: Impurities
RT: Charge carrier processes
Plasma immersion ion

implantation

Semiconductor materials

Semiconductor industry

USE: Electronics industry

Semiconductor laser arrays

BT: Semiconductor lasers

Semiconductor lasers

UF: Injection lasers
Junction lasers
Laser diodes
BT: Diodes
Lasers
Semiconductor devices
Solid lasers
RT: Molecular beam
applications
Optical transmitters
Refractive index
NT: Laser tuning
Quantum dot lasers
Quantum well lasers
Semiconductor laser arrays
Semiconductor optical
amplifiers
Surface emitting lasers

Semiconductor manufacturing

USE: Semiconductor device
manufacture

Semiconductor materials

UF: Pseudobinary
semiconductors
Semi-insulating materials
Semiconductor alloys
BT: Materials
RT: Acoustoelectric effects
Charge carriers
Conducting materials
Crystals
Excitons
High-k dielectric materials
Photoconducting materials
Radiative recombination
Semiconductor device
doping
Semiconductor films
Semiconductor growth



JULY 2025 IEEE Thesaurus

NT: Semiconductor impurities
Semiconductor thin films
Silicon compounds
Tunneling
Amorphous semiconductors
Deep level transient

spectroscopy

Elemental semiconductors
Gallium
Gallium arsenide
Germanium
II-VI semiconductor

materials

materials

III-V semiconductor

Indium gallium arsenide
Indium phosphide
Magnetic semiconductors
Organic semiconductors
Semiconductor

superlattices

Silicon
Silicon germanium
Substrates
Transition metal

dichalcogenides

Wide band gap

semiconductors

Semiconductor memory

UF: Semiconductor storage
BT: Memory
RT: Integrated circuits
NT: Integrated memory circuits

Semiconductor nanostructures

BT: Nanostructures

Semiconductor nanotubes

BT: Nanotubes

Semiconductor optical amplifiers

UF: SOA
BT: Optical amplifiers
Semiconductor lasers
RT: Optical transmitters
Quantum well lasers

Semiconductor process modeling

BT: Modeling
RT: Circuit simulation

Semiconductor quantum wells

USE: Quantum wells

Semiconductor radiation detectors

BT: Radiation detectors

Semiconductor storage

USE: Semiconductor memory

Semiconductor superlattices

BT: Semiconductor materials
Superlattices

Semiconductor thin films

BT: Thin films
RT: Epitaxial growth
Gallium
Germanium
Semiconductor materials
Silicon
Transition metal

dichalcogenides

Semiconductor waveguides

BT: Semiconductor devices

Semiconductor-insulator interfaces

BT: Semiconductor devices
RT: CMOSFETs
MIM devices
MIS devices
MOS devices
Silicon-on-insulator

Semiconductor-insulator-semiconductor devices

USE: Semiconductor devices

Semiconductor-metal interfaces

UF: Metal-semiconductor

interfaces

BT: Semiconductor diodes
RT: Magnetic field induced

strain

NT: Schottky diodes
Schottky barriers

Semiconductor integrated circuits

USE: Application specific
integrated circuits

Semidefinite programming

BT: Convex functions
RT: Array signal processing
Computational complexity

Semilunar valves

USE: Heart valves



JULY 2025 IEEE Thesaurus

Seminars

BT: Educational programs

Semiology

USE: Semiotics

Semiosis

USE: Semiotics

Semiotic studies

USE: Semiotics

Semiotics

UF: Semiology
Semiosis
Semiotic studies
BT: Communication symbols
RT: Linguistics
Natural language

processing

Phonetics
Professional

communication

NT: Pragmatics
Semantics
Syntactics

Semisupervised learning

UF: Semi-supervised learning
BT: Learning systems
RT: Artificial intelligence
Bayes methods
Large language models
Neural networks
Pattern classification
Reinforcement learning
Supervised learning
Unsupervised learning
Weak supervision

Senior citizens

USE: Older adults

Sense and avoid

USE: Collision avoidance

Sense organs

BT: Anatomy
RT: Somatosensory
NT: Ear
Eyes
Multisensory integration
Nose
Olfactory bulb
Taste buds

Visual systems

Sensitivity

BT: Measurement
RT: Circuit analysis
Control systems
Robustness
Tolerance analysis
NT: Sensitivity analysis

Sensitivity analysis

BT: Sensitivity

Sensitivity and specificity

BT: Biomedical measurement
Medical diagnosis

Sensor arrays

BT: Arrays
Sensor systems and

applications

RT: Wearable sensors
NT: Sensor fusion

Sensor fusion

BT: Sensor arrays
RT: Active perception
Kalman filters
Multimodal sensors
Wearable sensors
NT: Multisensor systems

Sensor phenomena and characterization

BT: Sensors

Sensor placement

BT: Sensors

Sensor systems

BT: Aerospace and electronic
systems

applications

RT: Navigation
Tiny machine learning
NT: Activity recognition
Gunshot detection systems

Sensor systems and applications

BT: Sensors
NT: Detectors
Electric sensing devices
Leak detection
Radiofrequency

identification



JULY 2025 IEEE Thesaurus

	Robot sensing systems		Wearable sensors
	Sensor arrays		
	Sensor systems	<i>Sensors (image)</i>	
		USE:	Image sensors
Sensorless control		Sensory aids	
BT:	Control systems	BT:	Medical services
RT:	AC machines	RT:	Assistive technologies
	DC machines		Biomedical equipment
	Drives		Orthotics
	Induction motors		Prosthetics
	Inductive power	NT:	Hearing aids
transmission			
	Motor drives		
	Motors	Sentiment analysis	
		UF:	Opinion mining
Sensors		BT:	Computational linguistics
UF:	Sun sensors		Natural language
RT:	Capacitive transducers	processing	
	Magnetostrictive devices	RT:	Anxiety disorders
	Odometry		Emotion recognition
	Wireless sensor networks		Information analysis
NT:	Acoustic sensors		
	Chemical and biological	Sentinel-1	
sensors		BT:	Earth Observing System
	Electromechanical sensors		
	Force sensors	Separation processes	
	Glucose sensors	BT:	Materials science and
	Inertial sensors	technology	
	Infrared sensors	NT:	Electrophoresis
	Integrated sensing and		Fractionation
communication			Particle separators
	Intelligent sensors	Separators	
	Intracranial pressure	USE:	Particle separators
sensors			
	Ionizing radiation sensors	Sepsis	
	Magnetic sensors	BT:	Medical conditions
	Mechanical sensors	RT:	Immune system
	Multimodal sensors		
	Nanosensors	September 11	
	Optical sensors	USE:	Terrorism
	Optoelectronic and		
photonic sensors		Sequence analysis	
	Pressure sensors	USE:	Sequences
	Quantum sensing		
	Quantum sensors	Sequences	
	Sensor phenomena and	UF:	Digital sequences
characterization			Sequence analysis
	Sensor placement	BT:	Mathematics
	Sensor systems and	RT:	Codes
applications		NT:	Binary sequences
	Soft sensors		Random sequences
	Thermal sensors	Sequencing	
	Thick film sensors	USE:	Sequential analysis
	Thin film sensors		
	Vision sensors		



JULY 2025 IEEE Thesaurus

Sequential analysis

UF: Sequencing
BT: System analysis and design
RT: DNA sequencing
NT: Zero correlation zone

Sequential circuits

UF: Sequential logic circuits
BT: Circuits

Sequential diagnosis

BT: System analysis and design

Sequential logic circuits

USE: Sequential circuits

Sequential production

USE: Flow production systems

Serious games

BT: Games
Simulation

Serverless computing

BT: Cloud computing
Resource management
Servers

Servers

BT: Client-server systems
RT: Network function

virtualization

NT: Serverless computing
Web servers

Service composability

USE: Interoperability

Service computing

BT: Information technology
RT: Business
Cloud computing
Process design
Service-oriented

architecture

Service-oriented systems

engineering

Web services
NT: Service level agreements

Service function chaining

UF: Service function chains
BT: Software defined

networking

Service function chains

USE: Service function chaining

Service level agreements

UF: SLA
BT: Contracts
Service computing
RT: Internet
Quality of service

Service oriented architecture

USE: Service-oriented
architecture

Service robots

BT: Robots
RT: Field robots
Home automation
Manipulators
Mobile robots
Wearable robots
NT: Assistive robots

Service-oriented architecture

UF: SOA
Service oriented

architecture

Service-oriented

architectures

BT: Web services
RT: Service computing
Service-oriented systems

engineering

NT: Microservice architectures

Service-oriented architectures

USE: Service-oriented
architecture

Service-oriented systems engineering

UF: SOSE
BT: Systems engineering and
theory

RT: Formal specifications
Service computing
Service-oriented

architecture

Software engineering

Servo control

USE: Servosystems

Servo-control

USE: Servosystems



JULY 2025 IEEE Thesaurus

Servomechanisms

BT: Servomotors
RT: Actuators
Manipulators

Pollution
Pollution control
Sanitary engineering
Sludge treatment
Water pollution

Servomotors

UF: Servos
BT: Motors
Rotating machines
Servosystems
NT: Servomechanisms

SF6

USE: Sulfur hexafluoride

SGIN

USE: Space-air-ground
integrated networks

Servos

USE: Servomotors

SGML

UF: Standard Generalized
Markup Language
BT: Markup languages

Servosystems

UF: Servo control
Servo-control
BT: Control equipment
RT: Actuators
Manipulators
Motion control
Motor drives
Position control
Robots
Velocity control
NT: Servomotors

Shadow mapping

UF: Projective shadowing
Shadowing
BT: Computer graphics
RT: Three-dimensional displays

Shadowing

USE: Shadow mapping

Session hijacking

UF: Cookie hijacking
Cookie side-jacking
Cookie sidejacking
TCP session hijacking
BT: Cyberattack
RT: Computer security
Privacy
TCP
Web sites

Shafts

BT: Machine components
Production
RT: Couplings
Gears
Machine tool spindles
Mechanical power

transmission

Mechanical splines
Pistons
Propellers
Torque converters
Camshafts

Set theory

BT: Algebra
Mathematics
RT: Boolean algebra
Maximum likelihood

Shape

BT: Graphics
RT: Geometry
Pattern recognition
Shape control
Shape measurement

estimation

NT: Fuzzy set theory
Fuzzy sets
Rough sets

Shape control

BT: Mechanical variables
control
RT: Shape

SEU

USE: Single event upsets

Sewage treatment

BT: Waste handling
RT: Fermentation



JULY 2025 IEEE Thesaurus

Shape measurement

BT: Measurement
RT: Shape

Shape memory alloys

BT: Alloying
RT: Actuators

Shape memory material

USE: Smart materials

Shape memory technology

USE: Smart materials

Sharding

BT: Database systems
Distributed processing

Share prices

BT: Economic indicators

Shared ledger

USE: Distributed ledger

Shared mobility

USE: Shared transport

Shared transport

UF: Bicycle sharing
Bike sharing
Car pools
Car sharing
Car-sharing
Carpools
Cycle sharing
Microtransit
Ridesharing
Shared mobility
Vanpools
BT: Sharing economy
Transportation
RT: Mobility as a service
Ride hailing
NT: Micromobility

Sharing economy

BT: Economics
NT: Shared transport

Sharks

BT: Fish

Shear testing

BT: Stress
Testing

RT: Failure analysis
Shearing

Shearing

BT: Materials processing
RT: Shear testing
Sheet metal processing

Sheet materials

BT: Materials
Structural shapes
RT: Sandwich structures
Sheet metal processing
Structural panels
Thin wall structures

Sheet metal processing

BT: Manufacturing systems
RT: Blanking
Embossing
Punching
Shearing
Sheet materials

Shewhart charts

USE: Control charts

Shift registers

BT: Registers
RT: Logic circuits
NT: Linear feedback shift

registers

Shingled magnetic recording

BT: Magnetic recording

Shipbuilding industry

UF: Boat building industry
BT: Manufacturing industries
RT: Construction industry

Ships

USE: Marine vehicles

Shock

USE: Electric shock

Shock (mechanics)

BT: Mechanical factors
NT: Thermal shock

Shock absorbers

UF: Dampers
BT: Suspensions (mechanical
systems)



JULY 2025 IEEE Thesaurus

RT:	Automotive components Damping Springs Vibration control	USE:	Side-scan sonar
Shock waves		Side-channel attacks	
BT:	Waves	UF:	Side channel attacks
RT:	Aerodynamics Seismic waves	BT:	Cryptography
<i>Shoe manufacture</i>		Side-scan sonar	
USE:	Footwear industry	UF:	Side imaging sonar Sidescan sonar
<i>Shoes</i>		BT:	Sonar
USE:	Footwear	RT:	Bathymetry
<i>Short circuit currents</i>		Sidelink	
USE:	Short-circuit currents	BT:	5G mobile communication Telecommunication traffic
Short-circuit currents		RT:	Cellular networks Device-to-device
UF:	Short circuit currents	communication	Peer-to-peer computing
BT:	Current	<i>Sidescan sonar</i>	
RT:	Molded case circuit breakers	USE:	Side-scan sonar
Shortest path problem		<i>SIEM</i>	
UF:	Shortest-path-problem	USE:	Security information and event management
BT:	Graph theory	Sieving	
RT:	Traveling salesman problems	BT:	Materials handling
<i>Shortest-path-problem</i>		RT:	Filtration
USE:	Shortest path problem	NT:	Molecular sieves
Shoulder		<i>SiGe</i>	
BT:	Extremities	USE:	Silicon germanium
NT:	Axilla	<i>Sigma delta</i>	
Shunts (electrical)		USE:	Sigma-delta modulation
BT:	Electric current control Photovoltaic effects	Sigma-delta modulation	
<i>Si</i>		UF:	Delta sigma Sigma delta
USE:	Silicon	BT:	Delta modulation
<i>SiC</i>		Sign language	
USE:	Silicon carbide	BT:	Gesture recognition
<i>Sick pay</i>		RT:	Assistive technologies Deafness Semantics Translation
USE:	Employee welfare	Signal analysis	
<i>Side channel attacks</i>		UF:	Waveform analysis
USE:	Side-channel attacks	BT:	Signal processing
<i>Side imaging sonar</i>		RT:	Autocorrelation Blind source separation



JULY 2025 IEEE Thesaurus

	Frequency-domain analysis		Phase detection
	Pattern clustering		Radar detection
	Power system faults		
	Rate distortion theory	<i>Signal estimation</i>	
	Signal resolution	USE:	Estimation
	Speech analysis		
	Total harmonic distortion	<i>Signal flow graphs</i>	
	Transient analysis	USE:	Flow graphs
	Wavelet transforms		
NT:	Discrete-event systems	Signal generators	
	Harmonic analysis	UF:	Function generators
	Parameter estimation		Waveform generators
	Signal mapping	BT:	Signal processing
	Sound recognition	NT:	Noise generators
	Spectral analysis		Pulse generation
<i>Signal classification</i>		Signal integrity	
USE:	Pattern classification	BT:	Signal processing
<i>Signal constellation</i>		Signal mapping	
USE:	Constellation diagram	BT:	Signal analysis
<i>Signal de-noising</i>		Signal processing	
USE:	Signal denoising	UF:	Vibrational signal
		processing	
<i>Signal decomposition</i>		RT:	Analog processing circuits
USE:	Signal resolution		Antennas and propagation
			Band-pass filters
Signal denoising			Bandwidth
UF:	Signal de-noising		Biomedical computing
BT:	Signal reconstruction		Bit rate
RT:	Signal resolution		Correlators
	Signal restoration		Data processing
	Signal to noise ratio		Decoding
			Deconvolution
Signal design			Digital signal processors
BT:	Signal processing		Discrete Fourier transforms
			Empirical mode
Signal detection		decomposition	
UF:	Detection (signal)		Encoding
BT:	Signal processing		Estimation
RT:	Blind source separation		Estimation theory
	Channel estimation		Feature extraction
	Correlators		Fourier series
	Decision making		Gaussian noise
	Demodulation		Independent component
	Pattern clustering	analysis	
	Receivers		Matrix decomposition
	Signal resolution		Pattern clustering
	Source separation		Prediction methods
	Time of arrival estimation		Random processes
NT:	Acoustic signal detection		Rate distortion theory
	Motion detection		Stability analysis
	Multiuser detection		Structure from motion
	Optical signal detection		Synapses



JULY 2025 IEEE Thesaurus

NT:	System-on-chip	Signal processing algorithms
	Transforms	BT: Algorithms
	Transversal filters	
	Vectors	<i>Signal quantisation</i>
	Wavelet transforms	USE: Quantization (signal)
	Acoustic signal processing	
	Adaptive signal processing	<i>Signal quantization</i>
	Amplifiers	USE: Quantization (signal)
	Array signal processing	
	Attenuators	Signal reconstruction
processing	Chirp	BT: Signal processing
	Convolution	RT: Inverse problems
	Cyclostationary process	Signal sampling
	Decorrelation	Signal to noise ratio
	Digital signal processing	NT: Signal denoising
	Dispersion	
	Distortion	Signal representation
	Error correction	BT: Modeling
	Fading channels	RT: Approximation methods
	Filters	Wavelet transforms
processing	Frequency locked loops	
	Geophysical signal	Signal resolution
	Limiting	UF: Signal decomposition
	Local field potentials	BT: Signal processing
	Modulation	RT: Array signal processing
	Multidimensional signal	Signal analysis
	Noise	Signal denoising
	Optical signal processing	Signal detection
	Optical wavelength	Spectral analysis
		NT: Diversity reception
conversion	Phase locked loops	Signal restoration
	Pulse compression	BT: Signal processing
		RT: Deconvolution
	Pulse shaping methods	Distortion
	Quantization (signal)	Signal denoising
	RF signals	Signal sampling
	Radar signal processing	BT: Signal processing
	Received signal strength	RT: Quantization (signal)
		Sampling methods
		Signal reconstruction
indicator	Recording	<i>Signal separation</i>
	Signal analysis	USE: Source separation
	Signal design	
	Signal detection	Signal synthesis
	Signal generators	BT: Signal processing
	Signal integrity	RT: Speech synthesis
	Signal reconstruction	
	Signal resolution	Signal to noise ratio
	Signal restoration	UF: S/N
	Signal sampling	SNR
methods	Signal synthesis	Signal-to-noise ratio
	Source separation	Signal-to-noise-ratio
	Spectrogram	
	Tracking loops	



JULY 2025 IEEE Thesaurus

BT:	Noise	Silicon photonics
RT:	Filters	
	Noise figure	
	RAKE receivers	
	Signal denoising	
	Signal reconstruction	
NT:	PSNR	
<i>Signal-to-noise ratio</i>		
USE:	Signal to noise ratio	
<i>Signal-to-noise-ratio</i>		
USE:	Signal to noise ratio	
<i>Signaling block systems</i>		
USE:	Block signalling	
<i>Signaling systems</i>		
USE:	Communication system	
signaling		
<i>Signalling block systems</i>		
USE:	Block signalling	
<i>Signature detection</i>		
USE:	Handwriting recognition	
<i>Signature verification</i>		
USE:	Handwriting recognition	
<i>Silica</i>		
USE:	Silicon dioxide	
Silicidation		
BT:	Semiconductor device	
manufacture		
Silicides		
BT:	Silicon compounds	
Silicon		
UF:	Si	
	Silicon materials	
	Siliconization	
BT:	Semiconductor materials	
RT:	Amorphous semiconductors	
	Elemental semiconductors	
	Epitaxial growth	
	Semiconductor thin films	
	Silicon devices	
	Silicon germanium	
	Silicon-on-insulator	
NT:	Amorphous silicon	
	Porous silicon	
	Silicon alloys	
Silicon alloys		
BT:	Silicon	
RT:	Alloying	
NT:	Germanium silicon alloys	
Silicon carbide		
UF:	SiC	
BT:	Silicon compounds	
Silicon compiler		
BT:	Computer aided	
manufacturing		
RT:	Integrated circuit	
manufacture		
Silicon compounds		
BT:	Compounds	
RT:	Semiconductor materials	
NT:	Silicides	
	Silicon carbide	
	Silicon dioxide	
	Silicon nitride	
<i>Silicon controlled rectifiers</i>		
USE:	Thyristors	
Silicon devices		
BT:	Semiconductor devices	
RT:	Doping	
	Photonics	
	Silicon	
Silicon dioxide		
UF:	Silica	
BT:	Silicon compounds	
<i>Silicon epitaxial layers</i>		
USE:	Semiconductor epitaxial	
layers		
Silicon germanium		
UF:	SiGe	
BT:	Semiconductor materials	
RT:	Germanium	
	Silicon	
	Silicon-on-insulator	
	Substrates	
	Transistors	
<i>Silicon materials</i>		
USE:	Silicon	



JULY 2025 IEEE Thesaurus

Silicon nitride

BT: Nitrogen
Silicon compounds

Silicon on insulator

USE: Silicon-on-insulator

Silicon on insulator technology

USE: Silicon-on-insulator

Silicon on sapphire

UF: Silicon-on-sapphire
BT: CMOS technology
Silicon-on-insulator
RT: Substrates

Silicon photonics

BT: Photonics
Silicon
RT: Optical fiber communication

Silicon radiation detectors

BT: Radiation detectors
RT: Ionizing radiation

Silicon-on-insulator

UF: SOI
SOS (silicon on sapphire)
Silicon on insulator
Silicon on insulator

technology

Silicon-on-insulator

technology

BT: Circuits
RT: Double-gate FETs
Integrated circuits
Interface states
Junctionless nanowire

transistors

Proton radiation effects
Semiconductor devices
Semiconductor-insulator

interfaces

Silicon
Silicon germanium
Thin film circuits

NT: Silicon on sapphire

Silicon-on-insulator technology

USE: Silicon-on-insulator

Silicon-on-sapphire

USE: Silicon on sapphire

Silicon-oxide-nitride-oxide-silicon

USE: SONOS devices

Siliconization

USE: Silicon

Silver

UF: Ag
BT: Metals

SIM card

UF: Subscriber identification
module
Subscriber identity module
BT: Integrated circuits
Mobile communication
Mobile handsets

SIMD

USE: Single instruction multiple
data

Similarity learning

BT: Supervised learning

SIMO

UF: Single input multiple output
systems
BT: Communication systems
RT: Antenna arrays
Diversity reception
Feedback
MIMO
MISO
Optical materials
Radio communication
SISO

Simple additive weighting

USE: Weighted sum model

Simple object access protocol

UF: SOAP
BT: Web services

Simulated annealing

BT: Mathematics
Optimization methods
RT: Annealing
Metaheuristics
Monte Carlo methods
Relaxation methods



JULY 2025 IEEE Thesaurus

Simulation

UF: Simulation results
 BT: Modeling
 RT: Application virtualization
 Computer aided analysis
 Computer graphics
 Emulation
 MATLAB
 Monte Carlo methods
 Numerical simulation
 Reduced order systems
 NT: Computer simulation
 Digital simulation
 Hardware-in-the-loop

simulation

Human in the loop
 Medical simulation
 Mixed reality
 Quantum simulation
 Serious games
 Systems simulation

Simulation Program with Integrated Circuit Emphasis

USE: SPICE

Simulation results

USE: Simulation

Simultaneous localization and mapping

UF: SLAM
 BT: Robot sensing systems

Simultaneous wireless information and power transfer

UF: SWIPT
 BT: Data transfer
 Power distribution
 Wireless power transfer
 RT: Internet of Things
 Low power electronics

Single atom lasers

USE: Atom lasers

Single electron devices

BT: Circuits and systems
 Electron devices
 RT: Nanoscale devices
 Nanotechnology
 Resonant tunneling devices
 NT: Single electron memory
 Single electron transistors

Single electron memory

BT: Single electron devices
 NT: Hetero-nanocrystal memory

Single electron transistors

UF: Single-electron transistors
 BT: Single electron devices

Single event latchup

BT: Proton effects
 Radiation effects

Single event transients

BT: Ionization

Single event upsets

UF: SEU
 Single-event upsets
 BT: Ionization

Single input multiple output systems

USE: SIMO

Single input single output systems

USE: SISO

Single instruction multiple data

UF: SIMD
 Single instruction, multiple

data

BT: Parallel processing

Single instruction, multiple data

USE: Single instruction multiple

data

Single machine scheduling

BT: Scheduling
 RT: Optimization methods

single photon avalanche diodes

USE: Single-photon avalanche

diodes

Single photon emission computed tomography

UF: SPECT
 BT: Computed tomography
 RT: Cancer
 Collimators
 Phantoms
 Tumors

Single-electron transistors

USE: Single electron transistors



JULY 2025 IEEE Thesaurus

Single-event upsets

USE: Single event upsets

Single-photon avalanche diodes

UF: SPAD
single photon avalanche

diodes

BT: Avalanche photodiodes

Single-wall carbon nanotubes

USE: Carbon nanotubes

Singular value decomposition

BT: Matrices

Sintering

UF: Frittage
BT: Manufacturing processes
NT: Spark Plasma sintering

siot

USE: Social Internet of Things

Siri

USE: Virtual assistants

SIS devices (semiconductor)

USE: Semiconductor devices

SIS devices (superconductor)

USE: Superconducting devices

SISO

UF: Single input single output
systems
BT: Communications
technology

RT: Wireless communication
Antenna arrays
Diversity reception
MIMO
MISO
Radio communication
SIMO
Transmitters

Six sigma

BT: Total quality management
RT: Quality assurance
Quality control

Size control

BT: Mechanical variables
control

RT: Thickness control

Size measurement

BT: Measurement
RT: Area measurement
Length measurement
Thickness measurement
Volume measurement
NT: Functional point analysis

Skeleton

BT: Musculoskeletal system
NT: Bones
Joints
Spine
Thorax

Skin

BT: Integumentary system
RT: Psoriasis
NT: Dermis
Electronic skin
Epidermis
Sebaceous glands
Skin burns
Sweat glands

Skin burns

UF: burn injuries
burn wounds
BT: Injuries
Skin

Skin cancer

BT: Cancer
NT: Basal cell carcinoma
Melanoma
Squamous cell carcinoma

Skin effect

BT: Current density
RT: Conductors
Power systems
Resistance
System analysis and design

Skin neoplasms

BT: Neoplasms

Skull

BT: Head
RT: Bones

Skymions

BT: Solitons



JULY 2025 IEEE Thesaurus

SLA	USE:	Service level agreements	NT:	Slot line components	
Slabs			<i>Slotline</i>		
	USE:			Slot lines	
Slag	BT:	Structural shapes	<i>Slotline components</i>		
	USE:			Slot line components	
	BT:	Industrial waste	Slow light		
	RT:	Fly ash			
		Waste disposal		BT:	Light sources
		Waste management		RT:	Velocity measurement
<i>SLAM</i>			<i>SLR</i>		
USE:	Simultaneous localization and mapping		USE:	Systematic literature review	
<i>SLD</i>			Sludge treatment		
USE:	Superluminescent diodes		UF:	Activated sludge process	
			BT:	Waste handling	
			RT:	Pollution control	
				Sewage treatment	
Sleep				Wastewater	
	BT:	Brain		Wastewater treatment	
	NT:	Rapid eye movement sleep			
		Sleep apnea			
Sleep apnea			Slurries		
UF:	Sleep apnoea		BT:	Waste materials	
	Snore activity		RT:	Industrial waste	
	Snore signals		Small business technology transfer		
	Snoring		BT:	Technology transfer	
	BT:	Medical conditions	<i>Small cell networks</i>		
	Sleep		USE:	Microcell networks	
<i>Sleep apnoea</i>			Small satellites		
USE:	Sleep apnea		UF:	Microsatellites	
<i>Slideways (mechanical)</i>				Miniaturized satellites	
USE:	Mechanical guides			Nanosatellites	
Sliding mode control				Smallsats	
UF:	Sliding-mode control		BT:	Satellites	
BT:	Control systems		NT:	CubeSat	
<i>Sliding-mode control</i>			<i>Smallsats</i>		
USE:	Sliding mode control		USE:	Small satellites	
Slot antennas			SMAP mission		
BT:	Antennas		UF:	Soil Moisture Active	
Slot line components			Passive mission		
	UF:	Slotline components	BT:	Soil moisture	
BT:	Slot lines		<i>Smart actuators</i>		
			USE:	Intelligent actuators	
Slot lines			Smart agriculture		
UF:	Slotline		UF:	Digital agriculture	
BT:	Planar transmission lines			Intelligent agriculture	



JULY 2025 IEEE Thesaurus

Smart farming	BT:	e-agriculture	RT:	Wireless communication		
		Agriculture		Fourth Industrial Revolution		
	RT:	Digital systems	function	Personal voice assistants		
		Information processing		Physical unclonable		
		Agribusiness		Smart healthcare		
		Anaerobic digestion		Smart manufacturing		
		Food industry		Tactile Internet		
		Food products		Virtual assistants		
		Food technology		Wearable Health Monitoring		
		Precision agriculture		Systems		
Smart assistants	USE:	Virtual assistants	NT:	Smart charging		
				Smart glasses		
				Smart lighting		
Smart automobile parking	USE:	Automated parking	Smart education	USE:	Wireless communication	
					Educational technology	
Smart buildings	BT:	Buildings	Smart elastomers	USE:	Dielectric elastomers	
Smart cameras	BT:	Cameras	Smart fabrics	USE:	Smart textiles	
		Computer vision				
Smart car parking	USE:	Automated parking	Smart factories	USE:	Smart manufacturing	
Smart cards	BT:	User interfaces	Smart farming	USE:	Smart agriculture	
		Access control				
		Data processing			Smart garments	USE:
Smart charging	BT:	Electric vehicle charging	Smart glasses	UF:	Smartglasses	
		Smart devices			BT:	Smart devices
						Wearable devices
Smart cities	BT:	Intelligent structures	Smart grids	UF:	Smart microgrids	
		Urban areas			Smart power grids	
	RT:	Buildings			BT:	Power grids
		Construction industry			RT:	Cyber-physical systems
		Cyber-physical systems				Energy Internet
Smart clothing	USE:	Smart textiles			Energy informatics	
					Microgrids	
					Power distribution networks	
Smart contracts	BT:	Contracts	NT:		Smart meters	
		Protocols			Transactive energy	
		Decentralized applications		Smart health	USE:	Smart healthcare
Smart devices	BT:	Electronic equipment				



