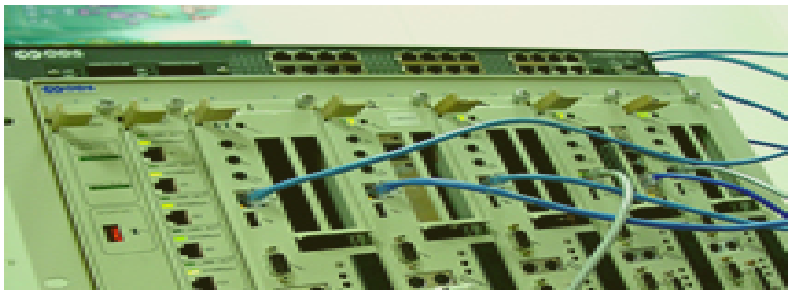
Research at the College of Engineering
University of North Texas

After a two-year study, the University of North Texas (UNT) made a special request to the Texas Higher Education Coordinating Board (THECB) in February 2002 to establish a College of Engineering. At that time, UNT submitted a proposal that entailed moving three existing departments (Computer Science and Engineering, Engineering Technology, and Materials Science and Engineering) into a College of Engineering. UNT's request for a new college of engineering was approved in April 2002. Subsequently, a new founding dean was hired in February 2003. Following the receipt of a $100,000 planning grant from NSF, the College began developing a new Electrical Engineering (EE) program. A chair for the EE program was selected in January 2004, and the program officially started in September 2004. At the same time, the first phase of renovation was completed in January 2004, and faculty and students from the four departments moved into the 550,000 square foot facility. Student enrollment for the new college is 1400, and there are 45 full time faculty. Research funding for 2005 was more than $6 million.

The College's Recent Accomplishments:

- ***Electrical Engineering (BS, MS) – January, 2005***
- ***Construction Engineering Technology – Sept 2005 – 19 students***
- ***NSF Grants***
  - ***$1.1 million - Electrical Engineering for innovation***
  - ***$100 thousand – Mechanical and Energy Engineering (planning)***
- ***ARTI – Advanced Research and Technology Institute (aka CART)***
  - ***$3.1 million ARL equipment grant – FY 2004***
  - ***$0.5 million DoE – FY 2004 – Electronic Sensor Lab***
  - ***$4.8 million Congressional appropriation - FY 2005***
  - ***$3.3 million Congressional appropriation - FY 2006***

Systems and Architecture



The systems group includes five faculty and 15 graduate students. Their interests are broad, spanning areas such as multithreaded systems, compiler optimization, low power and VLSI designs. The group includes **Krishna Kav**i, **Phil Sweany, Robert Akl, Saraju Mohanty**, and **Hao Li.**

The group's research is recognized for its breadth and quality, as reflected by its strong publication record. For example, during the last five years, they have published over 100 papers. They have also hosted the recent *Ninth Annual Workshop on Software and Compilers for Embedded Systems*

Databases and Intelligent Systems

The database and Intelligent Systems group includes **Robert Brazile, Yan Huang**, **Kathleen Swigger**, and **Rada Mihalcea**. The group's strength is in developing systems that do not require a skilled user to access information from a database. They have received funding from NSF, ARL, and industrial groups.

Two relatively new researchers in the group are:

Yan Huang has done extensive work in the area of spatial data mining, sensor database and data mining, and material science informatics. She is a co-author of two book chapters and a recent winner of the ***Ralph E. Prowe Junior Faculty Enhancement Award*** for Oak Ridge National Laboratory.

Rada Mihalcea has done extensive work in the area of Natural Language Processing, Machine Learning and Information Retrieval. She has recently received a grant from ***Google*** to investigate ways of searching unstructured text.

VLSI/CAD

The college has a VLSI/CAD group which is doing research that covers algorithmic aspects of VLSI, design automation, physical layout, and behavioral simulation.

The research of **Suraju Mohanty** seeks to push the envelope in CAD and Modeling for Nanoscale VLSI Circuits, Synthesis and Optimization for Low Power, Power Aware System Design, and VLSI Architecture for Security and Copyright Protection.

