1.3 Basic concepts and terminology

Robotics is a rapidly growing field of technology that has the potential to revolutionize many areas of our lives. It involves the development of machines that can imitate or surpass human capabilities in performing a variety of tasks. Robotics is an interdisciplinary field of science, engineering, and technology that deals with the design, construction, operation, and application of robots.

Robotics is a complex field involving both hardware and software components. Hardware components include physical robotic parts such as motors, sensors, and actuators, while software components include algorithms and programming languages used to control the robot and its functions. Robotics also requires an understanding of various disciplines including mathematics, physics, mechanics, and computer science.

At its core, robotics is all about autonomy. Autonomy is the process of designing a robot to perform and complete specific tasks, such as carrying out a surgical procedure or assembling a car. Automation can help reduce costs, increase productivity, and improve the safety of both workers and products.

When it comes to terminology, there are a few key terms used in robotics. Robot is a machine that is capable of performing tasks on its own or under the control of a computer program. Robotics is the science and technology of robots and their design, construction, operation, and application. Sensors measure and detect environmental conditions, such as temperature, pressure, or light. Actuators convert electrical signals into mechanical motion. Computer vision is the ability of robots to interpret visual information from cameras. AI, or artificial intelligence, is used to give robots the ability to learn and think for themselves.

Robotics is an exciting field with many potential applications. Taking the time to become familiar with the basic concepts and terminology can help you better understand and apply robotics in practical situations.

1.3.1 What is robotics

- Science of robots. :)
- What is a robot?
- How does the robot works?
- How are robots constructed?
- What is intended task of the robot?
- How do we control a robot?

1.3.2 What is a robot?

- automated (coffee) machine
- …
- Printer
- 3D printer
- CNC machine
- …
- “Robot” Vacuum cleaner (a.k.a. Roomba)
- Industrial robot arm (YASKAWA)
- Humanoid robot

It is not defined by the definition… but we have to describe it.

1.3.3 International Organization for Standardization - ISO

- Standards are not excluding each other…
- `ISO 2806` - defining the CNC machines
  - describing the processing technology
- `ISO 8373` - defining the robots
  - describing machine autonomy

1.3.3.1 ISO 8373 - General Terms in Robotics

ROBOTICS science and practice of designing, manufacturing, and applying robots (2.6)

ROBOT actuated mechanism programmable in two or more axes (4.3) with a degree of autonomy (2.2), moving within its environment, to perform intended tasks

- Note 1 to entry: A robot includes the control system (2.7) and interface of the control system.
- Note 2 to entry: The classification of robot into industrial robot (2.9) or service robot (2.10) is done according to its intended application.

REPROGRAMMABLE designed so that the programmed motions or auxiliary functions can be changed without physical alteration (2.3)

AUTONOMY ability to perform intended tasks based on current state and sensing, without human intervention

MANIPULATOR machine in which the mechanism usually consists of a series of segments, jointed or sliding relative to one another, for the purpose of grasping and/or moving objects (pieces or tools) usually in several degrees of freedom (4.4)

- Note 1 to entry: A manipulator can be controlled by an operator (2.17), a programmable electronic controller, or any logic system (for example cam device, wired).
- Note 2 to entry: A manipulator does not include an end effector (3.11).

CONTROL SYSTEM set of logic control and power functions which allows monitoring and control of the mechanical structure of the robot (2.6) and communication with the environment (equipment and users)

ROBOTIC DEVICE actuated mechanism fulfilling the characteristics of an industrial robot (2.9) or a service robot (2.10), but lacking either the number of programmable axes (4.3) or the degree of autonomy (2.2) EXAMPLE:Power assist device; teleoperated device; two-axis industrial manipulator (2.1)

INDUSTRIAL ROBOT automatically controlled, reprogrammable (2.4), multipurpose (2.5)manipulator (2.1), programmable in three or more axes (4.3), which can be either fixed in place or mobile for use in industrial automation applications Note 1 to entry: The industrial robot includes: — the manipulator, including actuators (3.1); — the controller, including teach pendant (5.8) and any communication interface (hardware and software). Note 2 to entry: This includes any integrated additional axes.

SERVICE ROBOT robot (2.6) that performs useful tasks for humans or equipment excluding industrial automation applications Note 1 to entry: Industrial automation applications include, but are not limited to, manufacturing, inspection, packaging, and assembly. Note 2 to entry: While articulated robots (3.15.5) used in production lines are industrial robots (2.9), similar articulated robots used for serving food are service robots (2.10).

MOBILE ROBOT robot (2.6) able to travel under its own control Note 1 to entry: A mobile robot can be a mobile platform (3.18) with or without manipulators (2.1).

ROBOT COOPERATION information and action exchanges between multiple robots (2.6) to ensure that their motions work effectively together to accomplish the task

INTELLIGENT ROBOT robot (2.6) capable of performing tasks by sensing its environment and/or interacting with external sources and adapting its behaviour EXAMPLE:Industrial robot (2.9) with vision sensor to pick and place an object; mobile robot (2.13) with collision avoidance; legged robot (3.16.2) walking over uneven terrain.