JULY 2025 IEEE Thesaurus

Smart healthcare

UF: Smart health
Smart medical services
BT: Medical services
RT: Electronic healthcare
Internet of Medical Things
Point of care
Smart devices
NT: Wearable Health Monitoring

Systems

Smart homes

BT: Buildings
Home automation

Smart learning

USE: Educational technology

Smart lighting

BT: Lighting
Smart devices

Smart manufacturing

UF: Smart factories
BT: Manufacturing
RT: Fourth Industrial Revolution
Intelligent manufacturing

systems

Smart devices
Smart materials

Smart materials

UF: Shape memory material
Shape memory technology
BT: Materials
RT: Austenite
Azobenzene
Dielectric elastomers
Intelligent materials
Martensite
Metamaterials
Polycaprolactone
Smart manufacturing
Smart transportation
Thermomechanical

processes

NT: Biomimetic materials
Smart textiles

Smart medical services

USE: Smart healthcare

Smart meters

BT: Meter reading
RT: Automatic meter reading

Smart grids

Smart microgrids

USE: Smart grids

Smart parking

USE: Automated parking

Smart phones

UF: Smartphones
BT: Mobile handsets
RT: Bring your own device
Fintech

Smart pixels

BT: Image processing
RT: Integrated optoelectronics
Optical switches

Smart power grids

USE: Smart grids

Smart sensors

USE: Intelligent sensors

Smart spaces

BT: Ergonomics
Sociotechnical systems

Smart structures

USE: Intelligent structures

Smart systems

BT: Systems support

Smart textiles

UF: Electronic textiles
Smart clothing
Smart fabrics
Smart garments
BT: Smart materials
RT: Wearable devices
NT: Textile antennas

Smart transportation

BT: Transportation
RT: Automated highways
Automated parking
Intelligent transportation

systems

Intelligent vehicles
Smart materials



JULY 2025 IEEE Thesaurus

Smart TV

BT: TV
RT: Internet

Smartglasses

USE: Smart glasses

Smartphones

USE: Smart phones

Smartwatch

USE: Wearable Health Monitoring

Systems

Smelting

BT: Materials processing
RT: Blast furnaces
Heat treatment
Melt processing
Metals industry
Refining

SMES

USE: Superconducting magnetic energy storage

Smoke alarms

USE: Smoke detectors

Smoke detectors

UF: Smoke alarms
BT: Alarm systems
RT: Domestic safety
Fires
Ionization chambers
Safety devices
Zigbee

Smooth methods

USE: Smoothing methods

Smoothed particle hydrodynamics

USE: Fluid flow AND
Hydrodynamics

Smoothing methods

UF: Smooth methods
BT: Mathematics

SMOS mission

UF: Soil moisture and ocean salinity

Soil moisture and ocean

salinity mission

BT: Ocean salinity

Soil moisture

SMPS

USE: Switched mode power supplies

SMPTE

UF: Society of Motion Picture and Television Engineers
BT: Standards organizations

SMPTE Standards

BT: Standards publications

Sn

USE: Tin

Snake bots

USE: Snake robots

Snake robots

UF: Snake bots
Snakebots
BT: Robots

Snakebots

USE: Snake robots

Snore activity

USE: Sleep apnea

Snore signals

USE: Sleep apnea

Snoring

USE: Sleep apnea

Snow

BT: Precipitation
RT: Glaciers
Ice

SNR

USE: Signal to noise ratio

SNS devices

USE: Superconducting devices

Snubbers

BT: Power electronics

SOA

USE: Semiconductor optical amplifiers AND



JULY 2025 IEEE Thesaurus

architecture		Service-oriented			Social intelligence
					Technology planning
SOAP				NT:	Demography
	USE:	Simple object access			Developing countries
protocol					Livelihood
					Social manufacturing
SOC					Socioeconomics
	USE:	System-on-chip			Technology social factors
Soccer				Social groups	
				BT:	Sociology
	USE:	Sports		NT:	Millennials
					Older adults
Social computing					
	BT:	Federated learning		Social implications of technology	
		Internet		UF:	Orange technology
	RT:	Behavioral sciences		RT:	Cyberbullying
		Community networks			Cyberethics
		Crowdsourcing			Digital divide
		Social computing			Social robots
		Social networking (online)			Socioeconomics
	NT:	Cyberbullying			Technology acceptance
		Persuasive systems			
		Social Internet of Things	model		
		Social intelligence		NT:	Cultural aspects
					Cultural differences
Social dynamics					Environmental factors
	BT:	Sociology			Ethical aspects
	NT:	Opinion dynamics			Ethics
					Globalization
Social economics					International relations
	USE:	Socioeconomics			Peace technology
					Philosophical
				considerations	
Social engineering (security)					Social factors
	BT:	Information security			Sustainable development
	RT:	Human factors			Technology
		Psychology			
		Social factors		Social intelligence	
				BT:	Behavioral sciences
Social factors					Social computing
	BT:	Social implications of			Sociology
technology				RT:	Cultural differences
	RT:	Bio-inspired computing			Digital intelligence
		Digital divide			Social factors
		Digital humans			
		Food security		Social Internet of Things	
		Governmental factors		UF:	SocialNet of Things
		Inclusive language			siot
		International collaboration		BT:	Internet of Things
		International relations			Social computing
		Philosophical		RT:	Behavioral sciences
considerations					Collaboration
		Social Internet of Things			Social factors
(security)		Social engineering			Social networking (online)



JULY 2025 IEEE Thesaurus

Social manufacturing

BT: Manufacturing processes
Social factors
RT: Product development
Production management

Social media

USE: Social networking (online)

Social network theory

BT: Sociotechnical systems
RT: Complex networks
Social networking (online)

Social networking

USE: Social networking (online)

Social networking (online)

UF: Facebook
Linkedin
Myspace
Online social networks
Reddit
Social media
Social networking
Social networking services
Social networks
Social-networks
TikTok
Twitter
WeChat
BT: Information retrieval
RT: Blogs
Crowdsourcing
Electronic mail
Internet
Journalism
Social Internet of Things
Social computing
Social network theory
Web sites
NT: Community networks
Computer mediated
communication
Cyberbullying
Information diffusion
Second Life

Social networking services

USE: Social networking (online)

Social networks

USE: Social networking (online)

Social robots

BT: Human-robot interaction
Robots
RT: Assistive robots
Assistive technologies
Educational robots
Emotion recognition
Humanoid robots
Mobile robots
Natural language

processing

technology

Social implications of

Social sciences

BT: Humanities
Science - general
RT: Complex networks
Graph drawing
Network theory (graphs)
NT: Anthropology
Behavioral sciences
Psychology
Sociology

Social-networks

USE: Social networking (online)

SocialNet of Things

USE: Social Internet of Things

Society of Motion Picture and Television Engineers

USE: SMPTE

Socio-economics

USE: Socioeconomics

Socio-technical systems

USE: Sociotechnical systems

Socioeconomics

UF: Social economics
Socio-economics
BT: Economics
Social factors
RT: Human factors
Social implications of

technology

Sociotechnical systems

Sociology

BT: Social sciences
RT: Collective intelligence
NT: Crowd dynamics



JULY 2025 IEEE Thesaurus

	Digital divide		<i>Soft sensing</i>	
	Social dynamics		USE:	Soft sensors
	Social groups			
	Social intelligence		Soft sensors	
			UF:	Data sources
Sociotechnical systems				Soft sensing
UF:	Socio-technical systems			Software sensors
BT:	Organizations			Virtual sensing
RT:	Data mesh			Virtual sensors
	Socioeconomics	BT:		Sensors
NT:	Smart spaces			Software
	Social network theory	RT:		Fuzzy systems
				Intelligent sensors
Sockets				Kalman filters
BT:	Connectors			Learning (artificial
			intelligence)	
Sodium				Neural networks
BT:	Chemical elements			Process control
				Process monitoring
<i>Sodium chloride</i>			<i>Soft switch</i>	
USE:	Chlorine compounds		USE:	Soft switching
<i>Sodium nitrate</i>				
USE:	Nitrogen compounds		Soft switching	
			UF:	Soft switch
Soft electronics				Softswitch
BT:	Electronic equipment		BT:	Telecommunication
RT:	Flexible electronics		computing	
	Inorganic materials		RT:	Routing
	Wearable devices			
Soft lithography			Softening	
UF:	Microcontact printing		UF:	Softening (metallurgical)
	Replica molding		BT:	Materials processing
	Replica moulding		RT:	Annealing
BT:	Lithography		<i>Softening (metallurgical)</i>	
RT:	Nanolithography		USE:	Softening
	Nanopatterning			
Soft magnetic materials			<i>Softswitch</i>	
BT:	Magnetic materials		USE:	Soft switching
Soft robotics			Software	
UF:	Soft robots		UF:	Computer software
BT:	Robots			On-demand software
RT:	Assistive robots		BT:	Computers and information
	Biomimetics		processing	
	Flexible structures		RT:	Algorithms
	Grippers			Computer languages
	Medical robotics			Computer science
	Mobile robots			Courseware
	Wearable robots			Documentation
			planning	Enterprise resource
<i>Soft robots</i>				Firewalls (computing)
USE:	Soft robotics			Geospatial analysis



JULY 2025 IEEE Thesaurus

	Microprogramming		Microarchitecture
	Programming		Representational state
	Software engineering	transfer	
	Software protection		Restful API
	Software standards		
NT:	Anti-virus software	Software as a service	
	Application software	UF:	On demand software
	Closed box		On-demand software
	Embedded software		SaaS
	Freeware		Software-as-a-service
	Glass box	BT:	Software
	Malware	RT:	Cloud computing
	Middleware		Information processing
	Open source software		
	Optical character	<i>Software assurance</i>	
recognition		USE:	Software reliability
	Privacy-invasive software		
	Public domain software	Software debugging	
	Soft sensors	BT:	Software
	Software agents	RT:	Programming
	Software as a service		Programming environments
	Software debugging	NT:	Software design
	Software maintenance		
	Software packages	Software defined networking	
	Software performance	UF:	SDN
	Software quality		Software defined networks
	Software reusability		Software-defined
	Software safety	networking	
	Software systems	BT:	Computer networks
	Software tools	RT:	Application programming
	System software	interfaces	
Software agents			Cloud computing
BT:	Software		Computer network
RT:	Artificial intelligence	management	
	Computer applications		Distributed processing
	Distributed computing		Intelligent networks
	Intelligent systems		Mobile computing
	Knowledge based systems	virtualization	Network function
	Learning systems		Network operating systems
	Mobile agents		Operating systems
NT:	Agent-based modeling		Protocols
	Autonomous agents		Virtual machining
	Botnet		Virtualization
	Intelligent agents	NT:	Service function chaining
			Virtual LAN
Software algorithms		<i>Software defined networks</i>	
BT:	Algorithms	USE:	Software defined
Software architecture		networking	
BT:	Software engineering	<i>Software defined radio</i>	
RT:	Distributed computing	USE:	Software radio
NT:	Client-server systems		
	Deep architecture		
	Dew computing		



JULY 2025 IEEE Thesaurus

Software design

BT: Software debugging
RT: Web design
NT: Model driven engineering
Usability

Python
Software reusability

Software development management

UF: Github
BT: Engineering management
RT: Release engineering
Scrum (Software

development)

Software product lines
NT: Agile project management
Agile software development
Continuous integration
DevOps
Model-driven development

Software documentation

USE: Documentation

Software engineering

BT: Computers and information

processing

RT: Code refactoring
Functional point analysis
Rapid prototyping
Requirements engineering
Service-oriented systems

engineering

Software
Static analysis
Systems Modeling

Language

Visual BASIC
NT: Capability maturity model
Computer aided software

engineering

Formal verification
Full stack
Programming environments
Release engineering
Runtime
Software architecture
Software libraries
Software product lines

Software libraries

BT: Libraries
Software engineering
RT: Algorithms
MATLAB
Object oriented

programming

Software maintenance

BT: Software
RT: Software product lines

Software measurement

BT: Measurement

Software packages

BT: Software
RT: Computer applications
Power system analysis

computing

NT: EMTDC
PSCAD
SPICE

Software performance

BT: Software
RT: Algorithmic efficiency
Capability maturity model

Software piracy

USE: Computer crime

Software product lines

BT: Product development
Software engineering
RT: Software development

management

Software maintenance

Software protection

BT: Copyright protection
Legal factors
RT: Digital rights management
Intellectual property
Software

Software prototyping

BT: System analysis and design

Software quality

BT: Software
RT: Algorithmic efficiency

Software radio

UF: Reconfigurable radio
Software defined radio
Software-defined radio
BT: Mobile communication
Radio communication
RT: Cellular radio



JULY 2025 IEEE Thesaurus

computing	Code division multiplexing	Programming environments
	Land mobile radio	Visual BASIC
	Telecommunication	NT: Authoring systems
	Transceivers	<i>Software-as-a-service</i>
		USE: Software as a service
Software reliability		<i>Software-defined networking</i>
UF: Software assurance		USE: Software defined
BT: Reliability		networking
Software reusability		<i>Software-defined radio</i>
UF: Software reuse		USE: Software radio
BT: Software		
RT: Capability maturity model		
	Object oriented	
programming		<i>SOI</i>
	Software libraries	USE: Silicon-on-insulator
		Soil
<i>Software reuse</i>		BT: Geoscience
USE: Software reusability		RT: Earth
		Excavation
Software reviews		Sediments
BT: IEEE indexing		Seeds (agriculture)
		Soil measurements
Software safety		Soil pollution
BT: Software		NT: Peat
RT: Product safety engineering		Permafrost
		Soil moisture
<i>Software sensors</i>		Soil properties
USE: Soft sensors		Soil remediation
		Soil texture
<i>Software stack</i>		
USE: Full stack		Soil measurements
		BT: Measurement
Software standards		RT: Geophysical measurements
BT: Standards categories		Moisture measurement
RT: ISO		Remote sensing
ISO Standards		Soil
Software		NT: Salinity (geophysical)
Software systems		Soil moisture
BT: Software		BT: Soil
		NT: SMAP mission
		SMOS mission
Software testing		
BT: Testing		<i>Soil Moisture Active Passive mission</i>
RT: Closed box		USE: SMAP mission
Glass box		
NT: Combinatorial testing		<i>Soil moisture and ocean salinity</i>
Fuzzing		USE: SMOS mission
Software tools		<i>Soil moisture and ocean salinity mission</i>
BT: Software		USE: SMOS mission
RT: Computer aided software		
engineering		
	Programming	



JULY 2025 IEEE Thesaurus

Soil pollution

BT: Land pollution
RT: Agriculture
Pesticides
Soil

Soil properties

BT: Soil

Soil remediation

BT: Pollution control
Soil
RT: Anaerobic digestion
Contamination
Environmental monitoring
Hazards

Soil texture

BT: Soil

Solar cells

USE: Photovoltaic cells

Solar cooling

BT: Cooling

Solar eclipses

BT: Sun

Solar energy

BT: Energy resources
RT: Maximum power point

trackers

Solar heating
Solar power generation
Solar radiation
NT: Solar geoengineering
Solar irradiance

Solar farms

BT: Solar power generation
RT: Solar panels

Solar generation

USE: Solar power generation

Solar geoengineering

UF: Solar radiation modification
BT: Geoengineering
Solar energy

Solar heating

BT: Energy conversion
Heating systems
RT: Phase change materials

Solar energy
Space heating

Solar irradiance

BT: Solar energy
RT: Solar radiation

Solar modules

USE: Solar panels

Solar panels

UF: Photovoltaic modules
Solar modules
BT: Photovoltaic systems
Solar power generation
RT: Building materials
Building services
Microinverters
Photovoltaic cells
Renewable energy sources
Solar farms
Solar tracking
NT: Backsheets

Solar polarimetry

USE: Polarimetry

Solar power generation

UF: Solar generation
BT: Power generation
RT: Building integrated

photovoltaics

Microinverters
Renewable Portfolio

Standard

Solar energy
Solar powered vehicles
NT: Maximum power point

trackers

Photovoltaic systems
Solar farms
Solar panels

Solar powered vehicles

BT: Electric vehicles
RT: Battery powered vehicles
Energy storage
Solar power generation
Traction motors
Vehicle-to-grid

Solar radiation

BT: Extraterrestrial phenomena
RT: Solar energy
Solar irradiance



JULY 2025 IEEE Thesaurus

Space radiation

Solar radiation modification
USE: Solar geoengineering

Solar system

BT: Astronomy
NT: Kuiper belt
Planets
Satellites
Sun

Solar trackers

USE: Solar tracking

Solar tracking

UF: Solar trackers
Sun trackers
Sun tracking
BT: Tracking
RT: Solar panels

Solder joints

USE: Soldering

Soldering

UF: Solder joints
BT: Assembly
Fabrication
Joining processes
RT: Bonding processes
Manufacturing
Materials processing
Soldering equipment
NT: Brazing
Flip chip solder joints
Reflow soldering

Soldering equipment

UF: Soldering irons
BT: Production equipment
RT: Joining materials
Joining processes
Soldering

Soldering irons

USE: Soldering equipment

Solderless breadboard

USE: Breadboard

Solenoids

BT: Magnetic devices
RT: Switches
Transducers

Solid insulation

UF: Solid insulators
BT: Insulation

Solid insulators

USE: Solid insulation

Solid lasers

UF: Color center lasers
Solid state lasers
Solid-state lasers
BT: Lasers
RT: Thermal lensing
Thermooptical devices
NT: Microchip lasers
Quantum well lasers
Semiconductor lasers
Surface emitting lasers

Solid modeling

BT: Modeling
RT: Digital twins
Solid-state physics
Virtual reality

Solid oxide electrolyzer cells

USE: Fuel cells

Solid scintillation detectors

BT: Scintillation counters
RT: Energy resolution
Medical diagnostic imaging
Spectroscopy

Solid state batteries

UF: Solid-state batteries
BT: Batteries

Solid state circuit design

UF: Solid-state circuit design
BT: Solid state circuits
RT: Circuit synthesis

Solid state circuits

UF: Solid-state circuits
RT: Circuits and systems
Solid state drives
NT: Circuit subsystems
Circuit theory
FET circuits
Gate leakage
Solid state circuit design
Transistors



JULY 2025 IEEE Thesaurus

Solid state drives

UF: Solid-state drives
BT: Digital storage
RT: DRAM chips
Flash memories
Integrated memory circuits
Solid state circuits

Solid state lasers

USE: Solid lasers

Solid state lighting

UF: Solid-state lighting
BT: Lighting

Solid waste

USE: Waste materials

Solid-state batteries

USE: Solid state batteries

Solid-state circuit design

USE: Solid state circuit design

Solid-state circuits

USE: Solid state circuits

Solid-state drives

USE: Solid state drives

Solid-state lasers

USE: Solid lasers

Solid-state lighting

USE: Solid state lighting

Solid-state physics

BT: Physics
RT: Materials science and
technology
Quantum mechanics
Solid modeling

Solids

BT: Materials
RT: Crystals
Materials science and
technology
NT: Young's modulus

Solitons

BT: Waves
NT: Optical solitons
Skyrmions

Solution design

BT: Systems engineering and
theory

Solution stack

USE: Full stack

Solvation

BT: Chemical reactions
RT: Hydrolysis

Solvents

BT: Chemical processes
RT: Methanol

SOM

USE: Self-organizing feature
maps

Soma

UF: Somata
BT: Neurons
RT: Brain

Somata

USE: Soma

Somatosensory

BT: Physiology
RT: Multisensory integration
Sense organs

Sonar

BT: Aerospace and electronic
systems
RT: Acoustic arrays
Chirp modulation
Ultrasonic transducers
NT: Side-scan sonar
Sonar applications
Sonar equipment
Synthetic aperture sonar

Sonar applications

BT: Sonar
RT: Sonar navigation
NT: Sonar detection
Sonar measurements

Sonar detection

BT: Acoustic signal detection
Sonar applications
RT: Echo sounders
Hydrophones
Reflectivity



JULY 2025 IEEE Thesaurus

Sonar equipment

BT: Sonar
NT: Echo sounders

Sonar measurements

BT: Sonar applications
RT: Remote sensing
Sea measurements

Sonar navigation

BT: Navigation
RT: Sonar applications

SONET

UF: Synchronous optical
network
BT: Communication standards
Digital communication
ETSI Standards
Optical fiber communication
RT: Asynchronous transfer
mode
Synchronous digital
hierarchy
Transport protocols

Sonification

BT: Audio systems
Information processing

Sonogram

BT: Ultrasonography
RT: Spectrogram

SONOS devices

UF: Silicon-oxide-nitride-oxide-
silicon
BT: Semiconductor devices

Sorting

BT: Data handling
RT: Merging

SOS (*silicon on sapphire*)

USE: Silicon-on-insulator

SOSE

USE: Service-oriented systems
engineering

Sound recognition

BT: Pattern recognition
Signal analysis

Sound systems

USE: Audio systems

Source address validation

BT: Computer network
management
RT: Media Access Control

Source coding

BT: Data compression
Encoding
Information theory
RT: Rate distortion theory
Release engineering

Source location

USE: Position measurement

Source separation

UF: Signal separation
BT: Signal processing
RT: Adaptive signal detection
Array signal processing
Signal detection
NT: Blind source separation

Source signal equalizers

USE: Blind equalizers

South America

BT: Continents

South Pole

BT: Antarctica

Southern Ocean

USE: Antarctic Ocean

Space based radar

USE: Spaceborne radar

Space born radar

USE: Spaceborne radar

Space charge

BT: Charge carrier processes
Electrostatic processes
RT: Pulsed electroacoustic
methods
Vacuum technology

Space communications

BT: Telecommunications
NT: Deep-space
communications



JULY 2025 IEEE Thesaurus

Space cooling

BT: Cooling
RT: Buildings
Coolants
Refrigerants

BT: Space exploration
RT: Interplanetary exploration
NASA

Space phenomena

USE: Extraterrestrial phenomena

Space debris

UF: Orbital debris
Space junk
Space waste
BT: Space technology
RT: Meteorites
Meteoroids

Space power stations

UF: Power stations (space)
BT: Space stations
RT: Power generation

Space diversity

USE: Spatial diversity

Space radiation

BT: Radiation effects
RT: Ionization
Solar radiation

Space division multiplexing

UF: Space-division multiplexing
Spatial division multiplexing
Spatial multiplexing
BT: Multiplexing

Space shuttles

BT: Space vehicles
RT: Aerospace safety

Space exploration

UF: Space travel
BT: Space technology
RT: NASA
NT: Interplanetary exploration
Space missions

Space stations

BT: Artificial satellites
NT: International Space Station
Space power stations

Space habitats

USE: Buildings AND
Space technology

Space technology

UF: Space habitats
BT: Aerospace engineering
RT: Artificial satellites
Extraterrestrial phenomena
Field programmable analog

Space heating

BT: Heating systems
RT: Building services
District heating
Gas appliances
Solar heating
Temperature control
Vents

arrays

NASA
Space vehicles
NT: Payloads
Space debris
Space exploration

Space junk

USE: Space debris

Space travel

USE: Space exploration

Space mapping

BT: Design optimization
Modeling

Space vector pulse width modulation

UF: SVPWM
BT: Pulse width modulation
RT: AC motors
Converters
DC motors

Space measurements

USE: Extraterrestrial

Space vehicle electronics

USE: Aerospace electronics

measurements

Space vehicle instrumentation

USE: Aerospace electronics

Space missions



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Created by The Institute of Electrical and Electronics Engineers (IEEE) for the benefit of humanity.

JULY 2025 IEEE Thesaurus

Space vehicle navigation

USE: Space vehicles

Space vehicles

UF: Planetary landers
Space vehicle navigation
BT: Vehicles
RT: Aerospace accidents
Aerospace control
Aerospace electronics
Aerospace materials
Aerospace safety
Artificial satellites
Ground support
Hypersonic vehicles
Proton effects
Space technology
NT: Space shuttles

Space waste

USE: Space debris

Space-air-ground integrated networks

UF: SAGIN
SGIN
Satellite-terrestrial
integrated networks
Satellite-terrestrial networks
Space-ground
communications
BT: Intserv networks
RT: 6G mobile communication
Satellite communications
Terrestrial communications

Space-division multiplexing

USE: Space division multiplexing

Space-ground communications

USE: Space-air-ground
integrated networks

Space-time codes

BT: Codes
RT: Channel coding
Decoding

Spaceborn radar

USE: Spaceborne radar

Spaceborne photography

USE: Satellite images

Spaceborne radar

UF: Satellite born radar

Satellite borne radar

Space based radar
Space born radar
Spaceborn radar
BT: Radar
RT: Radar remote sensing
Synthetic aperture radar

Spacecraft materials

USE: Aerospace materials

Spacial indices

USE: Spatial indexes

SPAD

diodes
USE: Single-photon avalanche

Spam

USE: Unsolicited e-mail

Spamming

USE: Unsolicited e-mail

Spark gaps

BT: Electromagnetic analysis
RT: Air gaps
Electrodes
Insulation
Sparks
Switches

Spark Plasma sintering

UF: Field assisted sintering
Plasma pressure

compaction

Pulsed electric current

sintering

BT: Plasma materials

processing

RT: Sintering
Powders

Sparks

BT: Electric breakdown
RT: Spark gaps

Sparse approximation

UF: Sparse representation
BT: Linear systems

Sparse matrices

UF: Sparse matrix
BT: Numerical analysis



JULY 2025 IEEE Thesaurus

Sparse matrix

USE: Sparse matrices

Sparse representation

USE: Sparse approximation

Spasticity

BT: Medical conditions
RT: Brain injuries
Cerebral palsy
Multiple sclerosis
Muscles
Spinal cord injury
Stroke (medical condition)

Spatial audio

UF: Surround sound
BT: Audio systems
RT: Ambisonics

Spatial augmented reality

BT: Augmented reality

Spatial coherence

BT: Image processing

Spatial computing

BT: Human computer interaction
RT: Augmented reality
Interactive systems
Mixed reality
Virtual reality

Spatial databases

BT: Databases

Spatial diversity

UF: Antenna diversity
Space diversity
BT: Communication systems
Wireless communication
RT: Antennas
Quality of service
Receiving antennas

Spatial division multiplexing

USE: Space division multiplexing

Spatial filters

BT: Filters

Spatial indexes

UF: Spatial indices
BT: Indexes

Spatial multiplexing

USE: Space division multiplexing

Spatial resolution

BT: Image resolution
RT: Contrast resolution
Image quality

Spatial temporal resolution

UF: Spatial-temporal resolution
Spatio temporal resolution
BT: Spatiotemporal phenomena

Spatial-temporal resolution

USE: Spatial temporal resolution

Spatio temporal resolution

USE: Spatial temporal resolution

Spatio-temporal phenomena

USE: Spatiotemporal phenomena

Spatiotemporal phenomena

UF: Spatio-temporal
phenomena
BT: Chaos
RT: Nonlinear dynamical
systems
Pattern formation
Pattern matching
Pattern recognition
NT: Spatial temporal resolution

Speaker recognition

BT: Identification of persons
RT: Biometrics
Speech
Speech recognition
Viterbi algorithm

Special issues

USE: Special issues and sections

Special issues and sections

UF: Special issues
Special sections
BT: IEEE indexing

Special sections

USE: Special issues and sections

Specific absorption rate

UF: SAR
BT: Electromagnetic interference



JULY 2025 IEEE Thesaurus

Specification languages

BT: Computer languages
NT: Domain specific languages
Unified modeling language

Speckle

BT: Optical noise
RT: Optical interferometry
Optical scattering

SPECT

USE: Single photon emission
computed tomography

Spectral analysis

UF: Power spectra
Spectral domain
Spectral-domain
Spectrum analysis
Spectrum estimation
BT: Signal analysis
RT: Direction-of-arrival
estimation
Estimation
Frequency estimation
Harmonic analysis
Parameter estimation
Prediction methods
Signal resolution
Spectroscopy
Speech analysis
Time series analysis
Transforms
NT: Infrared spectra
Judd-Ofelt theory
Spectroradiometers

Spectral domain

USE: Spectral analysis

Spectral efficiency

UF: Bandwidth efficiency
BT: Channel allocation
Measurement
RT: Bandwidth
Information processing

Spectral shape

BT: Acoustics

Spectral waterfall

USE: Spectrogram

Spectral-domain

USE: Spectral analysis

Spectrogram

UF: Spectral waterfall
Voice print
Voicegram
Voiceprint
BT: Signal processing
RT: Sonogram

Spectrometry

USE: Spectroscopy

Spectroradiometers

BT: Radiometers
Spectral analysis
NT: MODIS

Spectroscopy

UF: Spectrometry
BT: Measurement
RT: Atomic measurements
Bandwidth
Fourier series
Infrared spectra
Nuclear measurements
Radiation detectors
Solid scintillation detectors
Spectral analysis
Thermoreflectance imaging
NT: Deep level transient
spectroscopy
Diffuse reflectance
spectroscopy
Electrochemical impedance
spectroscopy
Electron paramagnetic
resonance
Fourier transform infrared
spectroscopy
Functional near-infrared
spectroscopy
Kirchhoff's Law
MERIS
Mass spectroscopy
Neutron spin echo
Optical emission
spectroscopy
Photoacoustic effects
Resonance light scattering

Spectrum analysis

USE: Spectral analysis

Spectrum estimation

USE: Spectral analysis



JULY 2025 IEEE Thesaurus

Spectrum management

USE: Radio spectrum management

Speech

BT: Oral communication
RT: Aphasia
Speaker recognition
NT: Hate speech

Speech activity detection

USE: Voice activity detection

Speech analysis

BT: Speech recognition
RT: Cepstral analysis
Frequency estimation
Signal analysis
Spectral analysis
Speech coding
Speech synthesis

Speech codecs

BT: Codecs
Communication equipment
RT: Decoding
Speech coding
Vocoders

Speech coding

BT: Encoding
Information theory
RT: Audio coding
Rate distortion theory
Speech analysis
Speech codecs
Vector quantization
Vocoders
Voice activity detection