Elias Kougianos is involved in analog and mixed signal circuit simulation and the application of stochastic techniques to the solution of electromagnetic problems. Kougianos recently obtained a $50K research grant from Cadence Design Systems, Inc., Texas in which he will work on simulation processes for next generation ICs.

Hao Li, a recent graduate of South Florida, is researching VLSI CAD for Deep Sub-Micron (DSM) regime Physical Design Automation reconfigurable Computing and High Level Synthesis

Algorithms

Computational Biology

Games

The computational science group spans complexity, algorithms, computational biology and games. **Farhad Shahrokhi's** interests include developing random graph models that capture the structure of large graphics problems.

The computational biology group includes **Armin Mikler** and **Tom Jacob**. Their interests include the development of complex simulations of disease outbreaks in large geographic domains. They are currently working on simulations in disparate fields such as epidemiology and public health.

Ian Parberry is a pioneer of game programming education and the author of three books on game programming. His most research is being funded by Microsoft for creating a game engine for instructional purposes. Parberry has published three books on games and has taught gaming courses for the past ten years.

CYBERSECURITY

CSCE professors **Ram Dantu** and **Steve Tate** have built an impressive track record of analyzing information and network security. With current funding from NSF, Dr. Tate has established a Computer Privacy and Security Laboratory that focuses on applied cryptography, cryptographic protocols, and computer security.

The Center for Information and Computer Security (CICS) is an interdisciplinary center, bringing together individuals and organizations with an interest in the areas of information security, computer security, information assurance, and cybercrime.

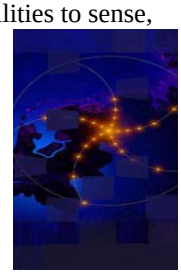
The mission of the Center for Information and Computer Security is to coordinate and promote educational, research, and service projects in information and computer security, with an emphasis on cross-disciplinary initiatives.

Ram Dantu has expanded these efforts into Voice over IP (VoIP) security with aid from a recent $60,000 NSF grant. Dantu has patented, architected, and successfully deployed the VoIP firewall and a perimeter controller. Dr. Dantu has also worked on research in network survivability and reliability in industries such as Cisco, Nortel, and Alcatel.

College of Engineering awarded approximately $1M for electrical engineering program

The National Science Foundation has awarded the University of North Texas College of Engineering $998,688 to establish an innovative electrical engineering curriculum. Titled "A Design- and Project-Oriented Innovative Electrical Engineering Program," the curriculum establishes modern approaches to teaching the discipline to undergraduates and is directed by **Murali Varanasi**, Chair of the Electrical Engineering Department.

Wireless Communication and Sensor Networks



Wireless sensor networks will soon have the capabilities to sense, communicate, coordinate, actuate – all to deliver a behavior that is defined at the network level. Unfortunately, scalability is still very much a problem. With a $500,000 grant from the Department of Energy, researchers from the College's new Sensor Laboratory are looking at many of the problems associated with implementing large-scale sensor networks. **Parthasarthy Guturu** is investigating issues related to modeling large sensor networks, **Xinrong Li** is investigating issues related to communication among and positioning of the nodes in the network, and **Shengli Fu** is developing energy efficient coding scheme based on cooperative strategies within the sensor nodes.

Intelligent Signal Processing

Intelligent Signal Processing and Communications deal with the processing and communication of "collections of information objects," called "intelligence objects," each collection exhibiting a relationship prevailing among these objects, called "intelligence," which is of value to some end-user. **Hai Deng**, assistant professor in Electrical Engineering, has more than ten years of research experience in signal processing and electromagnetic scattering. Deng is focusing on the emerging technologies of intelligent signal processing and intelligent communications.