Speech communication

USE: Oral communication

Speech detection

USE: Voice activity detection

Speech enhancement

BT: Speech processing
RT: Hearing aids
Speech recognition

Speech processing

BT: Acoustic signal processing
RT: Delay estimation
Phonetics

Prediction methods

NT: Human voice
Speech enhancement
Speech synthesis
Voice activity detection

Speech recognition

UF: Voice recognition
BT: Identification of persons
Pattern recognition
RT: Cepstral analysis
Emotion recognition
Feature extraction
Speaker recognition
Speech enhancement
Text to speech
Voice activity detection
NT: Automatic speech

recognition

Personal voice assistants
Speech analysis
Speech to text

Speech synthesis

UF: Synthetic speech
Voice response systems
BT: Speech processing
RT: Biomedical equipment
Natural language

generation

Personal voice assistants
Signal synthesis
Speech analysis
Voice activity detection
NT: Chatbots
Text to speech

Speech to text

UF: Computer speech recognition
BT: Speech-to-text
RT: Speech recognition
Automatic speech recognition
Text to speech

Speech-to-text

USE: Speech to text

Speechmaking

USE: Public speaking

Speed control

USE: Velocity control



JULY 2025 IEEE Thesaurus

Speed measurement

USE: Velocity measurement

SPICE

UF: Simulation Program with
Integrated Circuit Emphasis

pSPICE
BT: Software packages
RT: Circuit analysis
Design automation
Integrated circuits

Spiking neural networks

BT: Artificial neural networks

Spin electronics

USE: Spintronics

Spin injection

USE: Spin polarized transport

Spin polarised transport

USE: Spin polarized transport

Spin polarized transport

UF: Spin injection
Spin polarised transport
BT: Magnetoelectronics
RT: Magnetic tunneling
Magnetoresistance

Spin qubits

BT: Qubit

Spin systems

BT: Magnetics

Spin valves

BT: Magnetic sensors
RT: Hysteresis

Spin-dependent tunneling

USE: Magnetic tunneling

Spin-dependent tunnelling

USE: Magnetic tunneling

Spinal cord

BT: Nervous system
NT: Cerebrospinal fluid
Spinal cord injury

Spinal cord injuries

USE: Spinal cord injury

Spinal cord injury

UF: Spinal cord injuries
BT: Spinal cord
RT: Neurological diseases
Spasticity

Spinal cord stimulation

USE: Electrical stimulation

Spindle bearings

USE: Machine tool spindles

Spine

BT: Nervous system
Skeleton
RT: Degenerative disc disease
NT: Scoliosis

Spinelectronics

USE: Spintronics

Spinning

BT: Textile technology
RT: Spinning machines
Textile fibers

Spinning machines

BT: Textile machinery
RT: Paper making
Paper making machines
Paper mills
Pulp and paper industry
Spinning
Textile industry
Textiles

Spintronics

UF: Fluxtronics
Spin electronics
Spinelectronics
BT: Magnetoelectric effects

SPIONs

USE: Superparamagnetic iron
oxide nanoparticles

Spirals

BT: Mathematics

Spirometry

BT: Biomedical measurement
Pulmonology
RT: Lungs
Pulmonary diseases



JULY 2025 IEEE Thesaurus

Spleen

BT: Lymphatic system

RT: Games
Sports equipment

Splicing

UF: Cable splicing
Fusion splicing
BT: Joining processes
RT: Optical fiber cables
Transmission lines

Sports equipment

BT: Manufactured products
RT: Bicycles
Sports

Spline functions

USE: Splines (mathematics)

Spot welding

BT: Welding

Splines (mathematics)

UF: B-Spline
Spline functions
BT: Numerical analysis
RT: Curve fitting

SPR

USE: Surface plasmon
resonance

Spraying

BT: Surface finishing
RT: Aerosols
Coatings
Liquids
Particle production
Surface charging
NT: Thermal spraying

Split gate flash memory cells

UF: Split-gate flash memory
cells
BT: Flash memory cells

Spread spectrum communication

UF: Frequency hop
communication
Frequency-hop
communication
Multi-hop
Multihop
Pseudonoise coded
communication

Split ring resonators

BT: Resonators
RT: Electromagnetic
metamaterials
Metamaterials
Microwave metamaterials
Optical resonators
Terahertz metamaterials

Split-gate flash memory cells

USE: Split gate flash memory
cells

BT: Digital communication
RT: 3G mobile communication
4G mobile communication
Bluetooth
Channel estimation
Chirp modulation
Code division multiplexing
Electronic countermeasures
Electronic warfare
Multicarrier code division

SPO

USE: Triples (Data structure)

multiple access
Multiuser detection
Radio communication
countermeasures
Time division synchronous
code division multiple access
Ultra wideband
communication

Spontaneous emission

UF: Superradiance
BT: Photonics
RT: Microcavities
Photonic crystals
NT: Radiative recombination

Sports

UF: Baseball
Football
Hockey
Soccer
Swimming
Tennis
BT: Entertainment industry



JULY 2025 IEEE Thesaurus

Spread spectrum radar

UF: Frequency hop radar
Pseudonoise coded radar
BT: Radar
RT: Chirp modulation
Electronic countermeasures
Electronic warfare
Radar countermeasures

Spreadsheet programs

UF: Microsoft Excel
BT: Data processing

Springs

BT: Mechanical products
Production
RT: Shock absorbers
Suspensions (mechanical systems)
Wires

Sprites (computer)

BT: Computer graphics
RT: Three-dimensional displays
Two-dimensional displays

Spur gears

USE: Gears

Spurline

BT: Power filters
RT: Planar transmission lines
NT: Spurline components

Spurline components

BT: Spurline

Sputter deposition

USE: Sputtering

Sputter etching

BT: Sputtering
RT: Cardiology

Sputtering

UF: Sputter deposition
Thin film deposition
BT: Materials preparation
RT: Coatings
Films
Magnetrons
Physical vapor deposition
NT: Sputter etching

Spyware

BT: Privacy-invasive software

SQL

USE: Structured Query Language

SQL injection

BT: Computer crime
Information security

Squamous cell carcinoma

BT: Skin cancer

Squeezed light

USE: Optical squeezing

SQUID magnetometers

BT: Magnetometers
RT: Magnetic fields

SQUIDS

UF: Superconducting quantum interference devices
BT: Superconducting devices
RT: Readout electronics

Squeezed states

USE: Optical squeezing

Sr

USE: Strontium

SRAM

USE: SRAM chips

SRAM cells

BT: Random access memory

SRAM chips

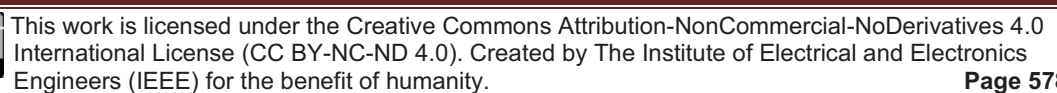
UF: SRAM
BT: Random access memory
RT: CMOS memory circuits

Stability

BT: Reliability
RT: Asymptotic stability
Control systems
Damping
Lyapunov methods
Predator prey systems
Robustness
Stability plasticity
Time invariant systems
NT: Circuit stability
Robust stability



		Stability analysis		Standardization	
		Thermal stability		BT:	Engineering - general
				RT:	IEC
Stability analysis					ISO
	BT:	Stability			ISO Standards
	RT:	Algorithms		NT:	Formal specifications
		Differential equations			Guidelines
		Laser stability			Standards
		Plasma properties			
		Signal processing		Standards	
		System analysis and design		BT:	Standardization
	NT:	Stability criteria		RT:	Conformance testing
Stability criteria					IEC
	BT:	Stability analysis			ISO
Stability plasticity					International collaboration
	UF:	Stability-plasticity			Open systems
	BT:	Learning systems		NT:	Qualifications
		Neural networks	Standard		Renewable Portfolio
	RT:	Constraint theory			Standards categories
		Neural activity			Standards organizations
		Neuroplasticity			Standards publications
		Stability		Standards categories	
Stability-plasticity				BT:	Standards
	USE:	Stability plasticity		NT:	Communication standards
Stacking					International Atomic Time
	BT:	Material storage			Measurement standards
	RT:	Containers			Military standards
		Materials handling	standards		Power and energy
		Warehousing			Software standards
Stairs				Standards organizations	
	BT:	Construction		BT:	Standards
	RT:	Elevators		NT:	3GPP
		Escalators			ANSI
		Legged locomotion			ASA
		Mobile robots			CSA Group
Stakeholder pensions					DMTF
	USE:	Pensions			ETSI
Stakeholders					IEC
	BT:	Customer relationship		Association	IEEE Standards
management					ISO
	RT:	Organizational aspects			ITU
		Decision making			NACE International
		Requirements engineering			NEMA
		Strategic planning			NFPA
Standard Generalized Markup Language					NIST
	USE:	SGML		Consortium	Open Geospatial
					SMPTE
					W3C



JULY 2025 IEEE Thesaurus

Standards publications

BT: Standards
NT: 3GPP Standards
ANSI Standards
ASA Standards
CSA Group Standards
ETSI Standards
IEC Standards
IEEE Standards
ISO Standards
ITU Standards
NACE Standards
NISO Standards
NIST Standards
SMPTE Standards
W3C Standards

Standby generators

UF: Emergency power
generators
BT: Generators
Rotating machines
RT: Emergency power supplies

Standby power supplies

USE: Emergency power supplies

Stark effect

BT: Electro-optic effects

Starlink

USE: Satellite constellations

Stars

BT: Astronomy
NT: Neutron stars

Starter motors (automotive)

USE: Automotive components

STATCOM

UF: Static compensator
BT: Static VAR compensators

State estimation

UF: State observers
BT: Estimation
RT: Control systems
NT: Observers

State feedback

BT: Linear feedback control
systems

State observers

USE: State estimation

State of charge

BT: Battery chargers

State pensions

USE: Pensions

State space theory

USE: State-space methods

State-space methods

UF: State space theory
State-space model
BT: Control system analysis
RT: Time-domain analysis

State-space model

USE: State-space methods

Static analysis

UF: Static projection
Statis scoring
BT: Statistical analysis
System analysis and design
RT: Model checking
Software engineering

Static compensator

USE: STATCOM

Static converters

USE: Static power converters

Static induction transistors

BT: Transistors

Static power converters

UF: Static converters
BT: Converters

Static projection

USE: Static analysis

Static VAR compensators

UF: SVC
BT: Power transmission
RT: Reactive power
NT: STATCOM

Stationary state

UF: Ground state
BT: Quantum mechanics



JULY 2025 IEEE Thesaurus

Statis scoring

USE: Static analysis

Statistical analysis

UF: Statistical testing

BT: Statistics

RT: Decision theory

Measurement errors

Nearest neighbor methods

Probability

R language

Random processes

Technology acceptance

model

NT:

Time series analysis

Analysis of variance

Conditional random fields

Descriptive statistics

Functional data analysis

Inferential statistics

Mean field theory

Mode matching methods

Monte Carlo methods

Parameter estimation

Pareto analysis

Predictive analytics

Principal component

analysis

Regression analysis

Static analysis

Trend analysis

detection

NT:

estimation

Statistical computing

USE: Computational statistics

Statistical distributions

BT: Probability

RT: Multi-armed bandit problem

NT: Distribution functions

Gaussian distribution

Weibull distribution

Statistical learning

BT: Machine learning

RT: Decision theory

Pattern recognition

NT: Confusion matrices

Statistical testing

USE: Statistical analysis

Statistics

BT: Mathematics

RT: Econometrics

Estimation theory

Extrapolation

Fourier transforms

Information theory

Interpolation

Matrix decomposition

Maximum likelihood

Operations research

Probability

Scheduling

Weibull distribution

Adaptive estimation

Autoregressive processes

Biostatistics

Boltzmann distribution

Computational statistics

Correlation

Correlation coefficient

Covariance matrices

Cyclostationary process

Decision theory

Differential privacy

Dimensionality reduction

Ensemble learning

Gamma distribution

Gaussian mixture model

Higher order statistics

Histograms

Imputation

Linear discriminant analysis

Maximum likelihood

Minimax techniques

Mixture models

Mortality

Nonparametric statistics

Parametric statistics

Prediction theory

Ranking (statistics)

Root mean square

Sampling methods

Statistical analysis

Surveys

Time series analysis

Total variance

Stator bars

BT: Stators

Stator cores

BT: Stators

Stator windings

BT: Stators



JULY 2025 IEEE Thesaurus

Stators

BT: Electric machines
NT: Stator bars
Stator cores
Stator windings

Steady state

USE: Steady-state

Steady-state

UF: Steady state
BT: Dynamic equilibrium
RT: Transient analysis

Steam engines

BT: Heat engines
RT: Boilers
Water

Steel

BT: Metals
RT: Pressure vessels
NT: Martensite

Steel industry

BT: Industries

Steerable antennas

BT: Antennas
Beam steering
Phased arrays

Steering systems

BT: Mechanical products
Production systems
RT: Advanced driver assistance

systems

Automotive components
Wheels

Steganography

BT: Cryptography
RT: Image coding
Message authentication

Steiner points

USE: Steiner trees

Steiner trees

UF: Steiner points
Steiner vertices
BT: Combinatorial mathematics

Steiner vertices

USE: Steiner trees

Stellar dynamics

BT: Astrophysics
NT: Stellar motion

Stellar motion

BT: Stellar dynamics

STEM

UF: Science technology
engineering mathematics
science technology
engineering and math
science, technology,
engineering, and math
BT: Educational programs
RT: Curriculum development
Educational courses
Engineering - general
Mathematics
Science - general
Technology

Stem cell research

USE: Stem cells

Stem cells

UF: Stem cell research
BT: Biological cells
RT: Cloning
Progenitor cells

Stereo image processing

UF: Stereoscopic
Stereoscopy
BT: Stereo vision

Stereo vision

UF: Stereovision
Three-dimensional vision
BT: Imaging
RT: Image matching
Machine vision
Robot vision systems
NT: Stereo image processing

Stereognosis

BT: Robot sensing systems

Stereolithography

BT: Lithography
RT: Laser applications
Laser sintering
Lasers
Layered manufacturing
Manufacturing



JULY 2025 IEEE Thesaurus

Prototypes		Stochastic resonance	BT: Resonance
<i>Stereophonic systems</i>	USE: Audio systems	Stochastic systems	BT: Systems engineering and
<i>Stereoscopic</i>	USE: Stereo image processing	theory	RT: Control systems Mean field theory Probability Random variables
<i>Stereoscopy</i>	USE: Stereo image processing	<i>Stochastic theory</i>	USE: Stochastic processes
<i>Stereovision</i>	USE: Stereo vision	<i>Stock exchanges</i>	USE: Stock markets
Sternum	BT: Thorax	Stock markets	UF: Stock exchanges BT: Economics
Stethoscope	BT: Biomedical equipment	Stokes parameters	BT: Optical polarization
Stimulated emission	UF: Optical amplification BT: Particle beam optics RT: Lasers Masers	Stomach	BT: Digestive system RT: Gastritis
Stirling engines	BT: Heat engines	Stomatognathic system	UF: stomognathic system BT: Anatomy RT: Faces Lips Mouth Pharynx Tongue NT: Masticatory muscles Salivary glands
<i>Stochastic distribution</i>	USE: Stochastic processes	<i>stomognathic system</i>	USE: Stomatognathic system
<i>Stochastic prediction</i>	USE: Stochastic processes	Storage area networks	UF: SAN BT: Computer networks RT: Buffer storage Local area networks
Stochastic processes	UF: Stochastic distribution Stochastic prediction Stochastic theory BT: Mathematics RT: Computational	Storage automation	UF: Automated storage and
electromagnetics	Diffusion processes Mean field theory Multi-armed bandit problem Particle swarm optimization Probability Q-learning Random number	retrieval systems	BT: Automation Material storage RT: Warehousing
generation	Random variables Viterbi algorithm		
NT: Gaussian processes Markov processes Scenario generation			



JULY 2025 IEEE Thesaurus

Storage batteries

USE: Batteries

Storage battery

USE: Batteries

Storage management

BT: Capacity planning
Management
RT: Memory management
NT: Digital storage

Storage rings

BT: Particle accelerators
RT: Ions
Muon colliders
Particle beams

Stored energy

USE: Energy storage

Storm surge

BT: Ocean dynamics
RT: Sea measurements
Tides
Tsunami

Storm systems

USE: Tropical cyclones

Storm water

USE: Stormwater

Storms

BT: Meteorology
RT: Lightning
Monsoons
Stormwater
NT: Geomagnetic storms

Stormwater

UF: Storm water
BT: Hydrology
Water resources
RT: Disaster management
Emergency services
Floods
Rain
Rivers
Storms

Strain

BT: Mechanical factors
RT: Elasticity
Elongation

Strain control

Strain measurement

NT:

Tensile strain

Uniaxial strain

Strain based sensors

USE: Capacitive sensors

Strain control

UF: Friction stir processing
BT: Mechanical variables

control

RT: Strain

Strain gauges

USE: Strain measurement

Strain measurement

UF: Strain gauges
BT: Mechanical variables

measurement

RT: Micrometers
Strain

Strain sensors

USE: Capacitive sensors

Strategic planning

BT: Planning
RT: Analytic hierarchy process
Business intelligence
Decision making
Information systems
Stakeholders

NT: Roadmaps (technology
planning)

Stratified media

USE: Nonhomogeneous media

Stratigraphy

BT: Geology
RT: Rocks

Stratosphere

USE: Terrestrial atmosphere

Stray light

BT: Light sources
Optics
RT: Ray tracing

Streaming media

UF: Media streaming
Video streaming



JULY 2025 IEEE Thesaurus

software
BT: Communication system
RT: Data compression
IEEE 802.11e Standard
IPTV
Internet
MPEG 4 Standard
MPEG standards
Multimedia communication
Unicast
Video coding
Video signal processing
NT: Mobile video
Over-the-top media
services
Video on demand

Streams

BT: Water

Streetcars

USE: Light rail systems

Stress

UF: Mechanical stress
BT: Mechanical factors
RT: Magnetomechanical effects
Photoelasticity
Piezoelectricity
Piezooptic effects
Piezoresistance
Stress control
Stress measurement
NT: Compressive stress
Internal stresses
Residual stresses
Shear testing
Tensile stress
Wind stress

Stress (psychological)

USE: Human factors

Stress control

BT: Mechanical variables
control
RT: Stress
Surface stress

Stress measurement

BT: Mechanical variables
measurement
RT: Stress

String theory

BT: Physics
RT: Quantum mechanics

String vacuum

USE: Elementary particle vacuum

Stripboard circuit

UF: Veroboard
BT: Electronic circuits

Stripline

BT: Planar transmission lines
Transmission lines
NT: Stripline components

Stripline components

BT: Stripline
RT: Power combiners
Power dividers

Strips

BT: Structural shapes

Stroke (medical condition)

BT: Medical conditions
RT: Aphasia
Spasticity

Strontium

UF: Sr
BT: Metals
NT: Strontium compounds

Strontium compounds

BT: Strontium
RT: Alloying

Structural beams

UF: Cantilever beams
Girders
BT: Structural shapes
RT: Building materials

Structural discs

UF: Disks (structures)
BT: Structural shapes

Structural engineering

UF: Structural parameter
Structural stability
BT: Civil engineering
RT: Architecture
Bridges



JULY 2025 IEEE Thesaurus

management		Building information			Structural discs
		Construction			Structural panels
		Flexible structures			Structural plates
		Floods			Structural rings
		Intelligent structures			Structural rods
		Mechanical factors			Structural shells
		Offshore installations			Thin wall structures
	NT:				Wires
Structural panels			Structural shells		
	UF:	Railway bridges		BT:	Structural shapes
		Road bridges		RT:	Thin wall structures
		Suspension bridges			
	BT:	Structural shapes			
	RT:	Honeycomb structures		<i>Structural stability</i>	
		Sandwich structures		USE:	Structural engineering
		Sheet materials			
		Structural plates			
		Thin wall structures			
<i>Structural parameter</i>					
	USE:	Structural engineering			
Structural plates			Structured Query Language		
	BT:	Electronic components		UF:	SQL
		Structural shapes		BT:	Database languages
	RT:	Flanges		RT:	Programming
		Structural panels			Relational databases
		Wheels			
Structural rings			<i>Student engineers</i>		
	UF:	O-rings		USE:	Engineering students
	BT:	Structural shapes			
	RT:	Engine cylinders		Student experiments	
		Mechanical products		BT:	Engineering education
		Pistons		RT:	Laboratories
		Seals			
Structural rods			Style sheet languages		
	BT:	Structural shapes		BT:	Computer languages
				NT:	Cascading style sheets
Structural shapes			<i>Sub-mm wave filters</i>		
	BT:	Mechanical products		USE:	Submillimeter wave filters
	NT:	Bars			
		Bridges		<i>Sub-sea cables</i>	
		Ducts		USE:	Underwater cables
		Flexible structures			
		Honeycomb structures		Subcontracting	
		Lightweight structures		BT:	Contracts
		Rails			
		Sandwich structures		Subduction	
		Sheet materials		UF:	Subduction zones
		Slabs		BT:	Geological processes
		Strips			Tectonics
		Structural beams			



JULY 2025 IEEE Thesaurus

Subduction zones

USE: Subduction

RT: Submillimeter wave circuits
Terahertz wave absorption

Subject matter experts

BT: Knowledge acquisition
RT: Knowledge discovery
Professional aspects

Submillimeter wave integrated circuits

BT: Integrated circuits
Submillimeter wave circuits
Submillimeter wave

Subject predicate object

USE: Triples (Data structure)

technology

RT: Analog integrated circuits
Submillimeter wave devices

Submarine cables

USE: Underwater cables

Submillimeter wave measurements

BT: Electromagnetic
measurements
RT: Hyperspectral sensors
Submillimeter wave

Submarine technology

USE: Underwater technology

technology

Submarines

USE: Underwater vehicles

Submillimeter wave propagation

BT: Electromagnetic
propagation

Submersible cables

USE: Underwater cables

Submillimeter wave systems

USE: Submillimeter wave devices

Submersibles

USE: Underwater vehicles

Submillimeter wave technology

BT: Microwave theory and
techniques
RT: Submillimeter wave
measurements
NT: Submillimeter wave circuits
Submillimeter wave
communication
Submillimeter wave devices
Submillimeter wave
integrated circuits

Submillimeter wave circuits

BT: Circuits
Submillimeter wave
technology
RT: Analog circuits
Submillimeter wave devices
Submillimeter wave filters
NT: Submillimeter wave
integrated circuits

Submillimeter wave communication

BT: Communication systems
Submillimeter wave
technology

Submillimetre wave filters

USE: Submillimeter wave filters

Submillimeter wave devices

UF: Submillimeter wave
systems
BT: Submillimeter wave
technology
RT: Submillimeter wave circuits
Submillimeter wave
integrated circuits
NT: Submillimeter wave filters

Subroutines

USE: Algorithms

Subscriber identification module

USE: SIM card

Subscriber identity module

USE: SIM card

Subscriber loops

BT: Communication systems
Multiaccess communication

Submillimeter wave filters

UF: Sub-mm wave filters
Submillimetre wave filters
BT: Submillimeter wave devices

Subscriber sets

USE: Telephone sets



JULY 2025 IEEE Thesaurus

Subsea cables

USE: Underwater cables

Subspace constraints

BT: Object segmentation

Substance abuse

USE: Addiction

Substation automation

BT: Substations

RT: Automation

SCADA systems

Substation protection

Substation protection

BT: Power system protection

Substations

RT: Substation automation

Substations

UF: Power stations
(substations)

BT: Power systems

NT: Substation automation

Substation protection

Substitution box

USE: S Box

Substrate hot electron injection

UF: Substrate hot-electron
injection

BT: Hot carrier injection

Substrate hot-electron injection

USE: Substrate hot electron
injection

Substrate integrated waveguides

UF: Post-wall waveguides

BT: Waveguide lasers

Substrates

BT: Semiconductor materials

RT: Epitaxial growth

Microprocessor chips

Printed circuits

Silicon germanium

Silicon on sapphire

Vapor deposition

Subthreshold conduction

USE: Subthreshold current

Subthreshold current

UF: Subthreshold conduction
Subthreshold drain current
Subthreshold leakage

BT: Threshold voltage

Subthreshold drain current

USE: Subthreshold current

Subthreshold leakage

USE: Subthreshold current

Subtraction techniques

BT: Image analysis

RT: Biomedical image
processing

Subways

USE: Public transportation

Sucrose

USE: Sugar

Sufficient conditions

BT: Logic

Sugar

UF: Sucrose

BT: Agricultural products
Food products

RT: Sugar industry

Sugar refining

NT: Glucose

Sugar industry

BT: Industries

RT: Food industry
Food products
Sugar

NT: Sugar refining

Sugar refining

BT: Sugar industry

RT: Food industry
Food products
Food technology
Purification
Refining
Sugar

Sulfur

UF: Sulphur

BT: Chemical elements

NT: Sulfur compounds



JULY 2025 IEEE Thesaurus

Sulfur compounds

UF: Sulphur compounds
BT: Sulfur

Sulfur hexafluoride

UF: SF6
BT: Gas insulation

Sulphur

USE: Sulfur

Sulphur compounds

USE: Sulfur compounds

Sum product algorithm

UF: Sum-product algorithm
BT: Iterative algorithms

Sum product message passing

USE: Belief propagation

Sum-product algorithm

USE: Sum product algorithm

Summing circuits

BT: Circuits
RT: Analog computers

Sun

BT: Solar system
NT: Solar eclipses

Sun sensors

USE: Sensors

Sun trackers

USE: Solar tracking

Sun tracking

USE: Solar tracking

Super capacitors

USE: Supercapacitors

Super earths

USE: Extrasolar planets

Super hi-vision

USE: UHDTV

Super intelligence

USE: Hyper-intelligence

Super resolution

USE: Superresolution

Super-resolution

USE: Superresolution

Supercapacitors

UF: Electrical double layer capacitors
BT: Super capacitors
Ultracapacitors
Electrochemical devices
Energy storage
Power capacitors
RT: Capacitance
Capacitance measurement
Electrolytes

Supercomputers

BT: Computers
RT: Petascale computing
NT: Exascale computing

Superconducting cables

BT: Superconducting transmission lines
RT: Superconducting coils
Superconducting magnets

Superconducting coils

BT: Coils
RT: Superconducting devices
Superconducting cables
Superconducting magnets
Superconducting wires

Superconducting device noise

BT: Noise
RT: Superconducting devices

Superconducting devices

UF: Josephson devices
SIS devices
(superconductor)
SNS devices
Superconductor-insulator-superconductor devices
Superconductor-normal-superconductor devices
BT: Superconductivity
RT: Cryogenic electronics
High-temperature superconductors
Superconducting device noise
Superconducting films
Thermal factors
NT: Josephson junctions



JULY 2025 IEEE Thesaurus

SQUIDs
Superconducting coils
Superconducting magnets
Superconducting
microwave devices
Superconducting
photodetectors

Superconducting epitaxial layers

BT: Epitaxial layers
RT: Superconducting materials

Superconducting filaments

BT: Superconducting materials

Superconducting films

UF: Superconducting tapes
BT: Superconductivity
RT: High-temperature
superconductors
Superconducting devices
Surface impedance
Surface resistance
Thick films
Thin films
NT: Superconducting thin films

Superconducting filters

BT: Filters
RT: Radiofrequency
interference

Superconducting infrared detectors

USE: Superconducting
photodetectors

Superconducting integrated circuits

BT: Integrated circuits
Superconductivity

Superconducting junction devices

USE: Josephson junctions

Superconducting logic circuits

BT: Logic circuits

Superconducting magnet energy storage

USE: Superconducting magnetic
energy storage

Superconducting magnetic energy storage

UF: SMES
Superconducting magnet
energy storage
BT: Energy storage

Superconductivity

Superconducting magnets

BT: Electromagnets
Superconducting devices
RT: Magnetic levitation vehicles
Persistent currents
Superconducting cables
Superconducting coils

Superconducting materials

UF: Pnictide superconductors
BT: Materials
Superconductivity
RT: Critical current density
Cryogenic electronics
Superconducting epitaxial

layers

NT: Thermal factors
Granular superconductors
High-temperature

superconductors

superconductors

Multifilamentary
Niobium-tin
Superconducting filaments
Superconducting wires
Type II superconductors

Superconducting microwave devices

BT: Superconducting devices
RT: Microwave devices

Superconducting photodetectors

UF: Superconducting infrared
detectors
Superconducting ultraviolet
detectors
BT: Photodetectors
Superconducting devices
RT: Infrared detectors

Superconducting quantum interference devices

USE: SQUIDs

Superconducting tapes

USE: Superconducting films

Superconducting thin films

BT: Superconducting films
RT: Thin films



JULY 2025 IEEE Thesaurus

Superconducting transition temperature

BT: Superconductivity
RT: High-temperature

superconductors

Superconducting transmission lines

BT: Transmission lines
RT: Power transmission lines
NT: Superconducting cables

Superconducting ultraviolet detectors

USE: Superconducting
photodetectors

Superconducting wires

BT: Superconducting materials
RT: Superconducting coils
NT: Multifilamentary

superconductors

Superconductive tunneling

UF: Superconductive tunnelling
BT: Superconductivity
Tunneling

Superconductive tunnelling

USE: Superconductive tunneling

Superconductivity

NT: Bean model
Critical current density
Flux pinning
Superconducting devices
Superconducting films
Superconducting integrated

circuits

energy storage

temperature

Superconducting magnetic

Superconducting materials
Superconducting transition

Superconductive tunneling

Superconductor-insulator-superconductor devices

USE: Superconducting devices

Superconductor-normal-superconductor devices

USE: Superconducting devices

Superconductors (high temperature)