New faculty in Electrical Engineering

Formerly from the University of Manchester, **Wuqiang Wang** became a member of the EE department in March. His research focuses on industrial process tomography, particularly electrical capacitance tomography (ECT), which is a new technique for gathering information about the contents of closed pipes or vessels non-intrusively and non-invasively and producing cross-sectional images. He is using the technology to work with homeland security and also with the oil industry to visualize gas and oil pipelines. Because ECT does not use radiation, it could also be used in medical applications, such as detecting breast cancer.

Shengli Fu has recently joined the EE faculty. Shengli has his masters degree in computer engineering from Wright State University and the Ph.D. degree in electrical engineering from the University of Delaware, Newark, DE, in 2005. His research interests include coding and information theory, wireless sensor network, and joint speech and visual signal processing.

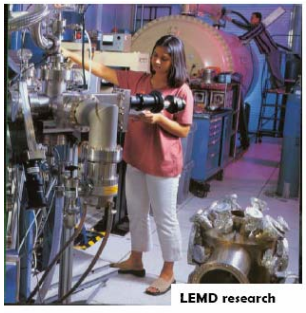
Materials Science and Engineering Research

The Materials Science and Engineering Department addresses the educational and technological challenges of creating, applying, and characterizing new materials for the 21st century.

The Department has built world-class facilities that are capable of studying properties of polymers and composites, including thermophysical, rheological, and mechanical properties of solids, liquid crystals, melts and solutions; surface analytical chemistry including metal-polymer interfaces, adhesion, corrosion and chemical vapor deposition; scanning electron microscopy and Auger spectroscopy of magnetic materials; optical, magnetic, and electrical characterization and analysis; scanning tunneling microscopy; resonant ionization mass spectrometry; solderability and X-ray diffraction; low-energy electron diffraction; and electrical characterization.

The Laboratory of Advanced Polymers and Optimized Materials

is focused on the development of materials with improved mechanical, tribological and thermophysical properties. **Dr. Witold Brostow,** the laboratory director, is also the President of the Scientific Committee of the POLYCHAR World Forum on Advanced Materials, a member of the scientific council of the Emil Zeadlowicz Museum in Wadowice, a member of the European Academy of Sciences in Brussels, and a member of the National Academy of Sciences in Mexico City.



LEMD research

The Laboratory for Electronic Materials and Devices (LEMD)

combines assorted surface science techniques. Topics of investigation include advanced gate dielectrics and devices, high-field chemical reaction pathways, and surface preparation for enhanced device performance. **Dr. Mohamed El Bouanani** is currently the director of the LEMD and has support for his research efforts in the area of high k dielectrics from both Sematech and the Texas Advanced Technology Program. He is also involved in outreach efforts through an NSF Research Experience for Undergraduates (REU) program.

The Mechanical and Rheology Laboratory

focuses on structure property relationships to increase the reliability of materials. The Lab's current emphasis is on hybrid organic-inorganic polymer nanocomposites using nanotubes and nanoclays for high temperature coatings and structural elements with dual electronic and optical functionality. The lab director, **Dr. Nandika D'Souza** receives research support from the Army, NASA and NIST as well as several private companies including Halliburton, Frito Lay, Zyvex and Boston Scientific. She is a recognized expert in the area of polymer nanocomposites for such applications as flexible displays, barrier materials, flame retardant applications and high altitude balloons.

The Materials Synthesis and Processing Lab

is focused on the research and characterization of aerogels, xerogels, and other novel ceramics for semiconductor, dielectric, energy, and sensor applications. **Dr. Richard Reidy** is lab director and receives support through Sematech. He is also the co-pi on an NSF GOALI program that supports his work in development and characterization of low-k dielectrics.

New Faculty In Materials Science

Brian Gorman, assistant professor directs the Energy Materials Laboratory and the Electron Microscopy Laboratory. His research interests include low-temperature processing of transparent conducting oxides on polymeric substrates for large area photovoltaics as well as processing and interfacial characterization of metallic interconnect supported thin film solid oxide fuel cells.

Thomas Scharf comes to UNT from Sandia National Laboratories in Albuquerque, NM. Scharf is a graduate from University of Alabama-Tuscaloosa (PhD) and has worked as a post-doc at the Naval Research Laboratory in Washington, D.C. Scharf brings expertise in the area of micro and nanotribology, atomic layer deposition, and materials for MEMS.