USE: High-temperature
superconductors

Supercontinuum generation

BT: Nonlinear optics
RT: Laser beams
Light sources
Optical fibers

Superintelligence

USE: Hyper-intelligence

Superlattices

BT: Crystalline materials
NT: Magnetic superlattices
Metallic superlattices
Optical superlattices
Semiconductor

superlattices

Superluminescent diodes

UF: SLD
BT: Diodes
Light emitting diodes
Light sources
Optoelectronic devices
Semiconductor devices
Semiconductor diodes
RT: Lasers

Superparamagnetic iron oxide nanoparticles

UF: SPIONs
BT: Paramagnetic materials
RT: Targeted drug delivery

Superposition calculus

BT: Mathematics

Superradiance

USE: Spontaneous emission

Superresolution

UF: Super resolution
Super-resolution
BT: Image resolution
RT: Deblurring

Supersonic flow

BT: Fluid flow

Superstring vacuum

USE: Elementary particle vacuum

Supervised learning

BT: Learning systems
RT: Deep learning
Graph neural networks
Naive Bayes methods



JULY 2025 IEEE Thesaurus

	Self-supervised learning		Support vector machine classification
	Semisupervised learning	BT:	Support vector machines
	Unsupervised learning		
	Weak supervision		Support vector machines
NT:	Boosting	UF:	SVM
	Similarity learning		Support vector regression
		BT:	Computation theory
Supervisory control		RT:	Artificial intelligence
BT:	Control systems		Feedforward neural
NT:	SCADA systems		networks
			Kernel machines
<i>Supervisory control and data acquisition systems</i>			Logistic regression
			Naive Bayes methods
USE:	SCADA systems		Pattern classification
			Reinforcement learning
<i>Supervisory control and data-acquisition systems</i>			Relevance vector machines
		NT:	Support vector machine
USE:	SCADA systems	classification	
			<i>Support vector regression</i>
<i>Supervisory programs</i>			USE:
USE:	Operating systems		Support vector machines
Supply and demand			Surface acoustic wave devices
BT:	Economics	BT:	Acoustic devices
RT:	Microeconomics	RT:	Acoustoelectric devices
	Utility theory		Piezoelectric devices
Supply chain management			Surface acoustic waves
UF:	SCM supply chains	UF:	Acoustic surface waves
BT:	Management	BT:	Acoustic waves
RT:	Business process		Surface waves
integration			Waves
	Business process		
management			Surface charging
	Capacity planning	BT:	Electrostatic processes
	Customer relationship	RT:	Spraying
management		NT:	Triboelectricity
	Electronic commerce		
	Food security		Surface cleaning
	Management information	BT:	Cleaning
systems			Surface treatment
	Materials requirements	RT:	Semiconductor device
planning		manufacture	
	Production control		Surface contamination
	Supply chains		
NT:	Procurement		Surface contamination
		BT:	Contamination
Supply chains		RT:	Semiconductor device
BT:	Logistics	manufacture	
RT:	Materials requirements		Surface cleaning
planning			Surface treatment
	Procurement		
	Supply chain management		Surface cracks
NT:	Cold chain	BT:	Mechanical factors
	Distribution networks		



JULY 2025 IEEE Thesaurus

Surface discharges

BT: Dielectric breakdown
RT: Insulator testing

Surface emitting lasers

BT: Lasers
Semiconductor devices
Semiconductor lasers
Solid lasers
RT: Laser cavity resonators
Quantum well lasers
Quantum wells
NT: Vertical cavity surface emitting lasers

Surface engineering

BT: Materials science and technology
RT: Surface treatment

Surface finishing

BT: Finishing
RT: Lapping
Polishing machines
NT: Burnishing
Deburring
Painting
Spraying

Surface fitting

BT: Numerical analysis
RT: Computational geometry
Computer graphics
Curve fitting
Interpolation
NT: Response surface methodology

Surface impedance

BT: Surfaces
RT: High-temperature superconductors
Superconducting films

Surface morphology

BT: Surfaces
RT: Surface roughness
NT: Adsorption

Surface mount technology

UF: Surface-mount technology
BT: Integrated circuit manufacture
NT: Printed circuits
Ball grid arrays

Surface plasmon polaritons

BT: Polaritons
Surface plasmons

Surface plasmon resonance

UF: SPR
BT: Nanoplasmonics
Surface plasmons

Surface plasmons

BT: Plasmons
NT: Surface plasmon polaritons
Surface plasmon resonance

Surface reconstruction

BT: Visualization
RT: Pattern analysis

Surface resistance

BT: Resistance
Surfaces
RT: High-temperature superconductors
Superconducting films

Surface roughness

BT: Surfaces
RT: Planing
Polishing machines
Rough surfaces
Sandblasting
Surface morphology

Surface soil

BT: Surfaces

Surface states

BT: Energy states
Surface structures
NT: Surfactants

Surface stress

BT: Mechanical factors
Surfaces
RT: Internal stresses
Stress control

Surface structures

BT: Surfaces
NT: Surface states

Surface tension

BT: Surfaces
RT: Surfactants



JULY 2025 IEEE Thesaurus

Surface texture

BT: Surfaces

Surface topography

BT: Geometry

Surfaces

NT: Nanotopography

Surface treatment

BT: Surfaces

RT: Colloidal lithography

Planing

Surface contamination

Surface engineering

NT: Electrochemical deposition

Etching

Finishing

Galvanizing

Painting

Passivation

Pickling

Planarization

Sandblasting

Surface cleaning

Surfactants

Vapor deposition

Surface waves

BT: Geophysics

RT: Sea surface

NT: Surface acoustic waves

Surface-mount technology

USE: Surface mount technology

Surfaces

BT: Materials science and
technology

NT: Corrosion

Corrugated surfaces

Metasurfaces

Rough surfaces

Surface impedance

Surface morphology

Surface resistance

Surface roughness

Surface soil

Surface stress

Surface structures

Surface tension

Surface texture

Surface topography

Surface treatment

Surfactants

BT: Materials

Surface states

Surface treatment

RT: Adsorption

Surface tension

Surge protection

BT: Power system protection

RT: Surges

NT: Arresters

Surgery

UF: Robot-assisted surgery

BT: Medical treatment

RT: Biomedical equipment

Catheters

Endoscopes

NT: Ambulatory surgery

Electrosurgery

Hepatectomy

Laser surgery

Mastectomy

Microsurgery

Minimally invasive surgery

Neurosurgery

Oncological surgery

Orthopedic surgery

Surgery oncology

USE: Oncological surgery

Surges

BT: Electromagnetic transients

RT: Surge protection

NT: Inrush current

Surgical instruments

BT: Biomedical equipment

NT: Laparoscopes

Surgical masks

USE: Face masks

Surgical robotics

USE: Medical robotics

Surgical robots

USE: Medical robotics

Surround sound

USE: Spatial audio



JULY 2025 IEEE Thesaurus

Surveillance

BT: Monitoring
 RT: Air to ground
 communication
 Conformance testing
 Hazardous areas
 Motion detection
 Reconnaissance
 Remote sensing
 Security
 Terrorism
 NT: Infrared surveillance
 Video surveillance

Surveys

BT: Statistics
 RT: Sampling methods

Suspension bridges

USE: Structural panels

Suspensions (mechanical systems)

BT: Mechanical systems
 RT: Automotive components
 Springs
 NT: Shock absorbers

Sustainability

USE: Sustainable development

Sustainable development

UF: Sustainability
 BT: Environmental
 management
 Social implications of
 technology
 RT: Anaerobic digestion
 Circular economy
 Electrification
 Food security
 Green computing
 Green energy
 Precision agriculture

SVC

USE: Static VAr compensators

SVM

USE: Support vector machines

SVPWM

USE: Space vector pulse width
 modulation

Swaging

BT: Materials processing
 RT: Metal products

Swarm intelligence

USE: Particle swarm optimization

Swarm optimization

USE: Particle swarm optimization

Swarm robotics

UF: Swarm robots
 BT: Multi-robot systems
 RT: Consensus control

Swarm robots

USE: Swarm robotics

Sweat glands

BT: Glands
 Skin

Swimming

USE: Sports

Swimming robots

USE: Aquatic robots

SWIPT

USE: Simultaneous wireless
 information and power transfer

Switch on surge

USE: Inrush current

Switched capacitor circuits

UF: Switched-capacitor circuit
 BT: Switched circuits

Switched capacitor networks

UF: Switched-capacitor
 networks
 BT: Resistors
 RT: Analog circuits
 Capacitors

Switched circuits

BT: Circuits
 RT: Telecommunications
 NT: Switched capacitor circuits

Switched mode power

USE: Switched mode power
 supplies



JULY 2025 IEEE Thesaurus

Switched mode power supplies

UF: SMPS
Switched mode power
BT: Power supplies

Switched reluctance motors

UF: Bridge converters
BT: Reluctance motors
RT: Brushless motors

Switched systems

BT: Time-varying systems
RT: Control systems
Power conversion

Switched-capacitor circuit

USE: Switched capacitor circuits

Switched-capacitor networks

USE: Switched capacitor
networks

Switches

BT: Control equipment
Electronic components
RT: Current control
IEEE 802.3 Standard
Solenoids
Spark gaps
Switchgear
Switching circuits
NT: Contactors
Microswitches
Optical switches

Switchgear

BT: Control equipment
RT: Current control
Fuses
Switches
NT: Circuit breakers
Interrupters
Relays

Switching circuits

BT: Circuits
RT: Circuit breakers
Digital circuits
Relays
Switches
NT: Choppers (circuits)
Logic circuits
Switching converters
Zero current switching
Zero voltage switching

Switching converters

BT: Switching circuits
RT: Power electronics
Zero current switching
Zero voltage switching

Switching converters

USE: Converters

Switching frequency

BT: Switching systems

Switching loss

UF: Switching losses
BT: Switching systems

Switching losses

USE: Switching loss

Switching systems

BT: Communication systems
RT: Communication switching
NT: Electronic switching
systems

Switching frequency
Switching loss
Telecommunication
switching

Symbiosis

UF: Symbiotic relationships
BT: Biological processes

Symbiotic relationships

USE: Symbiosis

Symbols

BT: Graphics
RT: Digital information
Huffman coding
Information retrieval
Pattern recognition
NT: CAPTCHAs
Communication symbols
Emojis

Symmetric matrices

UF: Symmetric matrix
BT: Numerical analysis

Symmetric matrix

USE: Symmetric matrices



JULY 2025 IEEE Thesaurus

Sympathetic nervous system

UF: Sympathetic outflow
BT: Autonomic nervous system

Sympathetic outflow

USE: Sympathetic nervous system

Symposia

USE: Conferences

Synapses

BT: Nervous system
RT: Artificial intelligence
Artificial neural networks
Brain
Communication channels
Computational intelligence
Electrochemical devices
Integrated optics
Local field potentials
Neuroinformatics
Neuromorphic engineering
Neurons
Neurotransmitters
Organic electronics
Photonics
Signal processing
Synaptic communication

Synaptic communication

BT: Biological processes
RT: Synapses

Synaptic transmission

USE: Neurotransmitters

Sync

USE: Synchronization

Synchrocyclotrons

BT: Particle accelerators

Synchronisation

USE: Synchronization

Synchronization

UF: Clock synchronization
Sync
Synchronisation
BT: Timing
RT: Chaotic communication
Concurrency control
Frequency locked loops
Scheduling

hierarchy

Synchronous digital

Time dissemination
Tracking loops

Synchronous digital hierarchy

UF: SDH
BT: Communication standards
Communication systems
ETSI Standards
RT: Digital communication
Optical fiber communication
SONET
Synchronization
Transport protocols

Synchronous DRAM

USE: SDRAM

Synchronous dynamic random access memory

USE: SDRAM

Synchronous generators

BT: AC generators
Synchronous machines
RT: Alternators
Grid following
Grid forming
NT: Reluctance generators

Synchronous machines

BT: AC machines
NT: Hysteresis motors
Reluctance machines
Synchronous generators
Synchronous motors

Synchronous motors

BT: Synchronous machines
RT: Rotating machines
NT: Hysteresis motors
Reluctance motors

Synchronous optical network

USE: SONET

Synchrophasors

USE: Phasor measurement units

Synchrotron radiation

BT: Synchrotrons
RT: Biomedical applications of radiation
Light sources
X-rays



JULY 2025 IEEE Thesaurus

Synchrotrons

BT: Particle accelerators
RT: Colliding beam accelerators
Electric fields
High energy physics

instrumentation computing

Magnetic fields

Particle beams

NT: Synchrotron radiation

Undulators

Synfuel

USE: Synthetic fuels

Syngas

UF: Synthesis gas

Synthetic gas

BT: Gases

Syntactics

UF: Syntax

BT: Semiotics

RT: Communication symbols

Grammar

Natural language

processing

Professional

communication

Programming

Syntax

USE: Syntactics

Synthesis gas

USE: Syngas

Synthesizers

USE: Synthesizers

Synthesizers

UF: Synthesizers

BT: Electronic music

Synthetic aperture radar

UF: SAR

BT: Radar

RT: Airborne radar

Ground penetrating radar

Radar imaging

Spaceborne radar

Synthetic aperture sonar

Ultra wideband radar

NT: Inverse synthetic aperture

radar

Polarimetric synthetic

aperture radar

Synthetic aperture radar imaging

USE: Radar polarimetry

Synthetic aperture radar interferometry

BT: Radar interferometry

Synthetic aperture sonar

UF: SAS

BT: Sonar

RT: Synthetic aperture radar

Synthetic biology

UF: Synthetic life research

BT: Biology

Engineering in medicine

and biology

RT: Biological system modeling

Computational biology

Synthetic data

BT: Computer simulation

Sampling methods

RT: Data augmentation

Data privacy

Information integrity

Neural radiance field

Synthetic fibers

UF: Artificial fibers

Artificial fibres

Nylon fiber

Synthetic fibres

BT: Textile fibers

Synthetic fibres

USE: Synthetic fibers

Synthetic fuels

UF: Synfuel

BT: Fuels

Synthetic gas

USE: Syngas

Synthetic life research

USE: Synthetic biology

Synthetic speech

USE: Speech synthesis



JULY 2025 IEEE Thesaurus

SYSML

USE: Systems Modeling
Language

System analysis

USE: System analysis and design

System analysis and design

UF: Logical decomposition
System analysis
System design
System metrics
BT: Systems engineering and theory

RT: Configuration management

Design methodology

Flowcharts

Multi-agent systems

Skin effect

Stability analysis

System improvement

System validation

System verification

Systems simulation

Threat modeling

NT: Asymptotic stability

Closed box

Control system analysis

Diakoptics

Distributed processing

Distributed vision networks

Fault detection

Fault tolerant systems

Glass box

Interconnected systems

Large-scale systems

Lyapunov methods

Open systems

Petri nets

Physical design

Robust control

Scalability

Scattering parameters

Sequential analysis

Sequential diagnosis

Software prototyping

Static analysis

System dynamics

System performance

System-level design

Systems Modeling

Language

Systems modeling

Task analysis

Time factors

System buses

BT: Computer interfaces

System design

USE: System analysis and design

System dynamics

BT: System analysis and design

RT: Behavioral sciences

Complex networks

Feedback

Flow production systems

Timing

System identification

BT: Modeling

System implementation

BT: Systems engineering and theory

System improvement

BT: Systems engineering and theory

RT: Quality management

Reliability

System analysis and design

System testing

System in package

USE: System-in-package

System integration

BT: Systems engineering and theory

RT: Enterprise resource

planning

Integrated manufacturing

systems

Project management

Resource management

System kernels

BT: Kernel
Operating systems

System level design

USE: System-level design

System life cycle management

USE: Technical management

System lifecycle management

USE: Product lifecycle management



JULY 2025 IEEE Thesaurus

System metrics
USE: System analysis and design

Program processors
Utility programs

System modeling
USE: Modeling

System testing

BT: System validation
System verification
Testing
RT: Closed box
Glass box
System improvement
NT: Model checking

System of systems

theory BT: Systems engineering and
RT: Complex networks
Emergent phenomena
Networked control systems
NT: Cyber-physical systems

System validation

theory BT: Systems engineering and
RT: System analysis and design
NT: System testing

System on chip
USE: System-on-chip

System performance

UF: Cooperative cache
BT: System analysis and design
NT: Cooperative caching

System verification

theory BT: Systems engineering and
RT: System analysis and design
NT: System testing

System planning
USE: Planning

System virtual machines

UF: Full virtualization VM
BT: Virtual machines

System privacy management
USE: Data security

System realization

theory BT: Systems engineering and

System-in-package

UF: System in package
BT: Chip scale packaging
System-on-chip
NT: Antenna-in-package

System recovery

UF: Deadlocks (computers)
Error recovery (computers)
BT: Computers and information
processing RT: Business continuity
Operating systems
Reliability
NT: Checkpointing
Core dumps
Debugging

System-level design

UF: System level design
BT: System analysis and design

System reliability
USE: Reliability

System-on-a-chip

USE: System-on-chip

System resilience
USE: Fault tolerance

System-on-chip

UF: On-chip
SOC
System on chip
System-on-a-chip
BT: Application specific
integrated circuits RT: AI accelerators
Microcontrollers
Microprocessors
Mixed analog-digital
integrated circuits
Power dissipation
Signal processing

System software

BT: Software
RT: Visual BASIC
NT: File systems
Operating systems



JULY 2025 IEEE Thesaurus

NT:	Lab-on-a-chip Network-on-chip System-in-package	engineering	Requirements engineering Requirements management Service-oriented systems
Systematic literature review			Solution design
UF:	Literature review		Stochastic systems
	SLR		System analysis and design
	Systematic review		System implementation
BT:	Reviews		System improvement
RT:	Publishing		System integration
	Research initiatives		System of systems
	Scientific publishing		System realization
<i>Systematic review</i>			System validation
USE:	Systematic literature review		System verification
			Systems architecture
			Systems engineering
Systematics		education	
UF:	Biological systematics		Systems operation
BT:	Biology		Systems simulation
			Systems support
			Systems thinking
Systems architecture			Task analysis
BT:	Systems engineering and		Technical management
theory			
NT:	Deep architecture		
Systems biology		Systems engineering education	
BT:	Biology	BT:	Engineering education
			Systems engineering and
<i>Systems engineering</i>		theory	
USE:	Systems engineering and	Systems modeling	
theory		BT:	Modeling
			System analysis and design
Systems engineering and theory		NT:	Threat modeling
UF:	Systems engineering		
RT:	Aerospace and electronic	Systems Modeling Language	
systems		UF:	SYSML
	Business process	BT:	Computer languages
integration			System analysis and design
	Business process	RT:	Modeling
management			Software engineering
	Digital twins	Systems neuroscience	
NT:	Adaptive systems	BT:	Neuroscience
	Capability engineering	RT:	Neural networks
	Complex systems		
	Configuration management	Systems operation	
	Failure state	BT:	Systems engineering and
	Hierarchical systems	theory	
	Integrated design		
	Interface management	Systems simulation	
	Military systems	BT:	Simulation
	Modeling		Systems engineering and
	Multidimensional systems	theory	
	Network systems	RT:	System analysis and design
	Physical design		Technical management
	Reduced order systems		



JULY 2025 IEEE Thesaurus

Systems support

BT: Maintenance engineering
Systems engineering and theory

NT: Smart systems

Systems thinking

BT: Systems engineering and theory

RT: Systems, man, and cybernetics

Systems, man, and cybernetics

RT: Systems thinking
NT: Behavioral sciences
Biological control systems
Computational linguistics
Cybernetics
Ergonomics
Human factors
Human-machine systems
Identification of persons
Pervasive computing
Posthuman
Remote working
Transhuman
User interfaces

Systolic arrays

BT: Multiprocessing systems
RT: Pipeline processing

T-cells

USE: Lymphocytes

T2V

USE: Text to video

Table lookup

UF: LUT
Look-up table
Lookup table
BT: Data structures
Image processing

Tablet computers

UF: Tablet PC
BT: Computers
RT: Mobile handsets
Portable media players

Tablet PC

USE: Tablet computers

Tachometers

BT: Meters

Tachycardia

BT: Heart rate
RT: Bradycardia

Tactile feedback

USE: Tactile sensors

Tactile Internet

BT: Haptic interfaces
Internet of Things
5G mobile communication
Human-machine systems
Human-robot interaction
Information exchange
Machine-to-machine

communications

Smart devices
Tactile sensors

Tactile sensors

UF: Tactile feedback
Touch sensors
BT: Robot sensing systems
RT: Braille
Electronic skin
Pressure measurement
Tactile Internet
Touch sensitive screens
Wearable sensors

Tag clouds

UF: Word cloud
BT: Tagging

Tagging

UF: Hashtag
BT: Information retrieval
RT: Indexing
Internet of Things
NT: Tag clouds

TAI

USE: International Atomic Time

Tail

BT: Animal structures

Takagi-Sugeno model

BT: Fuzzy logic
RT: Fuzzy control
Fuzzy systems



JULY 2025 IEEE Thesaurus

model	NT:	Takagi-Sugeno-Kang	Taste buds	BT:	Sense organs
Takagi-Sugeno-Kang model	BT:	Takagi-Sugeno model	<i>Taxes</i>	USE:	Finance
Talbot effect	BT:	Optical imaging	<i>Taxi</i>	USE:	Public transportation
	RT:	Interferometry	Taxonomy	BT:	Information retrieval
		Optical interferometry	<i>Taylor expansion</i>	USE:	Taylor series
<i>TAM</i>	USE:	Technology acceptance	Taylor series	UF:	Taylor expansion
model				BT:	Mathematics
Tantalum	BT:	Chemical elements	TCP	BT:	TCPIP
Tap changers	BT:	Transformers		RT:	Session hijacking
	NT:	On load tap changers		NT:	MPTCP
Tape casting	BT:	Casting	<i>TCP session hijacking</i>	USE:	Session hijacking
	RT:	Ceramics	<i>TCP/IP</i>	USE:	TCPIP
<i>Target detection</i>	USE:	Object detection	<i>TCP/IP protocol suite</i>	USE:	TCPIP
Target recognition	BT:	Object recognition	TCPIP	UF:	TCP/IP
	RT:	Missile guidance			TCP/IP protocol suite
Target tracking	BT:	Tracking			Transmission control
	RT:	Control systems			protocol-internet protocol
		Radar tracking			Transmission control
Targeted drug delivery	BT:	Drug delivery			protocol/internet protocol
	RT:	Superparamagnetic iron		BT:	IP networks
oxide nanoparticles				RT:	Computer networks
Tariffs					Data communication
	BT:	Regulation			Digital communication
	RT:	Free economic zones			Internet
		Trade agreements			Protocols
	NT:	Feed in tariff		NT:	Transport protocols
Task analysis					TCP
	BT:	Business process	<i>TD learning</i>	USE:	Temporal difference
management		System analysis and design	learning		
		Systems engineering and	<i>TDM</i>	USE:	Time division multiplexing
theory					



JULY 2025 IEEE Thesaurus

TDSCDMA

USE: Time division synchronous
code division multiple access

Teaching

USE: Education

Teaching machines

USE: Computer aided instruction

Team work

USE: Teamwork

Team working

USE: Teamwork

Teamwork

UF: Team work
Team working
BT: Collaboration
RT: Organizational aspects

Technetium

BT: Chemical elements

Technical assessment

USE: Technical management

Technical communication

USE: Professional
communication

Technical data management

USE: Database systems AND
Technical management

Technical drawing

BT: Design methodology
RT: Engineering drawings
Graphics

Technical management

UF: System life cycle
management
Technical assessment
Technical data

management

BT: Technical risk management
Management
Systems engineering and

theory

RT: Program management
Systems simulation
NT: Maintenance management
Technical planning

Technical manuals

USE: Manuals

Technical meetings

USE: Meetings

Technical planning

BT: Planning
Technical management

Technical proposals

USE: Proposals

Technical reports

USE: Writing

Technical requirements

BT: Requirements engineering
RT: Proposals

Technical risk management

USE: Technical management

Technical textiles

USE: Textile products

Technical writing

USE: Writing

Technician training

USE: Training

Technique for order of preference by similarity to ideal solution

USE: TOPSIS

Technological forecasting

USE: Technology forecasting

Technological innovation

UF: Innovation
Invention
BT: Technology
RT: Disruptive innovation
Disruptive technologies
Technology social factors

Technology

BT: Social implications of
technology

RT: Engineering - general
Museums
Oil drilling
Philosophical

considerations



JULY 2025 IEEE Thesaurus

	Research and development	Technology
	STEM	
	Technology forecasting	
	Technology planning	
NT:	Appropriate technology	
	Disruptive technologies	
	Fintech	
	Machine ethics	
	Neurotechnology	
	Technological innovation	
	Technology social factors	
	Technology transfer	
	Telepresence	
	Telexistence	
	Technology acceptance model	
	UF: TAM	
	BT: Human factors	
	Information theory	
	RT: Computer aided instruction	
	Consumer behavior	
	Information systems	
	Social implications of	
technology		
	Statistical analysis	
	Technology transfer	
	User centered design	
	User experience	
	Technology forecasting	
	UF: Futurism	
	Technological forecasting	
	BT: Forecasting	
	RT: Technology	
	Technology social factors	
	NT: Roadmaps (technology	
planning)		
	Technology management	
	BT: Management	
	RT: Data processing	
	Innovation management	
	Production management	
	Project management	
	Research and development	
management		
	Technology transfer	
	<i>Technology mediated communication</i>	
	USE: Computer mediated	
communication		
	Technology planning	
	BT: Planning	
	RT: Social factors	
	Technology social factors	
	BT: Social factors	
	Technology	
	RT: Philosophical	
	considerations	
	Risk analysis	
	Technological innovation	
	Technology forecasting	
	NT: Privacy	
	Technology transfer	
	BT: Technology	
	RT: Technology acceptance	
model		
	Technology management	
	NT: Small business technology	
transfer		
	<i>Technology-mediated communication</i>	
	USE: Computer mediated	
communication		
	Tectonics	
	BT: Geology	
	RT: Continental crust	
	Oceanic crust	
	Rocks	
	NT: Subduction	
	Teeth	
	UF: Tooth	
	BT: Mouth	
	<i>TEGFETs</i>	
	USE: MODFETs	
	<i>Telecom</i>	
	USE: Telecommunications	
	<i>Telecom channels</i>	
	USE: Communication channels	
	<i>Telecom computing</i>	
	USE: Telecommunication	
computing		
	<i>Telecom congestion control</i>	
	USE: Telecommunication	
congestion control		
	<i>Telecom control</i>	
	USE: Telecommunication control	



JULY 2025 IEEE Thesaurus

Telecom network management

USE: Telecommunication
network management

Telecom network reliability

USE: Telecommunication
network reliability

Telecom network topology

USE: Telecommunication
network topology

Telecom services

USE: Telecommunication
services

Telecom signaling

USE: Communication system
signaling

Telecom switching

USE: Telecommunication
switching

Telecom system signaling

USE: Communication system
signaling

Telecom traffic

USE: Telecommunication traffic

Telecommunication buffers

BT: Data communication

Telecommunication channels

USE: Communication channels

Telecommunication computing

UF: Communications computing
Telecom computing
BT: Computer applications
Telecommunications
RT: 3G mobile communication
4G mobile communication
Information-centric

networking

Mobile computing
Quality of service
Software radio
TV
Telecommunication control
Telecommunication

network management

Telegraphy
Telephony

NT: Internetworking
Soft switching

Telecommunication congestion control

UF: Telecom congestion control
BT: Telecommunication
network topology
NT: Call admission control

Telecommunication control

UF: Telecom control
BT: Communication system
control
RT: Telecommunication
computing
NT: Virtual links

Telecommunication network management

UF: Telecom network
management
BT: Telecommunication
network topology
RT: Border Gateway Protocol
Management information

base

Telecommunication
computing

Telecommunication
network performance

NT: Mobile nodes
Network architecture
Network neutrality
Network resource

management

Telecommunication network performance

BT: Communication networks
RT: Telecommunication
network management
Telecommunication
network reliability
Telecommunication
network topology
Telecommunication
services
Telecommunication traffic

Telecommunication network reliability

UF: Communication network
reliability
Telecom network reliability
BT: Reliability
Telecommunication
network topology



JULY 2025 IEEE Thesaurus

RT: Telecommunication
network performance
NT: Diversity schemes

Telecommunication network topology

UF: Telecom network topology
BT: Telecommunications
RT: Dynamic spectrum access
Network topology
Telecommunication

network performance
NT: Backhaul networks
Intelligent networks
Link aggregation
Passive networks
Telecommunication

congestion control
Telecommunication

network management
Telecommunication

network reliability
Telecommunication traffic

Telecommunication power management

USE: Power system management

Telecommunication security

USE: Communication system

security

Telecommunication services

UF: Telecom services
BT: Telecommunications
RT: Radio access networks
Telecommunication

network performance
NT: Acoustic communication
(telecommunication)
Number portability

Telecommunication signalling

USE: Communication system

signaling

Telecommunication standards

USE: Communication standards

Telecommunication switching

UF: Telecom switching
BT: Switching systems

Telecommunication traffic

UF: Network traffic
Telecom traffic
Traffic load

BT: Telecommunication
network topology
RT: Border Gateway Protocol
Communication system

traffic
Telecommunication

network performance
NT: Sidelink

Telecommunications

UF: Telecom
BT: Communication systems
RT: Convolutional codes
Diversity reception
Film bulk acoustic

resonators
Global Positioning System
Helical antennas
Multiaccess communication
Multicarrier code division

multiple access
Multicast communication
Next generation networking
Optical wavelength

conversion
Reflectivity
Switched circuits
Telecontrol equipment
NT: Ambient intelligence
Feedback communications
IP networks
Radio access networks
Railway communication
Space communications
Telecommunication

computing
Telecommunication

network topology
Telecommunication

services
Telematics

Telecommuting

USE: Remote working

Teleconferencing

BT: Communication systems
RT: Image communication
Meetings
Office automation
Web conferencing