Nigel Shepherd joins us from the United States Army Research Laboratory in Adelphi, Maryland where he was a Postdoctoral Fellow in the Sensors and Electron Devices Directorate. He is currently spearheading the establishment of our Opto-electronic and Thin Film Materials Laboratory.

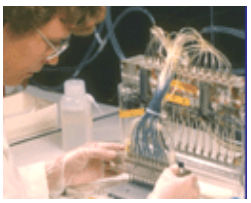
Advanced Metallics Laboratory

The focus in this laboratory is on the processing and characterization of metals, alloys, intermetallics and composites. Current projects involve production and characterization of bulk metallic glasses and nanocrystalline materials, higher temperature shape memory alloys, metallic biomaterials for bioimplants, production and characterization of automotive aluminum castings and thin film multilayers with metastable structures. Emphasis is on understanding microstructure (nanostructure) — property - processing relationships in these classes of materials. The major researchers associated with this lab are **Rajarshi Bannerjee** and **Michael Kaufman**. Recent work with the Air Force Research Lab and Ohio State is focusing on metal-matrix nanocomposites. In addition, **Reza Mirshams** is associated with this group through his research on characterization of mechanical properties using, primarily, nonoindentation.

FIB/SEM Dual Beam (CART)

Advanced Optics Laboratory

The recently established advanced optics laboratory is designed to provide a focal point for optical science and engineering research within the College of Engineering.



Vijay Vaidyanathan has expertise in the area of biomedical optics. He recently received grants to continue his research on biomedical optics and noninvasive detection of oral cancer.

Suping Wang is a new faculty member in the department of Engineering Technology. Dr. Wang received her PhD in Electrical Engineering from the University of Alabama, Her research interests are in the areas of electro-optic polymeric etalon modulators.

NUCONSTEEL & Construction Engineering

NUCONSTEEL™ and the College of Engineering have created a unique partnership that has established a light gauge steel testing laboratory in the Department of Engineering Technology. **Cheng Yu** from John Hopkins is directing the facilities and helping to establish a world-class laboratory in construction engineering.

Faculty and Areas of Expertise

Applications of Technology
Albert Grubbs
Robert Hayes
Paul Tarau

Communication & Wireless Networks
Robert Akl
Xinron Li
Shingli Fu

Computational Algorithms
Ian Parberry
Robert Renka
Farhad Shahrokhi

Information Assurance & Security
Ram Dantu
Steve Tate

Data Integration
Robert Brazile
Yan Huang
Kathleen Swigger
Rada Mihalcea

High Performance Computing
Robert Akl
Krishna Kavi
Armin Mikler
Phil Sweany

Metals & Ceramics
Rajarshi Banerjee
Brian Gorman
Michael Kaufman
Nigel Shepherd
Reza Mirshams

Nanotechnology
Reza Mirshams
Seifollah Nasrazadani
Rick Reidy
Tom Scharf
Brian Gorman

Polymers
Witold Brostow
Nandika D'Souza

Semiconductors
Mohamed Bouanani
Rick Reidy
Nigel Shephard

Optics & Signal Processing
Hai Deng
Vija Vaidyanathan
Murali Varanasi
Shuping Wang

VLSI Design & Test
Elias Kougianos
Sarju Mohanti

Major Materials Instrumentation

- Dual Beam FIB/SEM
- Technai F20 ARH TEM
- MBE-PVD Cluster Deposition Tools and Ion Beam Accelerator
- XPS/in-situ processing
- Local Electrode Atom Probe (LEAP)
- Horizontal & Vertical Burn Chamber
- Taber abraser with electrophotometer
- Pin-on-Disk Tribometer
- Magnetorhelogical fluid (MR) cell for rheometer
- Materials Testing System MTS 810
- Environmental SEM
- UV-VIS-IR Ellipsometry
- Instrument Impact Tester

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