Telecontrol equipment

BT: Control equipment
RT: Communication systems



JULY 2025 IEEE Thesaurus

	Data communication	Telephone poles	
	Power industry	BT:	Poles and towers
	Power systems		
	Remote handling	Telephone sets	
	Telecommunications	UF:	Handsets
Telegraphy			Subscriber sets
BT:	Communication systems	BT:	Telephone equipment
RT:	Telecommunication	RT:	Telephony
computing		NT:	Mobile handsets
<i>Telehealth</i>		Telephony	
USE:	Telemedicine	BT:	Communication systems
		RT:	Telecommunication
<i>Telehealthcare</i>		computing	
USE:	Telemedicine		Telephone equipment
			Telephone sets
<i>Teleheating</i>			Videophone systems
USE:	District heating		
		Teleportation	
Telematics		UF:	Quantum teleportation
BT:	Information technology	BT:	Quantum mechanics
	Telecommunications	RT:	Information theory
RT:	Cyberspace		Quantum communication
			Quantum entanglement
Telemedicine		Telepresence	
UF:	Telehealth	BT:	Human computer
	Telehealthcare	interaction	
BT:	Biomedical communication		Technology
RT:	Telepresence	RT:	Telemedicine
Telemetry		Teleprinting	
BT:	Aerospace and electronic	UF:	Teletype
systems		BT:	Communication systems
	Data communication		Data communication
RT:	Deep-space		Printing
communications		RT:	Digital communication
	Measurement		
NT:	Biomedical telemetry	Telerobotics	
		UF:	Telesurgical robotics
Teleoperators		BT:	Robots
BT:	Telerobotics	RT:	Delay systems
			Human factors
			Manipulators
Telephone equipment			Medical robotics
BT:	Communication equipment		Mobile robots
RT:	Land mobile radio		Remote handling
equipment			
	Radio communication	equipment	
equipment		NT:	Teleoperators
	Telephony		
NT:	Cellular phones	Telescopes	
	Landline	BT:	Instruments
	Telephone sets	RT:	Astronomy
	Vocoders		Observatories
			Radio astronomy



JULY 2025 IEEE Thesaurus

NT:	Gamma-ray telescopes X-ray telescopes	Temperature control	BT: Thermal variables control RT: Space heating Temperature Thermal factors Ventilation
<i>Telesurgical robotics</i>		NT: Cooling Heating systems	
USE:	Telerobotics		
Teletext			
BT:	Communication systems Information services		
RT:	Data communication Videotex	Temperature dependence	BT: Thermal factors
<i>Teletype</i>		Temperature distribution	BT: Temperature RT: Insulators
USE:	Teleprinting		
<i>Television</i>		Temperature measurement	BT: Thermal variables measurement RT: Bolometers Radiometry Temperature Temperature sensors Thermistors Thermoresistivity
USE:	TV	NT: Cryobiology Cryogenics Cryotherapy Global warming Kelvin Thomson effect	
<i>Teleworking</i>			
USE:	Remote working		
Telexistence			
BT:	Human computer interaction		
	Real-time systems Technology		
Tellurium			
BT:	Chemical elements		
<i>TEM</i>			
USE:	Transmission electron microscopy	Temperature sensors	BT: Thermal sensors RT: Bragg gratings Optical fibers Temperature measurement Transducers
TEM cells		NT: Thermocouples Thermometers	
UF:	GHZ transverse electromagnetic cells		
	GTEM cells Transverse electromagnetic cells		
BT:	Test facilities		
RT:	Anechoic chambers Electromagnetic compatibility and interference	Temporal difference learning	UF: TD learning Temporal-difference learning
	Electromagnetic interference	BT: Predictive models Reinforcement learning	
	Electronic equipment	RT: Dynamic programming Monte Carlo methods Unsupervised learning	
testing			
Temperature		Temporal lobe	BT: Brain NT: Hippocampus
BT:	Thermal factors		
RT:	Temperature control Temperature measurement		
NT:	Color temperature Temperature distribution		



JULY 2025 IEEE Thesaurus

Temporal-difference learning

USE: Temporal difference learning

Tendons

BT: Musculoskeletal system
NT: Achilles tendon

Tennis

USE: Sports

Tensile modulus

USE: Young's modulus

Tensile strain

BT: Strain
RT: Tensile stress

Tensile stress

BT: Stress
RT: Tensile strain

Tensors

BT: Mathematics

Terahertz communications

BT: Communication systems

Terahertz materials

BT: Materials
RT: Optical antennas
Terahertz wave absorption
NT: Terahertz metamaterials

Terahertz metamaterials

BT: Electromagnetic metamaterials
Terahertz materials
RT: Split ring resonators

Terahertz radiation

BT: Electromagnetic radiation
Radiation effects
RT: Terahertz wave absorption

Terahertz wave absorption

BT: Electromagnetic wave absorption
RT: Submillimeter wave filters
Terahertz materials
Terahertz radiation

Terahertz wave imaging

BT: Imaging

Terbium

BT: Chemical elements

Termination of employment

UF: Dismissal
Redundancy (employment)
BT: Employment
Human resource management
RT: Pensions

Terminology

UF: Definitions
Glossaries
BT: Information retrieval
RT: Translation
NT: Dictionaries
Inclusive language

Ternary logic

USE: Multivalued logic

Terrain factors

BT: Interference
RT: Earth
Multipath channels
Rough surfaces

Terrain mapping

UF: Topography (earth)
BT: Geoscience and remote sensing
RT: Earth
Geologic measurements
Geophysical measurements
Global Positioning System
Remote sensing
Vegetation mapping
NT: Digital elevation models

Terrestrial atmosphere

UF: Earth atmosphere
Stratosphere
Troposphere
BT: Geoscience and remote sensing
RT: Atmospheric measurements
Geophysics
Meteorology
NT: Clouds
Global warming
Ionosphere
Magnetosphere



JULY 2025 IEEE Thesaurus

Terrestrial communications

BT: Communication systems
RT: Space-air-ground
integrated networks

Terrorism

UF: 9/11
9/11 attack
911 attack
September 11
Terrorist
BT: Security
RT: Biohazards
Chemical weapons
Nuclear weapons
Public security
Surveillance
Threat assessment
US Department of
Homeland Security
Weapons
Weapons of mass
destruction
NT: Bioterrorism
Cyber terrorism
National security

Terrorist

USE: Terrorism

Test data compression

BT: Data compression

Test equipment

BT: Testing
RT: Oscilloscopes
NT: Automatic test equipment

Test facilities

BT: Testing
NT: Anechoic chambers
Laboratories
Large Hadron Collider
Open area test sites
TEM cells
Wind tunnels

Test generation

USE: Test pattern generators

Test pattern generators

UF: Test generation
BT: Automatic test pattern
generation

Testing

BT: Industrial electronics
Instrumentation and
measurement
RT: Cause effect analysis
Fault diagnosis
Hardware-in-the-loop
simulation
Inspection
Leak detection
Maintenance engineering
Measurement
NT: Aerospace testing
Automatic testing
Benchmark testing
Built-in self-test
Circuit testing
Conformance testing
Device under test
Electronic equipment
testing
Error analysis
Error-free operations
Failure analysis
Frequency response
Impulse testing
Insulator testing
Integrated circuit testing
Life testing
Materials testing
Optical fiber testing
Remaining life assessment
Ring generators
Semiconductor device
testing
Shear testing
Software testing
System testing
Test equipment
Test facilities
Text analysis
BT: Data mining
RT: Annotations
Conditional random fields
Naive Bayes methods
Translation
NT: Text categorization
Text summarization
Text categorization
UF: Text classification
BT: Text analysis
RT: Data analysis



JULY 2025 IEEE Thesaurus

Text classification

USE: Text categorization

RT: Image matching
Text processing
Machine learning
Text recognition

Text detection

BT: Image processing
Text processing
Video signal processing
RT: Discrete Fourier transforms
Discrete wavelet transforms
Image segmentation
Machine learning
Text to speech

Text to speech

UF: Text-to-speech
BT: Speech synthesis
Text processing
RT: Audio-visual systems
Digital TV
Speech recognition
Speech to text
Text detection

Text messaging

USE: Electronic messaging

Text mining

BT: Data mining
RT: Triples (Data structure)

Text to video

UF: T2V
Text-to-video
BT: Artificial intelligence
Text recognition
Videos
RT: Animation
Machine learning

Text processing

UF: Photocomposition
Word processing
BT: Data processing
RT: Desktop publishing
Document handling
Office automation
Publishing
Text recognition
NT: Text detection
Text to image
Text to speech
Typesetting

Text-to-image

USE: Text to image

Text-to-speech

USE: Text to speech

Text-to-video

USE: Text to video

Text recognition

BT: Pattern recognition
RT: Character recognition
Text processing
Text to image
NT: Large language models
Text to video

Textile antennas

BT: Antennas
Smart textiles
RT: Wearable antennas

Textile based electrodes

USE: Textile electrodes

Text summarization

UF: Automatic summarization
BT: Abstracts
Text analysis
RT: Artificial intelligence
Machine learning
Natural language

Textile electrodes

UF: Textile based electrodes
Textile-based electrodes
BT: Electrodes
RT: Textile technology
Wearable devices

processing

Unsupervised learning

Textile fibers

UF: Fibers
Textile fibres
BT: Textiles
RT: Cotton
Spinning
Textile products

Text to image

UF: Text-to-image
BT: Artificial intelligence



JULY 2025 IEEE Thesaurus

	Textile technology	RT:	Spinning machines
	Weaving		Textile machinery
	Wool		Textile products
NT:	Natural fibers		Textile technology
	Synthetic fibers		Weaving
	Yarn	NT:	Cotton
			Fabrics
			Textile fibers
			Wool
<i>Textile fibres</i>			
USE:	Textile fibers		
Textile industry		TFETs	
BT:	Manufacturing industries	UF:	Tunnel field effect
RT:	Clothing industry	transistors	
	Cotton	BT:	Field effect transistors
	Spinning machines	RT:	MOSFET
	Textile machinery		
	Textile products	<i>TFT</i>	
	Textile technology	USE:	Thin film transistors
	Weaving		
Textile machinery		Thalamus	
BT:	Machinery	BT:	Brain
RT:	Needles		
	Textile industry	Thallium	
	Textile products	BT:	Chemical elements
	Textile technology		
	Textiles	Theodolites	
NT:	Spinning machines	BT:	Instruments
		RT:	Geodesy
Textile products			Geologic measurements
UF:	Technical textiles		Geophysical measurement
BT:	Manufactured products	techniques	
RT:	Textile fibers	<i>Theoretical neuroscience</i>	
	Textile industry	USE:	Computational
	Textile machinery	neuroscience	
	Textile technology	<i>Theory of constraints</i>	
	Textiles	USE:	Constraint theory
Textile technology		<i>Therapy</i>	
BT:	Industries	USE:	Medical treatment
RT:	Bleaching		
	Textile electrodes	Thermal analysis	
	Textile fibers	BT:	Thermal variables control
	Textile industry	NT:	Thermomechanical
	Textile machinery	processes	
	Textile products	Thermal conductivity	
	Textiles	BT:	Thermal factors
NT:	Spinning	RT:	Grain boundaries
	Weaving		Thermal resistance
<i>Textile-based electrodes</i>		NT:	Heat transfer
USE:	Textile electrodes		
Textiles		Thermal decomposition	
BT:	Materials	BT:	Thermolysis



JULY 2025 IEEE Thesaurus

Thermal degradation

BT: Thermolysis

Thermal energy

BT: Heating systems
RT: Energy
Kinetic energy
Ocean thermal energy

conversion

Thermal engineering

Thermal engineering

BT: Engineering - general
RT: Cooling
Heat recovery
Heating systems
Thermal energy
Thermal factors
Thermal variables control
Thermal variables

measurement

Thermal expansion

BT: Thermal factors
RT: Electrothermal actuators
NT: Thermal force

Thermal factors

UF: High-temperature effects
BT: Physics
RT: Annealing
Critical current density
Heat treatment
Proton effects
Pyroelectricity
Superconducting devices
Superconducting materials
Temperature control
Thermal engineering
Thermal stability
Thermal variables control
Thermal variables

measurement

NT: Temperature
Temperature dependence
Thermal conductivity
Thermal expansion
Thermal management
Thermal stresses
Thermoelasticity
Thermoelectricity
Thermolysis
Thermooptic effects
Thermoresistivity

Thermal force

BT: Thermal expansion

Thermal lensing

BT: Thermooptic effects
RT: Laser beams
Nonlinear optics
Optical distortion
Solid lasers

Thermal loading

BT: Thermal stresses

Thermal management

BT: Thermal factors
RT: Enthalpy
Reliability

Thermal management of electronics

BT: Components, packaging,
and manufacturing technology
NT: Electronic packaging
thermal management
Electronics cooling

Thermal noise

UF: Johnson Nyquist noise
BT: Circuit noise
RT: Conductors

Thermal plumes

USE: Thermal pollution

Thermal pollution

UF: Heat islands
Thermal plumes
Urban heat islands
BT: Pollution
RT: Air pollution
Global warming
Industrial pollution
Marine pollution
Waste heat
Water pollution

Thermal quenching

BT: Cooling

Thermal resistance

BT: Resistance
RT: Thermal conductivity

Thermal sensors

BT: Sensors
NT: Electrothermal actuators



JULY 2025 IEEE Thesaurus

	Temperature sensors	RT:	Temperature measurement Thermoresistivity
Thermal shock			
BT:	Shock (mechanics) Thermal stresses	<i>Thermo-mechanics</i>	
		USE:	Thermomechanical processes
Thermal spraying			
BT:	Spraying	<i>Thermo-optic effects</i>	
		USE:	Thermooptic effects
Thermal stability			
BT:	Stability	<i>Thermo-optical devices</i>	
RT:	Integrated circuit reliability Thermal factors	USE:	Thermooptical devices
Thermal stresses			
BT:	Thermal factors	Thermochromism	
NT:	Thermal loading Thermal shock	BT:	Thermooptic effects
		Thermocouples	
		BT:	Temperature sensors
Thermal variables control			
BT:	Control systems	Thermodynamics	
RT:	Thermal engineering Thermal factors	BT:	Science - general
NT:	HVAC Temperature control Thermal analysis	NT:	Adiabatic processes Enthalpy Fermi level Isobaric processes Isothermal processes Quasi-Fermi level
Thermal variables measurement			
BT:	Measurement	Thermoelasticity	
RT:	Calorimetry Thermal engineering Thermal factors Transducers	BT:	Thermal factors
NT:	Temperature measurement	Thermoelectric devices	
<i>Thermal video</i>		BT:	Thermoelectricity
USE:	Infrared imaging	<i>Thermoelectric effect</i>	
		USE:	Thermoelectricity
<i>Thermal wave imaging</i>			
USE:	Photothermal effects	Thermoelectric materials	
		BT:	Materials Thermoelectricity
Thermionic emission			
BT:	Nuclear and plasma	Thermoelectricity	
sciences		UF:	Seebeck effect Thermoelectric effect
RT:	Electron emission Ion emission Transmission electron	BT:	Electricity Energy conversion Thermal factors
microscopy		NT:	Electrothermal effects Peltier effect Thermoelectric devices Thermoelectric materials
	Vacuum arcs		
<i>Thermionic valves</i>			
USE:	Electron tubes	Thermoforming	
		BT:	Manufacturing systems
Thermistors			
BT:	Semiconductor devices		



JULY 2025 IEEE Thesaurus

Thermoluminescence

BT: Luminescence
RT: Chemiluminescence

Thermolysis

BT: Chemical processes
Thermal factors
NT: Thermal decomposition
Thermal degradation

Thermomechanical effects

USE: Thermomechanical
processes

Thermomechanical processes

UF: Thermo-mechanics
Thermomechanical effects
Thermomechanics
BT: Thermal analysis
RT: Heat treatment
Smart materials

Thermomechanics

USE: Thermomechanical
processes

Thermometers

BT: Temperature sensors

Thermonuclear fusion

USE: Fusion reactors

Thermooptic effects

UF: Thermo-optic effects
BT: Thermal factors
RT: Birefringence
Optical propagation
Optical reflection
Optical refraction
Thermooptical devices
NT: Thermal lensing
Thermochromism
Thermoreflectance

Thermooptical devices

UF: Thermo-optical devices
BT: Optical devices
RT: Integrated optics
Optical switches
Solid lasers
Thermooptic effects

Thermoplastic polyethylene

BT: Polyethylene
NT: UHMWPE

Thermoreflectance

BT: Thermo optic effects

Thermoreflectance imaging

BT: Optical imaging
RT: Spectroscopy

Thermoresistivity

BT: Thermal factors
RT: Temperature measurement
Thermistors

Thermostats

BT: Control equipment

Thesauri

UF: Thesaurus
BT: Knowledge representation
Writing
RT: Ontologies

Thesaurus

USE: Thesauri

Thick film circuits

BT: Circuits
Integrated circuits
RT: Hybrid integrated circuits
Thick film devices
Thick film inductors

Thick film devices

BT: Electron devices
RT: Thick film circuits
Thick films
NT: Thick film inductors

Thick film inductors

BT: Inductors
Thick film devices
RT: Microstrip components
Thick film circuits
Thick films

Thick film sensors

UF: Thick-film sensors
BT: Sensors

Thick films

BT: Films
RT: Dielectric films
Semiconductor films
Superconducting films
Thick film devices
Thick film inductors



JULY 2025 IEEE Thesaurus

Thick-film sensors

USE: Thick film sensors

RT: Displays

Liquid crystal devices

NT: Organic thin film transistors

Thickness control

BT: Mechanical variables

control

RT: Size control

Thin films

BT: Films

RT: Diamond-like carbon

Dielectric films

Epitaxial layers

Magnetic films

Metasurfaces

Molecular beam epitaxial

Thickness measurement

BT: Mechanical variables

measurement

RT: Micrometers

Size measurement

growth

Thigh

BT: Extremities

Thin film circuits

BT: Circuits

Integrated circuits

RT: Hybrid integrated circuits

Silicon-on-insulator

Thin film devices

Thin film inductors

NT:

Molecular beams

Self-assembly

Semiconductor films

Superconducting films

Superconducting thin films

Thin film devices

Thin film inductors

Vapor deposition

Buffer layers

Epitaxial growth

Semiconductor thin films

Thin film deposition

USE: Sputtering

Thin wall structures

BT: Structural shapes

RT: Honeycomb structures

Lightweight structures

Sandwich structures

Sheet materials

Structural panels

Structural shells

Thin film devices

BT: Electron devices

RT: Amorphous semiconductors

Doping profiles

Giant magnetoresistance

Thin film circuits

Thin films

NT: Film bulk acoustic

resonators

Thin film inductors

Thin film transistors

Thin-film transistors

USE: Thin film transistors

Third generation mobile communication

USE: 3G mobile communication

Thin film inductors

BT: Inductors

Thin film devices

RT: Thin film circuits

Thin films

Thomson effect

BT: Temperature measurement

Thin film sensors

BT: Sensors

Thorax

BT: Body regions

Skeleton

NT: Ribs

Sternum

Thin film transistors

UF: TFT

Thin-film transistors

BT: Active matrix technology

Field effect transistors

Thin film devices

Thorium

BT: Chemical elements

Threat assessment

UF: Threat detection

BT: Risk analysis



JULY 2025 IEEE Thesaurus

RT: Law enforcement
Public security
Security information and
event management
Terrorism
NT: Threat modeling

Threat detection
USE: Threat assessment

Threat modeling
UF: Threat modelling
BT: Systems modeling
Threat assessment
RT: Computer crime
Computer security
Cyber threat intelligence
Cyberattack
Data privacy
Data security
System analysis and design

Threat modelling
USE: Threat modeling

Three dimensional displays
USE: Three-dimensional displays

Three dimensional integrated circuits
USE: Three-dimensional
integrated circuits

Three-dimensional displays
UF: 3-D displays
3-D modeling
3-D modelling
3-D reconstruction
3D displays
3D modeling
3D modelling
3D reconstruction
Three dimensional displays
BT: Displays
RT: Metaverse
Neural radiance field
Point cloud compression
Reconstruction algorithms
Shadow mapping
Sprites (computer)
Structure from motion
NT: Bundle adjustment
X3D

Three-dimensional integrated circuits
UF: 3D integrated circuits
3D integration
3D interconnect
3DI
Three dimensional

integrated circuits
BT: Integrated circuits

Three-dimensional printing
UF: 3D printing
Additive manufacturing
BT: Manufacturing systems
Printing
RT: Ink jet printing
Rapid prototyping
NT: Bioprinting

Three-dimensional television
BT: TV

Three-dimensional vision
USE: Stereo vision

Three-phase electric power
BT: Power electronics
RT: Conductors
Voltage control

Three-term control
BT: Process control

Threshold current
BT: Current
RT: Electron devices
Lasers

Threshold voltage
BT: Voltage
RT: Integrated circuit noise
MOSFET circuits
Transistors
NT: Subthreshold current

Thresholding (Imaging)
BT: Image processing
RT: Image edge detection

Thrombosis
BT: Medical conditions



JULY 2025 IEEE Thesaurus

Through-silicon vias

UF: TSV
BT: Integrated circuits

Throughput

UF: Network throughput
BT: Communication channels
RT: Quality of transmission

Throughput (communication systems)

USE: Information rates

Thulium

BT: Chemical elements

Thumb

BT: Fingers

Thyratrons

BT: Electron tubes
RT: Gas discharge devices

Thyristor circuits

BT: Circuits
RT: Thyristors

Thyristors

UF: Diacs
SCR
Semiconductor controlled

rectifiers

Silicon controlled rectifiers
Triacs

BT: Power semiconductor

switches

RT: Thyristor circuits
NT: Photothyristors

Thyroid

BT: Glands
RT: Endocrinology
Thyroid cancer

Thyroid cancer

BT: Cancer
RT: Thyroid

Ti

USE: Titanium

Tianwen-1

USE: Interplanetary exploration

Tidal energy

UF: Tidal power
BT: Renewable energy sources
Tides

Tidal power

USE: Tidal energy

Tides

BT: Oceans
RT: Ocean circulation
Ocean dynamics
Storm surge
NT: Tidal energy

TikTok

USE: Social networking (online)

Tiles

BT: Building materials
RT: Ceramic products
Ceramics
Floors

Timber industry

USE: Lumber industry

Timbre

BT: Music

Time complexity

BT: Computational complexity
RT: Computational modeling
NT: Reversible computing

Time delay

USE: Delay effects

Time difference of arrival

UF: Time-difference-of-arrival
BT: Object detection

Time dissemination

BT: Time measurement
RT: Satellite navigation systems
Synchronization

Time division multiaccess

USE: Time division multiple access

Time division multiple access

UF: Time division multiaccess
BT: Multiaccess communication



JULY 2025 IEEE Thesaurus

Time division multiplexed

USE: Time division multiplexing

Time division multiplexing

UF: TDM
Time division multiplexed
BT: Multiplexing

Time division synchronous code division multiple access

UF: TDSCDMA
BT: Multiaccess communication
RT: 3G mobile communication
4G mobile communication
Cellular radio
Multicarrier code division

multiple access

Spread spectrum

communication

Time domain analysis

USE: Time-domain analysis

Time factors

BT: System analysis and design
RT: Bang-bang control
NT: Continuous time systems
Discrete-time systems
Time invariant systems
Time-varying systems

Time frequency analysis

USE: Time-frequency analysis

Time invariant systems

BT: Time factors
RT: Differential equations
Discrete-time systems
Feedback
Linear systems
Stability
Time-varying systems

Time measurement

BT: Measurement
RT: Time-frequency analysis
Watches
NT: Clocks
Time dissemination
Timing

Time of arrival estimation

UF: TOA estimation
Time-of-arrival estimation
BT: Parameter estimation

RT: Array signal processing
Direction-of-arrival

estimation

Signal detection

Time series analysis

UF: time-series analysis
BT: Statistics
RT: Autocorrelation
Autoregressive processes
Chaotic communication
Modeling
Random processes
Spectral analysis
Statistical analysis

Time sharing computer systems

UF: Time-sharing computer

systems

Time-sharing systems

Computers and information

processing

RT: Mainframes

Time to market

BT: Design methodology
Product development
RT: Concurrent engineering

Time varying circuits

BT: Circuits

Time varying systems

USE: Time-varying systems

Time warp simulation

BT: Discrete event simulation

Time-difference-of-arrival

USE: Time difference of arrival

Time-domain analysis

UF: FDTD
Time domain analysis
BT: Electromagnetic analysis
RT: Phase noise
State-space methods
Waves

Time-frequency analysis

UF: Time frequency analysis
BT: Frequency-domain analysis
RT: Biomedical signal

processing

Fourier transforms



JULY 2025 IEEE Thesaurus

Frequency measurement
Image processing
Power systems
Time measurement
Video signal processing

Time-of-arrival estimation

USE: Time of arrival estimation

time-series analysis

USE: Time series analysis

Time-sharing computer systems

USE: Time sharing computer systems

Time-sharing systems

USE: Time sharing computer systems

Time-varying channels

BT: Communication channels
RT: Mobile communication
Wireless LAN

Time-varying systems

UF: Time varying systems
BT: Time factors
RT: Control systems
Time invariant systems
NT: Switched systems

Timing

BT: Time measurement
RT: Clocks
Logic design
System dynamics
Timing jitter
NT: Bit rate
Delays
Synchronization

Timing jitter

BT: Jitter
RT: Timing

Tin

UF: Sn
BT: Metals
NT: Tin alloys
Tin compounds

Tin alloys

BT: Tin
RT: Alloying

NT: Niobium-tin

Tin compounds

BT: Tin

Tiny machine learning

UF: TinyML
BT: Machine learning
RT: Data analysis
Microcontrollers
Sensor systems

TinyML

USE: Tiny machine learning

Tire pressure

BT: Pressure measurement
Tires

Tires

UF: Tyres
BT: Mechanical products
Rubber products
RT: Automobile manufacture
Automotive components
Vehicles
Wheels
NT: Tire pressure

Tissue damage

BT: Lesions

Tissue engineering

UF: Tissue scaffolds
BT: Biomedical engineering
RT: Biological materials
Bioprinting
Colloidal lithography
Diamond-like carbon
Genetic engineering
Hydrogels
NT: Regeneration engineering

Tissue scaffolds

USE: Tissue engineering

Tissues

USE: Biological tissues

Titanates

USE: Titanium compounds

Titania

USE: Titanium dioxide



JULY 2025 IEEE Thesaurus

Titanium

UF: Ti
BT: Chemical elements
Metals
NT: Titanium alloys
Titanium compounds
Titanium dioxide
Titanium nitride

Titanium alloys

BT: Titanium
RT: Alloying

Titanium compounds

UF: Titanates
BT: Titanium

Titanium dioxide

UF: Titania
BT: Titanium

Titanium nitride

BT: Titanium

TMR

USE: Tunneling
magnetoresistance

TOA estimation

USE: Time of arrival estimation

Toddler

USE: Pediatrics

Tokamak devices

BT: Tokamaks
RT: Magnetic confinement
Toroidal magnetic fields

Tokamaks

BT: Fusion reactors
Plasma applications
Plasma devices
RT: Magnetic confinement
Plasma simulation
NT: Tokamak devices

Token networks

BT: Communication systems
Computer networks
Digital systems
RT: Federated identity
Local area networks
Metropolitan area networks
Wide area networks

Tokenization

BT: Data security
Natural language
processing
RT: Federated identity

Tolerance analysis

UF: Circuit tolerance analysis
Tolerating problems
BT: Manufacturing
RT: Circuit analysis
Circuit optimization
Semiconductor device

breakdown

Sensitivity

Tolerating problems

USE: Tolerance analysis

Tomographic

USE: Tomography

Tomography

UF: Tomographic
BT: Imaging
RT: Biomedical imaging
Geophysical measurement

techniques

NT: Image reconstruction
Computed tomography
Electrical capacitance

tomography

Electrical impedance

tomography

Magnetic particle imaging
Optical coherence

tomography

Positron emission

tomography

Reconstruction algorithms

Tomosynthesis

USE: Biomedical imaging

Tongue

BT: Digestive system
RT: Stomatognathic system

Tools

BT: Manufactured products
NT: Hand tools

Tooth

USE: Teeth



JULY 2025 IEEE Thesaurus

Topography (earth)

USE: Terrain mapping

BT: Mechanical power
transmission
RT: Automotive components
Drives
Engines
Gears
Shafts
Torque

Topological insulators

BT: Insulators
RT: Quantum materials

Topology

BT: Mathematics
RT: Graph theory
Morphological operations

Torque convertors

USE: Torque converters

TOPSIS

UF: Technique for order of preference by similarity to ideal solution
BT: Decision theory
RT: Decision making
Fuzzy set theory
Operations research
Optimization

Torque measurement

UF: Torque ripple
BT: Mechanical variables
measurement
RT: Pressure gauges
Torque
NT: Dynamometers

Tornado

USE: Tornadoes

Torque ripple

USE: Torque measurement

Tornadoes

UF: Tornado
Tornados
BT: Geoscience

Torso

BT: Body regions

Tornados

USE: Tornadoes

Total harmonic distortion

BT: Distortion measurement
Harmonic distortion
RT: Signal analysis

Toroidal magnetic fields

BT: Magnetic fields
RT: Tokamak devices

Total ionizing dose

BT: Radiation effects
RT: Aerospace electronics
Radiation hardening

Torpedoes

USE: Missiles

(electronics)

Torque

BT: Mechanical factors
RT: Torque control
Torque convertors
Torque measurement

Total quality management

UF: TQM
BT: Quality management
RT: Business process re-engineering
Design for quality
Quality assurance
Quality awards
Quality control
NT: Continuous improvement
Six sigma

Torque control

BT: Mechanical variables
control
RT: Admittance control
Motor drives
Torque

Total variance

BT: Probability
Statistics

Torque convertors

UF: Torque convertors

Touch screens

USE: Touch sensitive screens



JULY 2025 IEEE Thesaurus

Touch sensitive screens

UF: Touch screens
touchscreens
BT: Computer displays
RT: Haptic interfaces
Tactile sensors

Touch sensors

USE: Tactile sensors

touchscreens

USE: Touch sensitive screens

Tourism industry

BT: Industries

Towers

USE: Poles and towers

Town gas

USE: Coal gas

Toxic chemicals

BT: Chemical hazards
Toxicology

Toxicology

UF: Poisons
BT: Hazards
RT: Chemical hazards
Hazardous materials
Occupational health
Pollution
NT: Toxic chemicals

Toy industry

BT: Industries

Toy manufacturing industry

UF: Toys
BT: Manufacturing industries
RT: Electronics industry

Toys

USE: Toy manufacturing industry

TQM

USE: Total quality management

Trachea

UF: Windpipe
BT: Respiratory system

Tracheal intubation

USE: Intubation

Tracking

BT: Motion measurement
RT: Iterative learning control
Maximum likelihood

estimation

Particle tracking
Position measurement
Tracking loops
Velocity measurement
NT: Object tracking
Solar tracking
Target tracking
Trajectory tracking
Underwater tracking
Video tracking

Tracking loops

UF: Delay lock loops
BT: Linear feedback control

systems

RT: Signal processing
Modulation
Synchronization
Tracking

Traction motors

BT: Motors
RT: Battery powered vehicles
Fuel cell vehicles
Hybrid electric vehicles
Propulsion
Solar powered vehicles

Traction power supplies

BT: Power supplies

Tractors

USE: Agricultural machinery

Trade (international)

USE: International trade

Trade agreements

UF: Free trade
GATT
General agreement on

tariffs and trade

BT: Economics
RT: Free economic zones
Freeports
Globalization
International collaboration
International trade
Tariffs



JULY 2025 IEEE Thesaurus

Trade unions

USE: Industrial relations

Trademarks

BT: Law
Legal factors
RT: Copyright protection

Traffic congestion

BT: Road transportation
RT: Traffic control

Traffic control

UF: Traffic pattern
Traffic simulation
BT: Control systems
RT: Communication systems
Computer network

management

NT: Traffic congestion
Advanced driver assistance

systems

Queueing analysis
Road traffic control
Vehicle routing

Traffic load

USE: Telecommunication traffic

Traffic pattern

USE: Traffic control

Traffic simulation

USE: Traffic control

Training

UF: Technician training
BT: Education
RT: Accreditation
Continuing education
Continuing professional

development

Electronic learning
Learning management

systems

Manuals
Mentoring
Personnel
NT: Certification
Industrial training
Management training
On the job training
Qualifications
Vocational training

Training data

BT: Data analysis
RT: Few shot learning
Fish schools
Generative Pre-trainer

transformer

One shot learning

Trajectory

BT: Path planning
RT: Motion control
Object tracking
NT: Trajectory optimization

Trajectory optimization

BT: Optimization
Trajectory

Trajectory planning

BT: Path planning

Trajectory tracking

BT: Path planning
Tracking
RT: Motion control
Robot control
Underactuated surface

vessels

Trans human

USE: Transhuman

Trans-human

USE: Transhuman

Transaction databases

BT: Databases
RT: Automated teller machine
NT: Itemsets

Transactive control

USE: Transactive energy

Transactive energy

UF: Transactive control
BT: Energy management
RT: Power distribution
Power markets
Power system economics
Smart grids

Transceivers

BT: Communication equipment
RT: Land mobile radio

equipment



JULY 2025 IEEE Thesaurus

	Mobile communication		Thermal variables
	Mobile handsets	measurement	
	Optical antennas	NT:	Acoustic transducers
	Software radio		Biomedical transducers
NT:	Radio transceivers		Capacitive transducers
			Chemical transducers
Transcoding			Inductive transducers
BT:	Encoding		Piezoelectric transducers
RT:	Data compression		Resistive transducers
	Image coding		Ultrasonic transducer
	Multimedia communication	arrays	
	Video coding		
Transconductance		Transfection	
UF:	Mutual conductance	BT:	Genetic engineering
BT:	Conductivity	RT:	Gene therapy
RT:	Transconductors	<i>Transfer function</i>	
		USE:	Transfer functions
Transconductors		Transfer functions	
BT:	CMOS integrated circuits	UF:	Transfer function
RT:	Transconductance	BT:	Differential equations
		RT:	Control systems
Transcranial direct current stimulation			Damping
BT:	Neuroscience		Linear systems
	Neurostimulation	NT:	Poles and zeros
Transcranial magnetic stimulation		Transfer learning	
BT:	Neuroscience	BT:	Machine learning
	Neurostimulation		
<i>Transcriptomic technologies</i>		Transfer molding	
USE:	Transcriptomics	UF:	Resin transfer molding
			Resin transfer moulding
Transcriptomics			Transfer moulding
UF:	Transcriptomic	BT:	Production
technologies		<i>Transfer moulding</i>	
	Transcriptomics	USE:	Transfer molding
technologies		<i>Transferred electron devices</i>	
BT:	Genomics	USE:	Gunn devices
RT:	DNA		
	RNA	Transform coding	
<i>Transcriptomics technologies</i>		UF:	JPEG
USE:	Transcriptomics		JPEG2000
			MPEG
Transducers		BT:	Data compression
BT:	Electronic components	RT:	Digital photography
RT:	Electric variables		MPEG standards
measurement			Principal component
	Measurement	analysis	
	Mechanical variables		Vector quantization
measurement			
	Solenoids		
	Temperature sensors		



JULY 2025 IEEE Thesaurus

Transformer cores

BT: Magnetic cores
Magnetic devices
RT: Power transformers
Transformers

Transformer oil

USE: Oil insulation

Transformer windings

USE: Windings

Transformers

BT: Power systems
RT: Coils
Core loss
Inductive power

transmission

Transformer cores
Voltage multipliers
Windings

NT: Baluns
Current transformers
Flyback transformers
High-frequency

transformers

Instrument transformers
Phase transformers
Power transformers
Pulse transformers
Tap changers
Vision transformers

Transforms

BT: Mathematics
RT: Numerical analysis
Signal processing
Spectral analysis
NT: Discrete transforms
Empirical mode

decomposition

Fourier transforms
Karhunen-Loeve transforms
Poincare invariance
Wavelet transforms

Transgender issues

BT: Gender issues
RT: Gender equity

Transhuman

UF: Trans human
Trans-human
Transhumanism

BT: Systems, man, and
cybernetics

RT: Posthuman

Transhumanism

USE: Transhuman

Transient analysis

UF: Transients
BT: Power system transients
RT: Electromagnetic transients
Signal analysis
Steady-state

Transient gratings

USE: Gratings

Transient response

UF: Natural response
BT: Propagation
RT: Damping

Transients

USE: Transient analysis

Transinformation

USE: Mutual information

Transistors

BT: Semiconductor devices
Solid state circuits
RT: Aluminum gallium nitride
Bipolar transistors
CMOS technology
Silicon germanium
Threshold voltage
NT: Field effect transistors
Heterojunction bipolar

transistors

Millimeter wave transistors
Phototransistors
Static induction transistors

Transition metal compounds

BT: Inorganic compounds
NT: Transition metal

dichalcogenides

Transition metal dichalcogenides

BT: Semiconductor materials
Transition metal

compounds

RT: Semiconductor thin films



JULY 2025 IEEE Thesaurus

Translation

BT: Natural languages
RT: Linguistics
Machine translation
Natural language

processing

Semantics
Sign language
Terminology
Text analysis
Writing

Translational medicine

USE: Translational research

Translational research

UF: Bench to bedside
Translational medicine
Translational science
BT: Biomedical engineering
Research and development
RT: Medical diagnosis
Medical services

Translational science

USE: Translational research

Transmembrane potential

USE: Membrane potentials

Transmissible disease

USE: Infectious diseases

Transmission control protocol-internet protocol

USE: TCP/IP

Transmission control protocol/internet protocol

USE: TCP/IP

Transmission electron microscopy

UF: TEM
BT: Electron microscopy
RT: Electron beams
Thermionic emission
NT: High-resolution

transmission electron microscopy

Transmission line antennas

BT: Antennas
RT: Transmission lines

Transmission line circuits

USE: Distributed parameter

circuits

Transmission line discontinuities

BT: Transmission lines
RT: Freight handling
NT: Waveguide discontinuities

Transmission line matrix methods

BT: Mathematics
Numerical analysis

Transmission line measurements

BT: Electric variables
measurement
RT: Impedance measurement
Transmission lines

Transmission line theory

BT: Transmission lines
RT: Capacitance
Conductivity
Crosstalk
Frequency
Inductance

Transmission lines

UF: Transmission-line
BT: Power transmission
RT: Baluns
Circuit noise
Civil engineering
Coaxial cables
Distributed parameter

circuits

Helical antennas
Splicing
Transmission line antennas
Transmission line

measurements

NT: Cables
Electromagnetic

waveguides

Multiconductor transmission

lines

Planar transmission lines
Poles and towers
Power line communications
Power transmission lines
Stripline
Superconducting

transmission lines

Transmission line

discontinuities

Transmission line theory

Transmission of electric power

USE: Power transmission



JULY 2025 IEEE Thesaurus

Transmission-line

USE: Transmission lines

Transmit antennas

USE: Transmitting antennas

Transmitters

BT: Communication equipment
RT: Linearization techniques
Modulation
Optical antennas
SISO
NT: Auxiliary transmitters
Diversity methods
Neurotransmitters
Optical transmitters
Radio transmitters
Transmitting antennas

Transmitting antennas

UF: Transmit antennas
BT: Antennas
Transmitters
RT: Receiving antennas

Transpiration

BT: Water cycle
RT: Evaporation

Transplants

USE: Organ transplantation

Transponders

BT: Communication equipment
Radio communication
equipment
RT: Radio navigation
Satellite communications

Transport protocols

BT: Protocols
RT: IP networks
Overlay networks
Radio links
SONET
Synchronous digital
hierarchy
TCPIP

Transportation

BT: Intelligent transportation
systems
RT: Bridges
Freight containers
NT: Air transportation

Escalators
Green transportation
Land transportation
Public transportation
Ride hailing
Seaports
Shared transport
Smart transportation
Vehicles

Transportation industry

BT: Industries

Transversal filters

BT: Filters
RT: Digital filters
Filtering theory
Signal processing

Transverse electromagnetic cells

USE: TEM cells

Trapped ions

UF: Ion trapping
BT: Ions
RT: Laser cooling
Quantum computing

Traveling salesman

USE: Traveling salesman
problems

Traveling salesman problems

UF: Traveling salesman
Travelling salesman
problem
BT: NP-hard problem
RT: Optimization methods
Shortest path problem

Traveling wave tubes

UF: Travelling wave tubes
BT: Electron tubes

Travelling salesman problem

USE: Traveling salesman
problems

Travelling wave tubes

USE: Traveling wave tubes



JULY 2025 IEEE Thesaurus

Tree data structures

BT: Data structures
NT: Binary trees
Branching factor
Tree traversal

Tree graphs

BT: Graph theory
RT: Circuit topology

Tree searching

USE: Decision trees

Tree traversal

BT: Tree data structures

Trees (botanical)

USE: Vegetation

Trees - insulation

UF: Water trees
BT: Insulators
RT: Humidity
Insulation life
Moisture

Trellis codes

USE: Convolutional codes

Trend analysis

BT: Statistical analysis
RT: Data analysis
Pattern analysis

Triacs

USE: Thyristors

Triboelectricity

BT: Electricity
Electrostatic processes
Surface charging
RT: Electrostatic discharge
protection
Nanogenerators

Tribology

BT: Motion measurement

Tricuspid valves

USE: Heart valves

Trigen

USE: Trigeneration

Trigeneration

UF: CHCP
Combined heat, cooling
and power
Combined heat, cooling,
and power

BT: Trigen
Cooling
Heating systems
Power generation
RT: Cogeneration

Trigger circuits

BT: Circuits

Trions

BT: Electrons

Triples (Data structure)

UF: SPO
Semantic triple
Subject predicate object
Triplestore
BT: Buffer storage
RT: Database systems
Information retrieval
Metasearch
Relational databases
Text mining

Triplestore

USE: Triples (Data structure)

Trojan horses

UF: Trojans
BT: Malware
RT: Cyber espionage

Trojans

USE: Trojan horses

Trolley cars

USE: Public transportation

Tropical cyclones

UF: Cyclonic storms
Storm systems
Tropical depressions
Tropical storms
BT: Cyclones

Tropical depressions

USE: Tropical cyclones



JULY 2025 IEEE Thesaurus

Tropical storms

USE: Tropical cyclones

Troposphere

USE: Terrestrial atmosphere

Truncation errors

USE: Finite wordlength effects

Trust management

BT: Decision making
Information security

RT: Access control
Computer security
Cryptography
Privacy

NT: Trusted computing
Trustless services

Trusted computing

BT: Computer security
Trust management

Trustless applications

USE: Trustless services

Trustless services

UF: Trustless applications
BT: Trust management
RT: Blockchains

Tsunami

BT: Geoscience
RT: Storm surge

TSV

USE: Through-silicon vias

Tuberculosis

BT: Diseases

Tubes

USE: Electron tubes

Tumor

USE: Tumors

Tumor cells

USE: Tumors

Tumor detection

USE: Tumors

Tumors

UF: Tumor
Tumor cells
Tumor detection
Tumours
BT: Medical conditions
RT: Cancer
Medical diagnostic imaging
Oncology
Positron emission

tomography

Single photon emission

computed tomography

NT: Benign tumors
Brain tumors
Breast tumors
Colonic polyps
Lesions
Malignant tumors

Tumours

USE: Tumors

Tunable circuits and devices

BT: Circuits and systems
Frequency control
RT: Inductors
Tuners
Tuning
NT: RLC circuits
Tuned circuits

Tundra

BT: Ecosystems
RT: Permafrost

Tuned circuits

BT: Tunable circuits and devices

Tuners

BT: Instruments
Tuning
RT: Frequency control
Frequency synthesizers
Resonators
Tunable circuits and

devices

Tungsten

UF: Wolfram
BT: Metals



JULY 2025 IEEE Thesaurus

Tuning

BT: Frequency control
RT: Ring oscillators
Tunable circuits and

devices

NT: Laser tuning
Optical tuning
Tuners

Tuning forks

USE: Vibrations

Tunnel effect

USE: Tunneling

Tunnel field effect transistors

USE: TFETs

Tunneling

UF: Tunnel effect
BT: Electron devices
Quantum mechanics
RT: Quantum well devices
Semiconductor materials
NT: Gate leakage
Josephson effect
Magnetic tunneling
Resonant tunneling devices
Superconductive tunneling
Tunneling

magnetoresistance

Tunneling magnetoresistance

UF: TMR
Tunnelling

magnetoresistance

BT: Magnetoresistance
Tunneling
RT: Magnetoresistive devices

Tunnelling magnetoresistance

USE: Tunneling

magnetoresistance

Turbidity

BT: Water quality
RT: Light scattering

Turbines

BT: Turbomachinery
RT: Aircraft propulsion
Boilers
Compressors
Turbogenerators
Wind energy

NT: Hydraulic turbines
Wind turbines

Turbo codes

BT: Channel coding
RT: Error correction
Viterbi algorithm

Turbo generators

USE: Turbogenerators

Turbogenerators

UF: Turbo generators
BT: Turbomachinery
RT: Turbines
Wind power generation

Turbomachine blades

USE: Turbomachinery

Turbomachinery

UF: Turbomachine blades
BT: Power generation
RT: Blades
Compressors
Engines
Machine components
Mechanical systems
Pumps
NT: Turbines
Turbogenerators

Turbulent media

USE: Random media

Turing completeness

BT: Computation theory
Data handling
RT: Instruction sets

Turing machines

BT: Automata
RT: Digital computers

Turning

BT: Machining
RT: Boring
Machine tools

Turnkey project

BT: Project engineering
Project management



JULY 2025 IEEE Thesaurus

Tutorials

BT: Educational programs
IEEE indexing

TV

UF: Mobile television
TV broadcasting
Television
BT: Communications

technology

RT: Closed captioning
Electronic learning
Entertainment industry
Flat panel displays
HbbTV Standards
Image communication
Must-carry regulations
TV equipment
Telecommunication

computing

UHDTV
Visual communication
NT: Analog TV
Cable TV
Color TV
Digital TV
Mobile TV
Smart TV
Three-dimensional

television

Web TV

TV broadcasting

USE: TV

TV equipment

BT: Communication equipment
TV
RT: Video equipment
NT: Large screen displays
TV receivers

TV interference

BT: Interference
RT: Echo interference
Gaussian noise

TV receivers

BT: TV equipment

Twitter

USE: Blogs AND
Social networking (online)

two degrees of freedom

USE: 2-DOF

Two dimensional hole gas

UF: 2-d hole gas
2d hole gas
BT: Quantum well devices
RT: Quantum well lasers
Quantum wells

Two dimensional photonic crystals

USE: Photonic crystals

Two-dimensional displays

UF: 2-D displays
2D displays
BT: Displays
RT: Neural radiance field
Sprites (computer)
Structure from motion

Two-dimensional electron gas FETs

USE: MODFETs

Two-dimensional photonic crystals

USE: Photonic crystals

Two-term control

BT: Process control

Type II superconductors

BT: Superconducting materials
RT: Flux pinning
Niobium

Type testing

USE: Conformance testing

Typesetting

BT: Text processing
RT: Printing

Tyres

USE: Tires

UAM

USE: Urban air mobility

UAV

USE: Autonomous aerial vehicles

Uber

USE: Ride hailing



JULY 2025 IEEE Thesaurus

Ubicomp

USE: Pervasive computing

BT: UHF technology
RT: UHF antennas
UHF integrated circuits

Ubiquitous computing

UF: Ubiquitous wireless*
BT: Pervasive computing
RT: Ambient intelligence
NT: Context-aware services

UHF integrated circuits

UF: Ultra-high-frequency
integrated circuits
BT: Circuits
Integrated circuits
UHF circuits
UHF technology
RT: Analog integrated circuits
UHF devices

*Ubiquitous wireless**

USE: Ubiquitous computing

UDN

USE: Ultra-dense networks

UHD

USE: UHDTV

UHDTV

UF: 4K UHD
8K UHD
Super hi-vision
UHD
Ultra HD
Ultra HD TV
Ultra-high definition TV
Ultra-high definition

television

BT: HDTV
RT: ITU Standards
TV

UHF antennas

BT: Antennas
UHF technology
RT: UHF devices

UHF circuits

UF: Ultra-high-frequency
circuits
BT: Circuits
UHF technology
RT: Analog circuits
NT: UHF integrated circuits

UHF communication

UF: Ultra-high-frequency
communication
BT: Communication systems
UHF technology
RT: Mobile handsets

UHF devices

UF: Ultra-high-frequency
devices

UHF measurements

UF: Ultra-high-frequency
measurements
BT: Measurement
RT: UHF technology

UHF propagation

UF: UHF radio propagation
Ultra-high-frequency
propagation
BT: Electromagnetic
propagation
RT: Broadband antennas

UHF radio propagation

USE: UHF propagation

UHF technology

UF: Ultra-high-frequency
technology
BT: Communications
technology
RT: UHF measurements
NT: UHF antennas
UHF circuits
UHF communication
UHF devices
UHF integrated circuits

UHMWPE

UF: Ultra high molecular weight
polyethylene
BT: Thermoplastic polyethylene

UK Space Agency

USE: United Kingdom Space
Agency

UKSA

USE: United Kingdom Space
Agency



JULY 2025 IEEE Thesaurus

Ulcerative colitis

BT: Inflammatory bowel disease
RT: Crohn's disease

ULSI

USE: Ultra large scale integration

Ultra HD

USE: UHDTV

Ultra HD TV

USE: UHDTV

Ultra high molecular weight polyethylene

USE: UHMWPE

Ultra large scale integration

UF: ULSI
BT: Circuits
Integrated circuits
Large scale integration

Ultra low power*

USE: Low power electronics

Ultra reliable low latency communication

UF: URLLC
Ultra-reliable low latency

communication

Ultra-reliable low-latency

communication

BT: Low latency communication

Ultra violet

USE: Ultraviolet sources

Ultra wide-band

USE: Ultra wideband technology

Ultra wideband

USE: Ultra wideband technology

Ultra wideband antennas

UF: UWB antennas
Ultrawideband antennas
BT: Broadband antennas
Ultra wideband technology
RT: Ultra wideband radar

Ultra wideband communication

UF: UWB communication
Ultrawideband

communication

BT: Ultra wideband technology
RT: Broadband communication

Military communication

Multipath channels

Spread spectrum

communication

Ultra wideband radar

UF: UWB radar
Ultrawideband radar
BT: Radar
Ultra wideband technology
RT: Ground penetrating radar
Radar detection
Radar imaging
Synthetic aperture radar
Ultra wideband antennas

Ultra wideband technology

UF: UWB technology
Ultra wide-band
Ultra wideband
Ultra-wide-band
Ultra-wideband
Ultrawideband
Ultrawideband technology
Communications

technology

NT: Ultra wideband antennas
Ultra wideband

communication

Ultra wideband radar

Ultra-dense networks

UF: UDN
BT: Cellular networks
Mobile communication
RT: 5G mobile communication
Microcell networks

Ultra-fast optics

USE: Ultrafast optics

Ultra-high definition television

USE: UHDTV

Ultra-high definition TV

USE: UHDTV

Ultra-high definition video

BT: High definition video

Ultra-high-frequency circuits

USE: UHF circuits

Ultra-high-frequency communication

USE: UHF communication



JULY 2025 IEEE Thesaurus

Ultra-high-frequency devices

USE: UHF devices

Ultra-high-frequency integrated circuits

USE: UHF integrated circuits

Ultra-high-frequency measurements

USE: UHF measurements

Ultra-high-frequency propagation

USE: UHF propagation

Ultra-high-frequency technology

USE: UHF technology

*Ultra-low power**

USE: Low power electronics

Ultra-reliable low latency communication

USE: Ultra reliable low latency communication

Ultra-reliable low-latency communication

USE: Ultra reliable low latency communication

Ultra-violet

USE: Ultraviolet sources

Ultra-wide-band

USE: Ultra wideband technology

Ultra-wideband

USE: Ultra wideband technology

Ultracapacitors

USE: Supercapacitors

Ultracold atoms

BT: Atoms
Cooling

RT: Laser cooling
Magnetooptic effects

Ultrafast electronics

BT: High-speed electronics

Ultrafast optics

UF: Ultra-fast optics
BT: Optics

Ultrasonic applications

USE: Acoustic applications

Ultrasonic devices

USE: Acoustic devices

Ultrasonic imaging

UF: Ultrasonic techniques
Ultrasound

BT: Ultrasonics, ferroelectrics,
and frequency control

RT: Amniocentesis
Biomedical imaging

NT: Ultrasonography

Ultrasonic techniques

USE: Ultrasonic imaging

Ultrasonic transducer arrays

BT: Transducers

Ultrasonic transducers

BT: Ultrasonics, ferroelectrics,
and frequency control

RT: Nondestructive testing
Piezoelectricity
Sonar

Ultrasonic variables measurement

BT: Measurement

Ultrasonics

USE: Acoustics

Ultrasonics, ferroelectrics, and frequency control

NT: Ferroelectric materials
Frequency control
Piezoelectricity
Pyroelectricity
Ultrasonic imaging
Ultrasonic transducers

Ultrasonography

BT: Biomedical image
processing

NT: Ultrasonic imaging
Sonogram

Ultrasound

USE: Ultrasonic imaging

Ultraviolet sources

UF: UV sources
Ultra violet
Ultra-violet

BT: Light sources
RT: Lamps



JULY 2025 IEEE Thesaurus

	Lasers	<i>Underactuated marine surface vehicles</i>	
<i>Ultrawideband</i>		USE:	Underactuated surface vessels
USE:	Ultra wideband technology	<i>Underactuated marine vehicles</i>	
<i>Ultrawideband antennas</i>		USE:	Underactuated surface vessels
USE:	Ultra wideband antennas		
<i>Ultrawideband communication</i>		Underactuated surface vessels	
USE:	Ultra wideband communication	UF:	USV
<i>Ultrawideband radar</i>			Underactuated marine surface vehicles
USE:	Ultra wideband radar		Underactuated marine vehicles
<i>Ultrawideband technology</i>			Underactuated unmanned surface vehicles
USE:	Ultra wideband technology		Underactuated unmanned surface vessels
Umbilical cable apparatus		BT:	Marine vehicles
UF:	Power supplies to	RT:	Control systems
BT:	Power supplies		Robots
<i>UML</i>			Trajectory tracking
USE:	Unified modeling language	<i>Underactuated unmanned surface vehicles</i>	
<i>UMTS</i>		USE:	Underactuated surface vessels
USE:	3G mobile communication	<i>Underactuated unmanned surface vessels</i>	
Uncertain systems		USE:	Underactuated surface vessels
UF:	Parameter uncertainty		
BT:	Mathematics	<i>Underarm</i>	
RT:	Control systems	USE:	Axilla
	Linear matrix inequalities	<i>Underground communication cables</i>	
	Robustness	USE:	Communication cables
	Uncertainty	<i>Underground object detection</i>	
Uncertainty		USE:	Buried object detection
BT:	Probability	<i>Underground objects</i>	
RT:	Cognitive science	USE:	Buried object detection
	Fuzzy sets	Underground power cables	
	Nonlinear dynamical	BT:	Power cables
systems		<i>Undersea communication</i>	
NT:	Uncertain systems	USE:	Underwater communication
<i>Uncrewed</i>		Underwater acoustics	
USE:	Autonomous vehicles	BT:	Acoustics
<i>Uncrewed aerial systems</i>		<i>Underwater autonomous vehicles</i>	
USE:	Autonomous aerial vehicles	USE:	Autonomous underwater vehicles
<i>Uncrewed aircraft</i>			
USE:	Autonomous aerial vehicles		



JULY 2025 IEEE Thesaurus

Underwater cables

UF: Marine cables
Sub-sea cables
Submarine cables
Submersible cables
Subsea cables
BT: Cables
Marine technology

Underwater equipment
Underwater navigation
Underwater structures

Underwater communication

UF: Undersea communication
BT: Communication systems
Marine technology
Underwater technology

Underwater drones

USE: Autonomous underwater vehicles

Underwater equipment

UF: Diving equipment
Flotation devices
BT: Marine technology
Underwater technology
RT: Underwater vehicles
NT: Hydrophones
Rebreathing equipment

Underwater exploration robots

USE: Autonomous underwater vehicles

Underwater navigation

BT: Navigation
Underwater technology
RT: Marine navigation
Underwater vehicles

Underwater robots

USE: Autonomous underwater vehicles

Underwater sensor networks

USE: Wireless sensor networks

Underwater structures

BT: Marine technology
Underwater technology

Underwater technology

UF: Submarine technology
BT: Marine technology
RT: Underwater vehicles
NT: Marine robots
Underwater communication

Underwater tracking

BT: Tracking

Underwater vehicles

UF: Aquatic vehicles
Submarines
Submersibles
BT: Marine vehicles
RT: Marine robots
Marine technology
Military robotics
Underwater equipment
Underwater navigation
Underwater technology
Autonomous underwater vehicles

vehicles

Remotely guided

underwater vehicles

Undulators

UF: Wiggler magnets
BT: Magnetic devices
Synchrotrons
RT: Free electron lasers
X-rays

Unemployment

BT: Human resource management

Uniaxial strain

BT: Strain

Unicast

BT: Computer networks
RT: Streaming media

Unified messaging

BT: Electronic mail
Electronic messaging

Unified modeling language

UF: UML
BT: Specification languages
RT: Client-server systems
Common Information Model

(electricity)

Uniform Resource Identifier

USE: Uniform resource locators



JULY 2025 IEEE Thesaurus

Uniform resource locators

UF: URL
Uniform Resource Identifier
Uniform resource name
BT: Web sites

Uniform resource name

USE: Uniform resource locators

Uninterruptible power systems

BT: Power systems
RT: Batteries
Emergency power supplies
Power supplies
Protection

Unit under test

USE: Device under test

United Kingdom Space Agency

UF: UK Space Agency
UKSA
BT: Organizations

Units (measurement)

USE: Measurement units

Universal mobile telecommunication service

USE: 3G mobile communication

Universal motors

BT: Motors

Universal Serial Bus

UF: USB
BT: Communication standards
Information technology

Universities

USE: Educational institutions

Unmanned aerial vehicles

USE: Autonomous aerial vehicles

Unmanned air vehicles

USE: Autonomous aerial vehicles

AND

Remotely piloted aircraft

Unmanned airborne vehicles

USE: Autonomous aerial vehicles

Unmanned automobiles

USE: Autonomous automobiles

Unmanned autonomous cars

USE: Autonomous automobiles

Unmanned autonomous vehicles

USE: Autonomous vehicles

Unmanned surface vehicles

USE: Autonomous vehicles

Unmanned systems

USE: Autonomous systems

Unmanned underwater vehicles

USE: Autonomous underwater vehicles

Unmanned vehicles

USE: Autonomous vehicles

Unpiloted aerial vehicles

USE: Autonomous aerial vehicles

Unpiloted air vehicles

USE: Autonomous aerial vehicles

Unsolicited e-mail

UF: Junk e-mail
Junk email
Spam
Spamming
Unsolicited electronic e-mail

mail

Unsolicited electronic email
Unsolicited email
BT: Electronic mail
RT: Computer crime
Cyberbullying
Office automation
Privacy-invasive software

Unsolicited electronic e-mail

USE: Unsolicited e-mail

Unsolicited electronic email

USE: Unsolicited e-mail

Unsolicited email

USE: Unsolicited e-mail

Unsupervised learning

BT: Learning systems
RT: Autoencoders
Deep learning
Formal concept analysis



JULY 2025 IEEE Thesaurus

networks	Generative adversarial	<i>Urban farming</i>	USE:	Urban agriculture
networks	Perception evolution	<i>Urban heat islands</i>	USE:	Thermal pollution
	Reinforcement learning	<i>Urban modeling</i>	USE:	Urban planning
	Self-supervised learning			
	Semisupervised learning			
	Supervised learning			
	Temporal difference			
learning		Urban planning		
	Text summarization	UF:		City planning
	Weak supervision			Urban modeling
NT:	Competitive learning	BT:		Urban areas
		RT:		Public infrastructure
Uplink		NT:		Urban policy
BT:	Satellite communications			
Upper bound		Urban policy		
BT:	Boundary conditions	BT:		Urban planning
RT:	Lower bound			
Uranium		Urban pollution		
BT:	Chemical elements	BT:		Pollution
		<i>Urinary calculosis</i>		
		USE:		Kidney stones
Urban agriculture		<i>URL</i>		
UF:	Urban farming	USE:		Uniform resource locators
BT:	Agriculture			
RT:	Urban areas			
Urban air mobility		<i>URLLC</i>		
UF:	UAM	USE:		Ultra reliable low latency
BT:	Aircraft navigation	communication		
RT:	Air traffic control			
	Autonomous aerial vehicles	Urogenital system		
	Helicopters	BT:		Anatomy
	Urban areas	NT:		Bladder
	Vertiports			Kidney
				Reproductive system
Urban areas		Urology		
UF:	Cities and towns	UF:		Genitourinary surgery
	City	BT:		Medical specialties
	Metropolitan areas			
	Urban environments	<i>US activities</i>		
BT:	Geography	USE:		IEEE United States
RT:	Public infrastructure	activities		
	Public transportation			
	Urban agriculture	US Department of Agriculture		
	Urban air mobility	BT:		US Government
	Vertiports			
NT:	Smart cities	US Department of Commerce		
	Urban planning	BT:		US Government
		NT:		NIST
<i>Urban environments</i>				NTIA
USE:	Urban areas			National Oceanic and



JULY 2025 IEEE Thesaurus

Atmospheric Administration

US Department of Defense

UF: DoD
BT: US Government

US Department of Energy

UF: DoE
BT: US Government

US Department of Health and Human Services

BT: US Government agencies
NT: National Institutes of Health

US Department of Homeland Security

BT: US Government
RT: Biological weapons
Chemical weapons
Cyberattack
Nuclear weapons
Terrorism
Weapons of mass

destruction

US Department of Transportation

UF: DOT
BT: US Government

US Government

BT: Government
NT: US Department of

Agriculture

Commerce

Homeland Security

Transportation

US Government agencies

BT: US Government
RT: Patents
NT: FAA
FCC
FDA
NASA
US Department of Health

and Human Services

US local government

BT: US Government

Usability

BT: Software design

USB

USE: Universal Serial Bus

User centered design

UF: User-centered design
User-centred design
BT: Design methodology
RT: Technology acceptance

model

User computer interfaces

USE: User interfaces

User experience

BT: Ergonomics
RT: Affective computing
Human computer

interaction

Human factors
Metaverse
Mobile computing
Quality of experience
Technology acceptance

model

NT: User interfaces
Cyberbullying

User friendliness

USE: Human computer

interaction

User generated content

USE: User-generated content

User interfaces

UF: Man-machine interfaces
User computer interfaces
User-computer interfaces
BT: Systems, man, and

cybernetics

RT: Adaptive learning
Affordances
Ambient intelligence
Browsers
Computer interfaces
Computer peripherals
Displays
Gaze tracking
Metaverse



JULY 2025 IEEE Thesaurus

interaction	NT:	User experience	<i>UWB antennas</i>	
		Web design	USE:	Ultra wideband antennas
		Audio user interfaces	<i>UWB communication</i>	
		Brain-computer interfaces	USE:	Ultra wideband
		Data visualization	communication	
		Emotion recognition	<i>UWB radar</i>	
		Exoskeletons	USE:	Ultra wideband radar
		Graphical user interfaces	<i>UWB technology</i>	
		Human computer	USE:	Ultra wideband technology
		Human vehicle systems	V2G	
User preference	BT:	Behavioral sciences	USE:	Vehicle-to-grid
		Decision making	V2I	
			USE:	Vehicle-to-infrastructure
			V2V	
			USE:	Vehicular ad hoc networks
			V2X	
			USE:	Vehicle-to-everything
			Vacancy defects	
			BT:	Crystallography
			Vaccines	
User-centered design	USE:	User centered design	BT:	Medical services
			RT:	Immune response
			Vacuum arc remelting	
			BT:	Melt processing
			Vacuum arcs	
			BT:	Vacuum breakdown
			RT:	Electron emission
				Thermionic emission
				Vacuum systems
			Vacuum breakdown	
User-centred design	USE:	User centered design	BT:	Dielectric breakdown
			RT:	Electron emission
				Vacuum systems
			NT:	Vacuum arcs
			Vacuum electronics	
			BT:	Vacuum technology
			<i>Vacuum energy</i>	
			USE:	Elementary particle vacuum
			<i>Vacuum plating</i>	
			USE:	Vapor deposition
User-computer interfaces	USE:	User interfaces		
User-created content	USE:	User-generated content		
User-generated content	UF:	Consumer-generated		
media	BT:	User generated content		
		User-created content		
		Data acquisition		
USV	USE:	Underactuated surface		
vessels	BT:	Reproductive system		
		Cervix		
Uterus	NT:			
Utility programs	BT:	System software		
Utility theory	BT:	Mathematics		
		Supply and demand		
UV sources	USE:	Ultraviolet sources		



JULY 2025 IEEE Thesaurus

Vacuum systems

BT: Vacuum technology
RT: Bellows
Casimir effect
Leak detection
Vacuum arcs
Vacuum breakdown
NT: Gettering

Pulsed laser deposition
Substrates
Thin films

Vapor trails

USE: Contrails

Vapour deposition

USE: Vapor deposition

Vapour trails

USE: Contrails

VAR

USE: Reactive power

Varactors

BT: Capacitors
Semiconductor diodes

Variable frequency drives

USE: Variable speed drives

Variable optical attenuators

USE: Optical attenuators

Variable selection

USE: Input variables

Variable speed drives

UF: Variable frequency drives
BT: Drives
RT: Magnetic gears
Motor drives
NT: Pitch control (audio)

Variable structure systems

BT: Adaptive systems

Varistors

BT: Resistors
RT: Arresters
Semiconductor devices

Vascular system

USE: Circulatory system

VCO

USE: Voltage-controlled oscillators

VCR

USE: Video recording

Vacuum technology

BT: Electron devices
RT: Field emitter arrays
Gettering
Space charge
NT: Photomultipliers
Vacuum electronics
Vacuum systems

Vacuum tubes

USE: Electron tubes

VAD

USE: Voice activity detection

Valuation

USE: Cost accounting

Valves

BT: Fluid flow
Hydraulic equipment
Machine components
RT: Fluid flow control
Manifolds
NT: Microvalves

Vanadium

BT: Chemical elements

Vanes

USE: Blades

VANET

USE: Vehicular ad hoc networks

Vanpools

USE: Shared transport

Vapor deposition

UF: Vacuum plating
Vapour deposition
BT: Materials processing
Surface treatment
RT: Coatings
Electrochemical deposition
MOCVD



JULY 2025 IEEE Thesaurus

VCSEL

USE: Vertical cavity surface emitting lasers

Vector optimization

USE: Pareto optimization

Vector processors

BT: Microprocessors

Vector quantisation

USE: Vector quantization

Vector quantization

UF: Vector quantisation
BT: Quantization (signal)
RT: Codes
Encoding
Image coding
MPEG 4 Standard
Speech coding
Transform coding
Video coding

Vectors

BT: Linear algebra
RT: Eigenvalues and eigenfunctions
Signal processing

Vegetable oils

BT: Oils
RT: Food products

Vegetation

UF: Trees (botanical)
BT: Biology
RT: Enhanced vegetation index
Forestry
Vegetation mapping
NT: Crops
Forests
Marine vegetation
Normalized difference
vegetation index

Vegetation mapping

BT: Geoscience and remote sensing
RT: Agriculture
Forestry
Geophysical measurement
techniques
Remote sensing
Terrain mapping

Vegetation

Vehicle crash testing

BT: Automotive engineering
Product safety engineering
RT: Collision avoidance
Vehicles

Vehicle detection

BT: Automotive engineering
NT: License plate recognition

Vehicle driving

BT: Automotive engineering
NT: Autonomous driving
Driver behavior

Vehicle dynamics

BT: Automotive engineering
RT: Hardware-in-the-loop
simulation
Vehicles
NT: Rollover

Vehicle license plate recognition

USE: License plate recognition

Vehicle plate detection

USE: License plate recognition

Vehicle routing

BT: Traffic control
RT: Intelligent vehicles
Path planning

Vehicle safety

UF: Automobile safety
Automotive safety
BT: Automotive engineering
Safety
RT: Pedestrians
Vehicle-to-everything
NT: Advanced driver assistance
systems
Lane departure warning
systems
Lane detection

Vehicle to vehicle communication

USE: Vehicular ad hoc networks

Vehicle-to-everything

UF: V2X
BT: Communication systems
Intelligent vehicles



JULY 2025 IEEE Thesaurus

systems RT: Advanced driver assistance

On board unit
Road safety
Vehicle safety
Vehicular ad hoc networks

NT: Vehicle-to-infrastructure

Vehicle-to-grid

UF: V2G

BT: Electric vehicles
Smart grids

RT: Battery powered vehicles
Demand side management
Distributed power

generation

Fuel cell vehicles
Hybrid electric vehicles
Load management
Propulsion
Solar powered vehicles

Vehicle-to-infrastructure

UF: V2I

BT: Vehicle-to-everything

Vehicle-to-vehicle

USE: Vehicular ad hoc networks

Vehicles

BT: Transportation
Vehicular and wireless

technologies

RT: Mobile robots
Tires
Vehicle crash testing
Vehicle dynamics
Vehicular ad hoc networks
NT: Bicycles
Connected vehicles
Electric vehicles
Hydrogen powered vehicles
Hypersonic vehicles
Intelligent vehicles
Internet of Vehicles
Land vehicles
Military vehicles
Remotely guided vehicles
Space vehicles

Vehicular ad hoc networks

UF: Ad hoc vehicle networks
Ad hoc vehicular networks
V2V
VANET

communication

Vehicle to vehicle

Vehicle-to-vehicle

BT: Ad hoc networks

RT: Dedicated short range

communication

Internet of Vehicles
Mobile communication
Vehicle-to-everything
Vehicles
Vehicular automation
Road side unit

NT:

Vehicular and wireless technologies

UF: Vehicular technologies

NT: Automotive engineering
Land mobile radio

equipment

Navigation
Propulsion
Vehicles
Wireless sensor networks

Vehicular automation

BT: Automation

RT: Autonomous vehicles

Intelligent vehicles

Mechatronics

Mobile robots

Multi-agent systems

Vehicular ad hoc networks

Vehicular technologies

USE: Vehicular and wireless

technologies

Veins

BT: Blood vessels

Velocity control

UF: Rotational measurement

Rotational speed

Speed control

BT: Mechanical variables

control

RT: Aerospace control

Angular velocity

Cruise control

Motion control

Motor drives

Servosystems

NT: Angular velocity control



JULY 2025 IEEE Thesaurus

Velocity measurement

UF: Speed measurement
BT: Mechanical variables
measurement
RT: Angular velocity
Doppler measurement
Flowmeters
Motion measurement
Slow light
Tracking

Vented

USE: Ventilators

Ventilation

BT: Cooling
RT: Air conditioning
HVAC
Temperature control
Vents
NT: Fans

Ventilators

UF: Vented
BT: Biomedical equipment
RT: Intubation
Respiratory system

Ventricle system

BT: Brain

Vents

BT: Mechanical products
RT: Air conditioning
Buildings
Ducts
Space heating
Ventilation
Windows

Venture capital

BT: Economics
Financial management
RT: Business continuity
Enterprise resource
planning
Entrepreneurship
Research and development
management
Risk analysis

Venus

BT: Planets

Vermin control

USE: Pest control

Veroboard

USE: Stripboard circuit

Vertical cavity surface emitting lasers

UF: VCSEL
emitting lasers
Vertical cavity surface-
emitting lasers
Vertical-cavity surface-
emitting lasers
BT: Surface emitting lasers
RT: Distributed Bragg reflectors
P-i-n diodes

Vertical cavity surface-emitting lasers

USE: Vertical cavity surface
emitting lasers

Vertical recording

USE: Perpendicular magnetic
recording

Vertical takeoff and landing aircraft

UF: VTOL aircraft
BT: Aircraft
RT: Vertiports
NT: Helicopters

Vertical-cavity surface-emitting lasers

USE: Vertical cavity surface
emitting lasers

Vertiports

BT: Airports
RT: Air traffic control
Aircraft navigation
Urban air mobility
Urban areas
Vertical takeoff and landing

aircraft

Very high speed integrated circuits

UF: VHSIC
BT: Integrated circuits

Very large scale integration

UF: VLSI
Very-large-scale-integration
BT: Circuits
Integrated circuits
Large scale integration
RT: Damascene integration
Nanotechnology



JULY 2025 IEEE Thesaurus

	Parameter extraction	<i>Vibrating bodies</i>	
NT:	Neuromorphics	USE:	Vibrations
<i>Very long instruction word</i>		Vibration control	
USE:	VLIW	BT:	Mechanical variables
<i>Very-high-frequency circuits</i>		control	
USE:	VHF circuits	RT:	Damping
<i>Very-high-frequency devices</i>			Isolation technology
USE:	VHF devices		Shock absorbers
			Vibration measurement
			Vibrations
<i>Very-large-scale-integration</i>		Vibration measurement	
USE:	Very large scale integration	BT:	Mechanical variables
<i>Very-long-instruction-word</i>		measurement	
USE:	VLIW	RT:	Modal analysis
			Vibration control
			Vibrations
			Vibrometers
Vesicles		<i>Vibrational signal processing</i>	
BT:	Cells (biology)	USE:	Signal processing
VHDL		Vibrations	
UF:	VHSIC Hardware	UF:	Mechanical vibrations
Description Language			Tuning forks
BT:	Hardware design		Vibrating bodies
languages		BT:	Mechanical factors
RT:	Electronic design	RT:	Acoustic noise
automation and methodology			Acoustics
	Field programmable gate		Damping
arrays			Dynamics
	Integrated circuits		Elastodynamics
	Parallel programming		Nanogenerators
VHF circuits			Oscillators
UF:	Very-high-frequency circuits		Resonance
BT:	Circuits		Vibration control
RT:	Analog circuits		Vibration measurement
	Helical antennas		
	VHF devices		
VHF devices		Vibrometers	
UF:	Very-high-frequency	BT:	Meters
devices		RT:	Vibration measurement
BT:	Communications	<i>Video analytics</i>	
technology		USE:	Visual analytics
RT:	VHF circuits	<i>Video annotation</i>	
<i>VHSIC</i>		USE:	Image annotation
USE:	Very high speed integrated	<i>Video chats</i>	
circuits		USE:	Web conferencing
<i>VHSIC Hardware Description Language</i>			
USE:	VHDL		



JULY 2025 IEEE Thesaurus

Video codecs

BT: Codecs
Communication equipment
Video equipment
RT: Decoding
Image coding
MPEG 4 Standard
MPEG standards
Video coding

Videogames
Videos
NT: Role playing games

Video coding

UF: Advanced video coding
Videocoding
BT: Video signal processing
RT: Image coding
MPEG 4 Standard
MPEG standards
Rate distortion theory
Streaming media
Transcoding
Vector quantization
Video codecs
NT: DVD
High efficiency video coding

Video compression

BT: Video signal processing
RT: Data compression

Video conferencing

UF: Videoconferencing
BT: Communication systems
RT: Meetings

Video conversion

USE: Video restoration

Video description

BT: Assistive technologies
Audio systems
Videos

Video equipment

UF: Camcorders
BT: Communication equipment
RT: Consumer electronics
TV equipment
Video recording
NT: Optical projectors
Video codecs
Videos

Video games

UF: Computer games
Video-games

Video on demand

BT: Streaming media
RT: Broadband communication
Digital multimedia
broadcasting

Video recording

UF: VCR
VTR
BT: Recording
RT: DVD
Image storage
Mobile video
Video equipment
NT: High definition video
Video restoration
Videos
Webcams

Video restoration

UF: Video conversion
BT: Video recording
RT: Computer vision
Deblurring
Image restoration
Video sequences

Video reviews

BT: IEEE indexing

Video sequence

USE: Video sequences

Video sequences

UF: Video sequence
BT: Computer graphics
RT: Image databases
Image processing
Multimedia computing
Video restoration

Video signal processing

BT: Multidimensional signal
processing
RT: Authentication
Fall detection
Firewire
Gaze tracking
IEEE 1394 Standard
Image annotation
Image recognition



JULY 2025 IEEE Thesaurus

	MPEG 4 Standard		Videotex	
	MPEG standards		UF:	Viewdata
	Motion detection		BT:	Communication systems
	Object tracking			Information services
	Streaming media		RT:	Data communication
	Time-frequency analysis			Teletext
NT:	Motion artifacts			
	Text detection		<i>Viewdata</i>	
	Video coding		USE:	Videotex
	Video compression			
<i>Video streaming</i>			Virology	
USE:	Streaming media		BT:	Microbiology
			RT:	Epidemics
				Viruses (medical)
Video surveillance			Virtual artifact	
BT:	Surveillance		BT:	Artificial intelligence
RT:	Motion detection			Brain
				Digital systems
Video tracking				Virtual reality
BT:	Image motion analysis			
	Tracking		Virtual assistants	
<i>Video-games</i>			UF:	Alexa
USE:	Video games			Bixby
				Cortana
				Siri
<i>Videocoding</i>				Smart assistants
USE:	Video coding		BT:	Computer applications
				Conversational artificial
Videoconferences			intelligence	
BT:	Collaborative tools		RT:	Digital humans
				Smart devices
<i>Videoconferencing</i>			NT:	Personal voice assistants
USE:	Video conferencing			
			Virtual colonoscopy	
<i>Videogames</i>			BT:	Colonoscopy
USE:	Video games			
			<i>Virtual currency</i>	
Videophone systems			USE:	Online banking
UF:	Picture phones			
	Picturephones		Virtual enterprises	
BT:	Communication systems		BT:	Computer applications
RT:	Image communication			Data processing
	Telephony			Economics
	Visual communication			Operations research
			RT:	Electronic commerce
Videos				Internet
UF:	Multimedia products			Research and development
BT:	Video equipment			Virtual manufacturing
	Video recording			Virtual reality
NT:	Deepfakes		Virtual environments	
	Text to video		BT:	Virtual reality
	Video description		RT:	Internet of Things
	Video games			



JULY 2025 IEEE Thesaurus

base	Management information	networking	Software defined
NT:	Metaverse		Virtual prototyping
	Virtual links		Virtual reality
	Virtualization		
<i>Virtual factories</i>		Virtual manufacturing	
USE:	Virtual manufacturing	UF:	Digital factories
			Virtual factories
Virtual groups		BT:	Computer applications
UF:	Virtual teams	RT:	CADCAM
BT:	Collaboration		Computer integrated
Virtual LAN		manufacturing	
UF:	VLAN		Concurrent engineering
	Virtual local area network		Research and development
BT:	Local area networks		Virtual enterprises
	Network function		Virtual prototyping
virtualization		NT:	Virtual reality
networking	Software defined		Virtual machining
RT:	Virtual private networks	<i>Virtual meetings</i>	
		USE:	Web conferencing
<i>Virtual learning</i>		Virtual museums	
USE:	Electronic learning	BT:	Digital images
			Museums
Virtual links		RT:	Augmented reality
BT:	Communication networks		Cultural differences
	Routing protocols		Digital art
	Telecommunication control		Digital photography
	Virtual environments		Digital preservation
RT:	Ethernet		Digital recording
	Routing		Digital representation
			Virtual reality
<i>Virtual local area network</i>		<i>Virtual office</i>	
USE:	Virtual LAN	USE:	Remote working
Virtual machine monitors		Virtual power plants	
UF:	Hypervisors	BT:	Distributed power
	VMMs	generation	
BT:	Computers and information	RT:	Cloud computing
processing			Power engineering
RT:	Platform virtualization	computing	
			Power system control
Virtual machines			Power system management
UF:	VM	Virtual private networks	
BT:	Virtualization	UF:	VPN
NT:	Process virtual machines	BT:	Computer networks
	System virtual machines	RT:	Data security
Virtual machining			Internet
BT:	Machining		Local area networks
	Virtual manufacturing		Virtual LAN
RT:	Network function		Wide area networks
virtualization		NT:	Extranets



JULY 2025 IEEE Thesaurus

Virtual prototyping

BT: Design methodology
RT: Product development
Prototypes
Rapid prototyping
Research and development
Virtual machining
Virtual manufacturing
Virtual reality

Virtual reality

BT: Computer graphics
Graphics
RT: 3D audio
Affordances
Cyberspace
Digital humans
Digital representation
Digital transformation
Digital twins
Immersive audio
Metaverse
Mixed reality
Solid modeling
Spatial computing
Virtual enterprises
Virtual machining
Virtual manufacturing
Virtual museums
Virtual prototyping
Virtualization
NT: Augmented reality
Augmented virtuality
Avatars
Cybersickness
Extended reality
Immersive experience
Immersive learning
Photorealistic images
Virtual artifact
Virtual environments

Virtual seminars

USE: Web conferencing

Virtual sensing

USE: Soft sensors

Virtual sensors

USE: Soft sensors

Virtual teams

USE: Virtual groups

virtual twins

USE: Digital twins

Virtualization

BT: Virtual environments
RT: Network function

virtualization

Software defined

networking

Virtual reality
Virtual machines

Virulence

BT: Microbiology

Viruses (computer)

USE: Computer viruses

Viruses (medical)

BT: Microorganisms
RT: COVID-19
Measles
Virology
NT: Bacteriophages
Coronaviruses
Influenza
Zika virus

Viruses (microorganisms)

USE: Microorganisms

Visa gold

USE: Credit cards

Viscera

BT: Body regions

Viscosity

BT: Fluids
Measurement
Resistance
RT: Navier-Stokes equations
Rheology

Visible light communication

UF: VLC
BT: Data communication
Optical fiber communication
RT: Light emitting diodes
Light fidelity
Lighting

Vision (biological)

USE: Visual systems



JULY 2025 IEEE Thesaurus

Vision Based Robot Control

USE: Visual servoing

Vision captioning

USE: Closed captioning

Vision defects

UF: Amblyopia
Color blindness
Myopia
BT: Visual systems
RT: Eye diseases
Visual impairment

Vision impairment

USE: Visual impairment

Vision sensors

BT: Sensors
RT: Image processing

Vision systems (nonbiological)

USE: Machine vision

Vision transformers

UF: ViTs
BT: Computer vision
Transformers
RT: Convolutional neural

networks

Visual

USE: Visualization

Visual analytics

UF: Video analytics
BT: Visualization
RT: Information representation

Visual BASIC

BT: Computer languages
RT: Software engineering
Software tools
System software

Visual captioning

USE: Closed captioning

Visual communication

BT: Communication systems
RT: Image communication
Image resolution
TV
Videophone systems

Visual databases

UF: Moving object databases
BT: Databases
NT: Point cloud compression

Visual effects

BT: Visualization
RT: Animation
Computer graphics

Visual impairment

UF: Vision impairment
BT: Medical conditions
Blindness
Cataracts
Eye diseases
Vision defects
NT: Macular degeneration

Visual information retrieval

BT: Information retrieval
RT: Cross modal retrieval
Image matching

Visual odometry

BT: Computer vision
Robots

Visual perception

BT: Visual systems

Visual place recognition

UF: VPR
BT: Image matching
RT: Image recognition
Location awareness

Visual prostheses

USE: Visual prosthesis

Visual prosthesis

UF: Electronic visual prosthesis
Visual prostheses
BT: Prosthetics
RT: Blindness

Visual servoing

UF: Vision Based Robot Control
BT: Motion control
Robot vision systems

Visual systems

UF: Vision (biological)
BT: Sense organs
RT: Head



JULY 2025 IEEE Thesaurus

	Machine vision	VLIW	
	Saliency detection	UF:	Very long instruction word
NT:	Vision defects		Very-long-instruction-word
	Visual perception	BT:	Central Processing Unit
<i>Visualisation</i>		<i>VLPR</i>	
USE:	Visualization	USE:	License plate recognition
Visualization		<i>VLSI</i>	
UF:	Visual	USE:	Very large scale integration
	Visualisation		
BT:	Computer graphics	<i>VM</i>	
	Graphics	USE:	Virtual machines
RT:	Animation		
	Confusion matrices	<i>VMMs</i>	
	Design tools	USE:	Virtual machine monitors
	Educational technology		
	Image forensics	Vocabulary	
	YOLO	BT:	Information retrieval
NT:	Curve fitting		Lexicon
	Surface reconstruction	RT:	Ranking (statistics)
	Visual analytics		
	Visual effects	Vocational training	
Viterbi algorithm		UF:	NVQ
BT:	Algorithms		National vocational
RT:	Dynamic programming	qualification	
	Information theory	BT:	Training
	Mathematics	RT:	Industrial training
	Multiaccess communication		Multiskilling
	Probability	Vocoders	
	Speaker recognition	BT:	Communication equipment
	Stochastic processes		Telephone equipment
	Turbo codes	RT:	Speech codecs
			Speech coding
Vitrification		<i>Voice activity</i>	
BT:	Chemical technology	USE:	Voice activity detection
RT:	Radioactive waste disposal		
<i>ViTs</i>		Voice activity detection	
USE:	Vision transformers	UF:	Speech activity detection
			Speech detection
Vivaldi antennas			VAD
UF:	Vivaldi-antennas		Voice activity
BT:	Broadband antennas	BT:	Speech processing
		RT:	Personal voice assistants
<i>Vivaldi-antennas</i>			Speech coding
USE:	Vivaldi antennas		Speech recognition
			Speech synthesis
<i>VLAN</i>		Voice mail	
USE:	Virtual LAN	BT:	Message systems
		RT:	Electronic mail
<i>VLC</i>			Office automation
USE:	Visible light communication		



JULY 2025 IEEE Thesaurus

Voltage multipliers

BT: Circuits
 RT: AC-DC power converters
 Charge pumps
 Particle accelerators
 Rectifiers
 Transformers
 Voltage control
 NT: Capacitors
 Diodes

Voltage regulation

USE: Voltage control

Voltage sags

USE: Power quality

Voltage source inverters

BT: Inverters

Voltage transformers

UF: Potential transformers
 BT: Instrument transformers
 RT: Voltage measurement

Voltage-controlled oscillators

UF: VCO
 Voltage controlled

oscillators

BT: Oscillators
 RT: Ring oscillators

Voltage-mode control

USE: Voltage control

Voltage-source converters

UF: Modular multi-level
 converters
 VSC
 Voltage-source convertors
 BT: Converters
 Power conversion
 RT: AC-DC power converters
 HVDC transmission
 Power electronics
 Pulse width modulation
 converters

Voltage-source convertors

USE: Voltage-source converters

Voltmeters

BT: Meters
 RT: Voltage measurement

Volume estimation

USE: Volume measurement

Volume measurement

UF: Volume estimation
 BT: Mechanical variables
 measurement
 RT: Size measurement

Volume relaxation

BT: Mechanical factors

Volunteer computing

USE: Computer applications AND
 Distributed processing

Vortices, optical

USE: Optical vortices

Voting

BT: Government
 NT: Electronic voting

VPN

USE: Virtual private networks

VPR

USE: Visual place recognition

VPU

USE: Graphics processing units

VSC

USE: Voltage-source converters

VTOL aircraft

USE: Vertical takeoff and landing
 aircraft

VTR

USE: Video recording

W3C

UF: World Wide Web
 Consortium
 BT: Standards organizations

W3C Standards

BT: Standards publications

Wafer bonding

BT: Bonding processes
 Semiconductor device
 manufacture



JULY 2025 IEEE Thesaurus

Wafer level packaging

USE: Wafer scale integration

Wafer scale integration

UF: Wafer level packaging
Wafer-level packaging
BT: Circuits
Integrated circuits
Large scale integration

Wafer-level packaging

USE: Wafer scale integration

Walking

USE: Legged locomotion

WAMS

USE: Wide area measurements

WAN

USE: Wide area networks

WANs

USE: Wide area networks

WAP

USE: Wireless access points

AND

protocol

Wireless application

Warehousing

BT: Material storage
RT: Production facilities
Stacking
Storage automation

Warning systems

USE: Alarm systems

Warranties

UF: Product warranties
Product warranty
BT: Product liability

Washing machines

BT: Electric machines
Electrical products
Home appliances
Home automation

Wasm

USE: Webassembly

Waste compaction

USE: Waste reduction

Waste disposal

BT: Waste management
RT: Effluents
Pollution
Radioactive waste
Sanitary engineering
Slag
NT: Incineration
Landfills
Radioactive waste disposal

Waste electrical and electronic equipment

USE: Electronic waste

Waste handling

BT: Waste management
RT: Radioactive waste disposal
Waste reduction
NT: Sewage treatment
Sludge treatment
Waste handling equipment
Wastewater treatment

Waste handling equipment

BT: Waste handling
RT: Materials handling
equipment
Remote handling
equipment

Waste heat

BT: Energy conversion
RT: Boilers
Cogeneration
Energy conservation
Industrial waste
Thermal pollution

Waste incineration

USE: Incineration

Waste management

BT: Environmental
management
RT: Anaerobic digestion
Biodegradation
Circular economy
Composting
Effluents
Pollution control
Production management
Radioactive waste



JULY 2025 IEEE Thesaurus

	Sanitary engineering		Sanitary engineering
	Slag		Sludge treatment
	Waste materials		Waste management
	Wastewater treatment		Wastewater
NT:	Waste disposal		Water conservation
	Waste handling		Water pollution
	Waste recovery	NT:	Ozonation
	Waste reduction		
Waste materials		Watches	
UF:	Refuse	BT:	Clocks
	Solid waste	RT:	Consumer products
BT:	Materials		Time measurement
RT:	Fuels		
	Radioactive pollution	Water	
	Sanitary engineering	UF:	H2O
	Waste management	BT:	Liquids
	Waste recovery	RT:	Evaporation
	Water pollution		Hydrodynamics
NT:	Effluents		Hydrologic measurements
	Electronic waste		Hydrology
	Food waste		Lakes
	Industrial waste		Oceans
	Plastic waste		Reservoirs
	Radioactive waste		Rivers
	Slurries		Steam engines
	Wastewater		Wastewater
Waste recovery			Water heating
BT:	Waste management		Water pollution
RT:	Waste materials		Water resources
	Waste reduction		Water splitting
			Water storage
Waste reduction		NT:	Wetlands
UF:	Waste compaction		Coastlines
BT:	Waste management		Freshwater
RT:	Design for disassembly		Groundwater
	Waste handling		Normalized difference
	Waste recovery	water index	
NT:	Compaction		Streams
			Water cycle
			Water quality
Wastewater		Water conservation	
BT:	Waste materials	UF:	Water recycling
RT:	Industrial waste	BT:	Environmental
	Sanitary engineering	management	
	Sludge treatment	RT:	Wastewater treatment
	Wastewater treatment		Water resources
	Water		Water storage
	Water pollution	NT:	Desalination
	Water pumps		
Wastewater treatment		Water cycle	
UF:	Dissolved air flotation	BT:	Water
BT:	Waste handling	NT:	Evaporation
RT:	Rubber products		Precipitation
			Transpiration



JULY 2025 IEEE Thesaurus

Water energy

USE: Hydroelectric power
generation

Water heating

BT: Heating systems
RT: District heating
Water

Water jet cutting

UF: Abrasive water jet cutting
BT: Cutting tools

Water monitoring

BT: Monitoring
Water resources

Water pollution

BT: Oceanic engineering and
marine technology

RT: Pollution
Effluents
Industrial pollution
Lakes
Oils
Pesticides
Rivers
Sanitary engineering
Sewage treatment
Thermal pollution
Waste materials
Wastewater
Wastewater treatment
Water
Water quality
Water resources
NT: Marine pollution

Water power

USE: Hydroelectric power
generation

Water pumps

BT: Pumps
RT: Automotive components
Cooling
Hydraulic equipment
Irrigation
Photovoltaic systems
Wastewater

Water quality

BT: Water
RT: Water pollution
NT: Turbidity

Water recycling

USE: Water conservation

Water resources

BT: Environmental
management
RT: Lakes
Remote sensing
Rivers
Water
Water conservation
Water pollution
Watersheds
NT: Aquifers
Desalination
Eutrophication
Reservoirs
Stormwater
Water monitoring

Water splitting

BT: Chemical processes
RT: Chemical reactions
Hydrogen
Photochemistry
Water

Water storage

UF: Water-storage
BT: Material storage
RT: Aquifers
Crops
Lakes
Land use planning
Water
Water conservation
NT: Dams
Reservoirs

Water trees

USE: Trees - insulation

Water-storage

USE: Water storage

Watermark

USE: Watermarking

Watermarking

UF: Audio watermarking
Digital watermarking
Image watermarking
Watermark
BT: Security
RT: Copyright protection



JULY 2025 IEEE Thesaurus

Embossing Internet of Things

BT: Energy resources
Ocean waves
RT: Renewable energy sources

Watersheds

BT:	Hydrology
	Land surface
RT:	Rivers
	Water resources

Wave propagation
USE: Propagation

Wave scattering
USE: Scattering

Watt hour meters

USE: Watthour meters

Waveform analysis
USE: Signal analysis

Watt-hour meters

USE: Watthour meters

Waveform generators
USE: Signal generators

Watt-hour meters

UF:	Watt hour meters Watt-hour meters
BT:	Wattmeters
RT:	Energy measurement

Waveguide components

BT:	Electromagnetic
RT:	Circulators
	Conformal mapping
	Gap waveguide
	Helical antennas
	Waveguide theory
NT:	Optical waveguides
	Power combiners
	Power dividers

Wattmeters

BT:	Meters
RT:	Power measurement
NT:	Watt-hour meters

WAVE

USE: Wireless Access in Environments

Waveguide discontinuities

UF:	Irises
	Waveguide obstacles
BT:	Transmission line
discontinuities	
RT:	Electromagnetic
waveguides	
	Loaded waveguides
	Waveguide theory
NT:	Reflection coefficient
	Waveguide transitions

Wave diffraction

USE: Diffraction

Wave energy conversion

UF:	Wave energy converters
BT:	Energy conversion
	Hydroelectric power

generation

Wave energy converters

USE: Wave energy conversion

Waveguide junctions

BT: Junctions

Wave equations

USE: Propagation

Waveguide lasers

BT:	Electromagnetic waveguides
RT:	Lasers
NT:	Substrate integrated waveguides

Wave functions

BT:	Waves
RT:	Conformal mapping
	Elementary particle

exchange interactions

NT: Functional analysis
Wavelet analysis
Wavelet domain

Waveguide obstacles

USE: Waveguide discontinuities

Wave power



JULY 2025 IEEE Thesaurus

Waveguide theory

UF: Guided electromagnetic
wave propagation
BT: Electromagnetic
waveguides
RT: Antennas
Conformal mapping
Mathematics
Mode matching methods
Waveguide components
Waveguide discontinuities
Waveguide transitions

Waveguide transitions

BT: Waveguide discontinuities
RT: Waveguide theory

Wavelength assignment

BT: Optical fiber networks

Wavelength conversion

BT: Optical fibers
RT: Wavelength converters

Wavelength converters

UF: Wavelength convertors
BT: Converters
RT: Wavelength conversion

Wavelength convertors

USE: Wavelength converters

Wavelength division multiplexed

USE: Wavelength division
multiplexing

Wavelength division multiplexing

UF: WDM
multiplexed
Wavelength-division
multiplexing
BT: Multiplexing
RT: Bragg gratings
Multicast communication
NT: WDM networks

Wavelength measurement

BT: Measurement
RT: Acoustic measurements
Electromagnetic
measurements
Frequency measurement
Hyperspectral sensors

Optical variables

measurement

Wavelength routing

BT: Routing

Wavelength-division multiplexing

USE: Wavelength division
multiplexing

Wavelet analysis

BT: Wave functions
RT: Wavelet transforms
NT: Multiresolution analysis

Wavelet coefficients

BT: Wavelet transforms

Wavelet domain

BT: Wave functions

Wavelet neural networks

USE: Neural networks

Wavelet packets

BT: Wavelet transforms

Wavelet transforms

BT: Transforms
RT: Harmonic analysis
Signal analysis
Signal processing
Signal representation
Wavelet analysis
NT: Biorthogonal modulation
Continuous wavelet
transforms
Discrete wavelet transforms
Wavelet coefficients
Wavelet packets

Waves

BT: Physics
RT: Acoustic propagation
Acoustic scattering
Electromagnetic
propagation
Electromagnetic radiation
Electromagnetic scattering
Time-domain analysis
NT: Atmospheric waves
Berry phase
Doppler effect
Electrodynamics
Magnetostatic waves



JULY 2025 IEEE Thesaurus

	Matter waves		US Department of
	Plasma waves	Homeland Security	
	Propagation		
	Reflectivity	Wearable antennas	
	Seismic waves	BT:	Antennas
	Shock waves		Wearable devices
	Solitons	RT:	Body area networks
	Surface acoustic waves		Textile antennas
	Wave functions		Wearable sensors
WDM		Wearable computers	
USE:	Wavelength division	USE:	Wearable devices
multiplexing		Wearable computing	
WDM networks		USE:	Wearable devices
BT:	Wavelength division		
multiplexing		Wearable devices	
Weak supervision		UF:	Body borne computers
UF:	Weakly supervised learning		Wearable computers
BT:	Learning systems		Wearable computing
RT:	Machine learning		Wearable electronics
	Semisupervised learning	BT:	Wearables
	Supervised learning		Computers
	Unsupervised learning	RT:	Pervasive computing
			Fall detection
Weakly supervised learning			Internet of Medical Things
USE:	Weak supervision		Smart textiles
			Soft electronics
Weapons			Textile electrodes
UF:	Bomb	NT:	Smart glasses
	Munitions		Wearable Health Monitoring
	Ordinance	Systems	
BT:	Military equipment		Wearable antennas
RT:	Defense industry	Wearable electronics	
	Electronic countermeasures	USE:	Wearable devices
	Military systems		
	Terrorism	Wearable Health Monitoring Systems	
NT:	Biological weapons	UF:	Apple watch
	Chemical weapons		Fitbit
	Guns		Smartwatch
	Missiles		WHMS
	Nuclear weapons	BT:	Smart healthcare
	Projectiles		Wearable devices
	Weapons of mass	RT:	Electronic healthcare
destruction			Smart devices
Weapons of mass destruction		Wearable robots	
UF:	WMD	UF:	Hardsuit
BT:	Weapons		Powered armor
RT:	Biological weapons		Powered exoskeleton
	Chemical weapons	BT:	Robots
	National security	RT:	Assistive technologies
	Terrorism		Biomechanics
			Human-robot interaction



JULY 2025 IEEE Thesaurus

	Medical robotics		Textile fibers
	Military equipment		Textile industry
	Military robotics		Textiles
	Military systems		
	Mobile robots	Web 2.0	
	Orthotics	BT:	Internet
	Prosthetics		
	Service robots	<i>Web 3.0</i>	
	Soft robotics	USE:	Semantic Web
	Wearable sensors		
Wearable sensors		Web and internet services	
BT:	Sensors	UF:	Baidu
RT:	Biosensors		Internet services
	Body sensor networks	BT:	Web services
	Image sensors		
	Infrared detectors	<i>Web assembly</i>	
	Magnetic sensors	USE:	Webassembly
	Nanosensors		
	Optical sensors	<i>Web browsers</i>	
	Pressure sensors	USE:	Browsers
	Sensor arrays		
	Sensor fusion	<i>Web cams</i>	
	Tactile sensors	USE:	Webcams
	Wearable antennas		
	Wearable robots	Web conferencing	
	Wireless sensor networks	UF:	Online conferencing
			Video chats
<i>Wearables</i>			Virtual meetings
USE:	Wearable devices		Virtual seminars
			Web meetings
<i>Weather</i>			Web seminars
USE:	Meteorology		Webcasts
			Webinars
Weather forecasting		BT:	Internet
UF:	Weather prediction		Online services
BT:	Meteorology		Web services
NT:	Wind forecasting	RT:	Teleconferencing
Weather modification		Web design	
BT:	Meteorology	UF:	Web site design
RT:	Climate variability	BT:	Web sites
		RT:	Authoring systems
			Content management
<i>Weather prediction</i>			Software design
USE:	Weather forecasting		User interfaces
		NT:	Web page design
Weathering			Web pages
BT:	Geological processes		
RT:	Biodegradation	<i>Web filters</i>	
	Erosion	USE:	Information filters
Weaving		<i>Web meetings</i>	
BT:	Textile technology	USE:	Web conferencing
RT:	Cotton		
	Fabrics		



JULY 2025 IEEE Thesaurus

Web mining

BT: Data mining

Web ontology language

USE: OWL

Web page design

BT: Web design

Web pages

BT: Web design

Web real-time communications

USE: WebRTC

Web robot

USE: Bot (Internet)

Web search

BT: Search methods

RT: Metasearch

NT: Crawlers

Web seminars

USE: Web conferencing

Web servers

BT: Servers
Web services

Web services

BT: Internet
Middleware
Asynchronous

communication

Cloud computing
Dark Web
Service computing
Webcams

NT: Business Process

Execution Language

Mashups
Message services
Service-oriented

architecture

Simple object access

protocol

Web TV
Web and internet services
Web conferencing
Web servers
WebRTC

Web services business process execution language

USE: Business Process
Execution Language

Web site design

USE: Web design

Web sites

UF: Reddit
BT: Computer applications
Information retrieval
Computer networks
Content management
Electronic commerce
Extranets
Internet
Portals
Session hijacking
Social networking (online)
World Wide Web
NT: Uniform resource locators
Web design

Web television

USE: Web TV

Web TV

UF: Web television
BT: Broadcasting
TV
Web services

Webassembly

UF: Wasm
Web assembly
BT: Binary codes
RT: Browsers
C++ languages
Java

Webcams

UF: Web cams
BT: Cameras
Video recording
RT: Web services

Webcasts

USE: Web conferencing

Webinars

USE: Web conferencing



JULY 2025 IEEE Thesaurus

WebRTC

UF: Web real-time

communications

BT: Application programming

interfaces

Real-time systems

Web services

NT:

Materials processing

Spot welding

Well logging

BT:

Geophysics

Petroleum industry

RT:

Oil drilling

Seismology

WeChat

USE: Message services AND
Social networking (online)

Wet electrodes

BT:

Electrodes

RT:

Biomedical electrodes

WEEE

USE: Electronic waste

Wet etching

BT:

Etching

Weibo

USE: Blogs

Wetlands

BT:

Ecosystems

Geoscience

RT:

Aquatic ecosystems

Estuaries

Hydrology

Lakes

Rivers

Water

Weibull distribution

BT: Statistical distributions

RT: Failure analysis

Probability

Reliability engineering

Statistics

Weibull fading channels

BT: Fading channels

Whale optimization algorithms

BT:

Algorithms

RT:

Biomimetics

Weight control

BT: Mechanical variables

control

Whales

BT:

Marine animals

Weight measurement

BT: Mechanical variables

measurement

WhatsApp

USE:

Freeware AND
Internet telephony

Weighted linear combination

USE: Weighted sum model

Wheelchairs

BT:

Assistive technologies

Weighted sum model

UF: SAW

Simple additive weighting

WLC

WSM

Weighted linear

combination

BT: Decision theory

Wheels

BT:

Mechanical products

RT:

Automobile manufacture

Automotive components

Automotive engineering

Axles

Flanges

Machine components

Manufacturing

Production

Steering systems

Structural plates

Tires

Welding

BT: Fabrication

Joining processes

RT: Bonding processes

Brazing

Fasteners

Manufacturing



JULY 2025 IEEE Thesaurus

Whispering gallery modes

UF: Whispering-gallery modes
BT: Optics
RT: Microcavities

Whispering-gallery modes

USE: Whispering gallery modes

White blood cells

BT: Blood
RT: Leukemia
NT: Eosinophils
Lymphocytes
Mast cells

White box

USE: Glass box

White matter

BT: Central nervous system
RT: Action potentials
Axons
Brain
Learning systems

White noise

BT: Noise
RT: AWGN channels
Music
Random number

generation

NT: AWGN

White spaces

BT: Radio spectrum
management

White-box

USE: Glass box

Whitebox

USE: Glass box

WHMS

USE: Wearable Health Monitoring
Systems

Whole body imaging

BT: Biomedical image
processing

Whole-body PET

BT: Positron emission
tomography

wi-fi

USE: Wireless fidelity

Wi-Fi 6

USE: IEEE 802.11ax Standard

Wi-Max

USE: WiMAX

Wide area measurement systems

USE: Wide area measurements

Wide area measurements

UF: WAMS
Wide area measurement

systems

Wide-area measurement

systems

Wide-area measurements
BT: Measurement

Wide area networks

UF: WAN
WANs
BT: Communication systems
Computer networks
RT: Electronic learning
Frame relay
IEEE 802.3 Standard
Internetworking
LAN interconnection
LoRa
Multiprocessor

interconnection

Open systems
Protocols
Token networks
Virtual private networks
Low-power wide area

networks

Wide band gap semiconductors

BT: Semiconductor materials
RT: Gallium alloys

Wide dynamic range

USE: High dynamic range

Wide-area measurement systems

USE: Wide area measurements

Wide-area measurements

USE: Wide area measurements



JULY 2025 IEEE Thesaurus

Wideband

BT: Bandwidth
Communication systems
RT: Narrowband

Wideband amplifiers

USE: Broadband amplifiers

Wideband antennas

USE: Broadband antennas

Wiener filters

BT: Noise reduction

wifi

USE: Wireless fidelity

Wiggler magnets

USE: Undulators

WiGig

USE: IEEE 802.11 Standard

Wild fires

USE: Wildfires

Wildfires

UF: Wild fires
BT: Fires

Wildlife

BT: Animals

WiMax

USE: WiMAX

Wimax

USE: WiMAX

WiMAX

UF: Wi-Max
WiMax
Wimax
Worldwide Interoperability

for Microwave Access

BT: Wireless communication
RT: IEEE 802.16 Standard

Winches

BT: Materials handling
equipment
RT: Cables
Lifting equipment

Wind

BT: Meteorology
RT: Sea surface
Wind energy
Wind power generation
NT: Wind forecasting
Wind speed
Wind stress

Wind energy

UF: Wind-energy
BT: Energy resources
RT: Turbines
Wind
Wind forecasting
Wind power generation
Wind turbines
NT: Wind energy conversion

Wind energy conversion

BT: Energy conversion
Wind energy
Wind power generation

Wind energy generation

BT: Power generation
RT: Wind forecasting
Wind turbines
NT: Wind energy integration

Wind energy integration

UF: Wind integration
Wind power grid integration
BT: Power systems
Wind energy generation
RT: Power grids

Wind farm

USE: Wind farms

Wind farms

UF: Wind farm
BT: Energy resources

Wind forecasting

BT: Weather forecasting
Wind
RT: Wind energy
Wind energy generation
Wind turbines

Wind integration

USE: Wind energy integration



JULY 2025 IEEE Thesaurus

Wind power

USE: Wind power generation

Wind power generation

UF: Wind power
BT: Power generation
RT: Renewable Portfolio

Standard

Turbogenerators
Wind
Wind energy
NT: Wind energy conversion

Wind power grid integration

USE: Wind energy integration

Wind speed

BT: Wind
RT: Wind stress

Wind stress

BT: Stress
Wind
RT: Wind speed

Wind tunnels

BT: Aerospace testing
Test facilities
RT: Aerodynamics
Aerospace simulation

Wind turbines

BT: Turbines
RT: Doubly fed induction
generators
Wind energy
Wind energy generation
Wind forecasting

Wind-energy

USE: Wind energy

Windings

UF: Transformer windings
BT: Electromagnetic fields
RT: AC machines
Coils
Electric machines
Magnetic circuits
Power transformers
Rotating machines
Transformers
NT: Machine windings

Windows

BT: Building materials
Manufactured products
RT: Glass products
Vents

Windpipe

USE: Trachea

Windscreen wipers

USE: Automotive components

Windscreens

USE: Automotive components

Windshield wipers

USE: Automotive components

Windshields

USE: Automotive components

Windup

BT: Feedback control

Wine industry

BT: Industry applications
NT: Wineries

Wineries

BT: Wine industry

Wire

BT: Materials
RT: Communication cables
Conductors
Wiring

Wire drawing

BT: Wires
RT: Manufacturing
Production

Wireless Access in Vehicular Environments

UF: WAVE
BT: Wireless networks
RT: IEEE 802.11p Standard
Intelligent vehicles

Wireless access networks

USE: Wireless networks

Wireless access points

UF: WAP
BT: Computer networks
Hardware



JULY 2025 IEEE Thesaurus

	Mobile computing		WiMAX
	Wireless communication		Wireless access points
RT:	IEEE 802.11 Standard		Wireless application
	Routing protocols	protocol	
	Wireless LAN		Wireless networks
	Wireless fidelity		
<i>Wireless ad hoc network</i>		<i>Wireless digital devices</i>	
USE:	Mobile ad hoc networks	USE:	Personal digital devices
Wireless application protocol		<i>Wireless energy transmission</i>	
UF:	WAP	USE:	Wireless power transfer
BT:	Protocols		
	Wireless communication	Wireless fidelity	
		UF:	wi-fi
			wifi
Wireless cellular systems		BT:	Wireless LAN
BT:	Wireless networks	RT:	IEEE 802.11 Standard
			Light fidelity
<i>Wireless charging</i>			Radio frequency
USE:	Inductive charging		Wireless access points
			Wireless communication
Wireless communication		Wireless LAN	
UF:	Wireless systems	UF:	Radio LAN
BT:	Communication systems		WLAN
RT:	Bluetooth		Wireless Metropolitan Area
	Dynamic spectrum access		
	IEEE 802.11 Standard	Networks	
	IEEE 802.11p Standard		Wireless local area
	IEEE 802.22 Standard	networks	
	Inductive charging		
	Light fidelity	BT:	Local area networks
	Location awareness	RT:	Ad hoc networks
	Long Term Evolution		Bluetooth
	Machine-to-machine		Butler matrices
communications			IEEE 802.11 Standard
	Mobile applications		IEEE 802.11e Standard
	Paging systems		IEEE 802.11g Standard
	Regional area networks		IEEE 802.11n Standard
	Wireless LAN		IEEE 802.15 Standard
	Wireless fidelity		LAN interconnection
NT:	Cognitive radio		Personal area networks
	Cooperative communication		Radio communication
communication	Dedicated short range		Time-varying channels
			Wireless access points
	GSM		Wireless communication
	MIMO		Wireless sensor networks
	MISO	NT:	Light fidelity
	Open wireless architecture		Wireless fidelity
communications	Point-to-multipoint	<i>Wireless local area networks</i>	
		USE:	Wireless LAN
	Roaming	Wireless mesh networks	
	SISO		
	Smart devices	BT:	Communication systems
	Spatial diversity	RT:	Wireless sensor networks
	WRAN		



JULY 2025 IEEE Thesaurus

Wireless Metropolitan Area Networks

USE: Wireless LAN

Wireless networks

UF: Over-the-air
Wireless access networks
BT: Wireless communication
RT: Acoustic communication

(telecommunication)

IEEE 802.11p Standard
IEEE 802.22 Standard
Nanocommunication
WRAN
Wireless power

transmission

NT: AODV
Self-organizing networks
Wireless Access in

Vehicular Environments

Wireless cellular systems

Wireless personal area networks

UF: WPAN
BT: Personal area networks

Wireless power transfer

UF: Wireless energy

transmission

BT: Wireless power

transmission

NT: Simultaneous wireless

information and power transfer

Wireless power transmission

BT: Power transmission
RT: Conductors
Wireless networks
NT: Wireless power transfer

Wireless regional area networks

USE: WRAN

Wireless security

USE: Communication system

security

Wireless sensor networks

UF: Underwater sensor
BT: Communication systems
Vehicular and wireless

technologies

RT: Ad hoc networks
Cyber-physical systems
Edge computing

communications

Internet of Things

Machine-to-machine

Microsensors

Nanocommunication

Sensors

Wearable sensors

Wireless LAN

Wireless mesh networks

Body sensor networks

Event detection

NT:

Wireless systems

USE: Wireless communication

Wires

BT: Structural shapes

RT: Nanowires

Springs

NT: Wire drawing

Wiring

BT: Electric variables

RT: Building services

Cables

Conductors

Layout

Metallization

Printed circuits

Wire

WLAN

USE: Wireless LAN

WLC

USE: Weighted sum model

WMD

USE: Weapons of mass
destruction

Wolfram

USE: Tungsten

Women's issues

USE: Gender issues

Wood alcohol

USE: Methanol

Wood industry

BT: Industries

RT: Forestry

Pulp and paper industry

Pulp manufacturing



JULY 2025 IEEE Thesaurus

Wood naphtha

USE: Methanol

Wood poles

USE: Poles and towers

Wood spirits

USE: Methanol

Wool

BT: Agricultural products

Textiles

RT: Clothing

Fabrics

Natural fibers

Textile fibers

Yarn

Word cloud

USE: Tag clouds

Word processing

USE: Text processing

Work-place

USE: Employment

Workability

BT: Mechanical factors

Workflow management software

UF: Workflow management

system

BT: Office automation

Workflow management system

USE: Workflow management software

Working conditions

USE: Employee welfare

Working environment noise

UF: Environmental noise

BT: Acoustic noise

RT: Ergonomics

Hazards

Occupational health

Occupational safety

Workplace

USE: Employment

Workshops

USE: Conferences

Workstation clusters

USE: Cluster computing

Workstations

BT: Microcomputers

RT: Cluster computing

Computer displays

Computer graphics

Peer-to-peer computing

World Wide Web

UF: WWW

BT: Computer applications

RT: Cyberspace

InterPlanetary File System

Internet

Web sites

NT: Bot (Internet)

Mashups

World Wide Web Consortium

USE: W3C

Worldwide Interoperability for Microwave Access

USE: WiMAX

Worm gears

USE: Gears

Worms

USE: Grippers

Worms (computer)

USE: Computer worms

Wounds

BT: Injuries

Woven fabric composites

USE: Fabrics

WP-BPEL

USE: Business Process Execution Language

WPAN

USE: Wireless personal area networks

WRAN

UF: Wireless regional area

BT: Regional area networks
Wireless communication

RT: IEEE 802.22 Standard



JULY 2025 IEEE Thesaurus

	Wireless networks	X-ray applications	BT: X-rays RT: Collimators Phantoms X-ray detection X-ray telescopes NT: X-ray imaging X-ray lasers
Wrapping	BT: Packaging RT: Packaging machines		
Wrist	BT: Arms RT: Carpal tunnel syndrome		
Writing	UF: Business writing Engineering writing Report writing Technical reports Technical writing BT: Professional communication RT: Manuals Proposals Translation NT: Abstracts Bibliographies Biographies Braille Dictionaries Documentation Grammar Readability metrics Resumes Reviews Thesauri	X-ray astronomy BT: Astronomy X-rays RT: X-ray telescopes X-ray detection BT: X-rays RT: Diagnostic radiography Diffraction Electromagnetic radiation Phantoms Radiography X-ray applications X-ray detectors X-ray imaging X-ray detectors BT: Ionizing radiation sensors RT: Crystallography Electromagnetic radiation Gamma-ray detectors Radiation detectors X-ray detection X-ray imaging X-rays X-ray diffraction BT: Electromagnetic diffraction X-ray imaging BT: X-ray applications Gamma-ray detectors Phantoms Radiography X-ray detection X-ray detectors NT: Plasma x-ray sources X-ray lasers BT: Lasers X-ray applications RT: Plasma x-ray sources X-rays X-ray lithography BT: Lithography	
<i>Written character recognition</i>	USE: Handwriting recognition		
<i>Written characters</i>	USE: Handwriting recognition		
<i>Written-character recognition</i>	USE: Handwriting recognition		
WSM	USE: Weighted sum model		
WWW	USE: World Wide Web		
<i>WWW robot</i>	USE: Bot (Internet)		
<i>X reality</i>	USE: Extended reality		



JULY 2025 IEEE Thesaurus

X-ray scattering

UF: XRD
BT: X-rays

XR

USE: Extended reality

X-ray telescopes

BT: Telescopes
X-rays
RT: Aerospace electronics
X-ray applications
X-ray astronomy

XRD

USE: X-ray scattering

XSS

USE: Cross-site scripting

X-ray tomography

BT: X-rays

Y-Ba-Cu-O

USE: Yttrium barium copper

oxide

X-rays

BT: Medical services
RT: Collimators
Electromagnetic radiation
Synchrotron radiation
Undulators
X-ray detectors
X-ray lasers
NT: X-ray applications
X-ray astronomy
X-ray detection
X-ray scattering
X-ray telescopes
X-ray tomography

Yachts

USE: Boats

Yagi-Uda antennas

BT: Antennas

Yarn

BT: Textile fibers
RT: Wool

YBa2Cu3O7

USE: Yttrium barium copper

oxide

YBCO

USE: Yttrium barium copper

oxide

X3D

BT: Computer graphics
Three-dimensional displays
RT: ISO Standards

Yield estimate

USE: Yield estimation

XAI

USE: Explainable AI

Yield estimation

UF: Yield estimate
BT: Estimation
RT: Circuit analysis
Crops
Microprocessor chips

Xenon

BT: Gases

Xerography

USE: Electrophotography

YOLO

UF: YOLOv3
YOLOv5
You only look once
BT: Object detection
RT: Real-time systems
Visualization

XML

UF: Automatic Test Markup
Language
Extensible Markup
Language
BT: Markup languages

YOLOv3

USE: YOLO

Xplainable AI

USE: Explainable AI

YOLOv5

USE: YOLO

XPM

USE: Cross-phase modulation



JULY 2025 IEEE Thesaurus

You only look once

USE: YOLO

BT: Zero-shot learning

Deep learning

Young modulus

USE: Young's modulus

Zero touch networks

USE: Autonomous networks

Young's modulus

UF: Tensile modulus

Young modulus

BT: Solids

Zero Trust

BT: Security

RT: Access control

Authentication

Permission

Ytterbium

BT: Chemical elements

Zero voltage switching

UF: ZVS

Zero-voltage switching

Yttrium

BT: Chemical elements

BT: Switching circuits

Metals

RT: Inverters

NT: Yttrium compounds

Switching converters

Yttrium barium copper oxide

UF: Y-Ba-Cu-O

YBCO

YBa₂Cu₃O₇

BT: High-temperature

superconductors

Zero-current switching

USE: Zero current switching

Zero-shot learning

USE: Zero shot learning

Zero-touch networks

USE: Autonomous networks

Yttrium compounds

BT: Yttrium

RT: Alloying

NT: Yttrium barium copper

oxide

Zero-voltage switching

USE: Zero voltage switching

Zeros

USE: Poles and zeros

ZCS

USE: Zero current switching

Zigbee

BT: Radio communication

RT: Automation

Biomedical equipment

Bluetooth

IEEE 802.15 Standard

Personal area networks

Personal communication

Zero correlation zone

BT: Codes

Multiaccess communication

Sequential analysis

Zero current switching

UF: ZCS

Zero-current switching

BT: Switching circuits

RT: Inverters

Switching converters

networks

Smoke detectors

Zero knowledge proof

BT: Cryptography

Protocols

Zinc

UF: Zn

BT: Metals

NT: Zinc compounds

Zero shot learning

UF: ZSL



JULY 2025 IEEE Thesaurus

Zinc compounds

BT: Zinc
NT: Zinc oxide

Zinc oxide

UF: ZnO
BT: Zinc compounds
NT: Indium gallium zinc oxide

ZINDO

USE: Computational modeling

Zip fasteners

USE: Fasteners

Zirconium

BT: Chemical elements
NT: Zirconium compounds

Zirconium compounds

BT: Zirconium

Zn

USE: Zinc

ZnO

USE: Zinc oxide

Zoology

BT: Biology
NT: Animals
Entomology

Zooplankton

BT: Plankton

ZSL

USE: Zero shot learning

ZVS

USE: Zero voltage switching

