Dear Prospective Graduate Student,

We are very pleased that you are considering the UIC Department of Electrical and Computer Engineering to pursue your advanced studies. Our department offers programs of study leading to master’s and doctoral degrees which educate and prepare students for rewarding careers in research, education and industry.

This is an exciting time for everyone in the department. We have experienced substantial growth since 2001, adding four faculty positions and doubling our annual research expenditure. This includes two Multi-University Research Initiatives and one DARPA Center program award. In order to meet the demands of a rapidly evolving field, we are highlighting four innovative thrust areas: Biotechnology, Nanotechnology, Information Technology and Infrastructure and Energy Technology.

ECE graduate students benefit from individualized attention from their academic advisors; the ratio of PhD students to faculty is low. Our students find positions that lead to satisfying careers after graduating, sometimes even before. Our department consists of 29 tenure-track faculty members, 514 undergraduate and 175 graduate students.

Our faculty has a broad range of expertise, and many professional achievements:

- Six have received the prestigious CAREER and Young Investigator awards from the National Science Foundation and other federal agencies
- Many of our faculty have served as presidents or editors of various IEEE societies
- Nearly all our full professors are IEEE Fellows
- The majority are also Fellows of other peer societies
- Two are UIC Distinguished Professors
- Several have received IEEE and Peer Society named awards

We invite you to explore the exciting opportunities available to you. Learn about our programs, visit the department and discover our interdisciplinary research topics. I hope that you will discover that ECE offers the research environment, instruction and curriculum to significantly contribute to your professional development.

Sincerely,

Mitra Dutta, Distinguished Professor and Head
Graduate Programs

The UIC Department of Electrical and Computer Engineering offers graduate programs leading to the following degrees:

- Master of Science, Electrical and Computer Engineering
- Doctor of Philosophy, Electrical and Computer Engineering

Course Offerings

Bioelectronics and Biomimetics:
Biomedical Imaging, Biomedical Instrumentation, Biomedical Sensors, Biomedical Signal Processing, Computational Biology, Intelligent and Adaptive Systems, Rehabilitation Engineering, and Surgical Intervention

Computer Engineering:

Electromagnetics, Device Physics and Electronics:
Electromagnetics, MEMS and Nanotechnology, Microelectronics, Optoelectronics, Power Electronics, and Solid-State Electronics

Information Systems:

Admissions, Policies and Regulations

An application may be completed in one of three ways: applicants may submit an online form, print and submit downloadable forms, or request a paper copy of the application by writing to the address on the back cover. Applicants who seek a research assistantship should write directly to faculty members in their area of interest after they are admitted to the MS or PhD program by the department. All international applicants are required to submit scores from the Graduate Record Examinations for admission. The GRE is recommended for all applicants for financial aid.
MEMS & Nanotechnology

Professors Dutta, Feinerman, Ghosh, Metlushko and Stroscio
The mission of the Nanotechnology area is to study new concepts and to utilize and develop novel nanoscale devices and systems.

Nanotechnology is a rapidly emerging field that involves the manipulation and use of matter at the scale of atoms and molecules. On such a small scale, quantum effects cause the properties of materials to change quickly and dramatically. The resulting materials can exhibit greater strength, conductivity, elasticity or reactivity when synthesized on the nanoscale—compared to materials that exist in nature.

Areas of interest include Nanoelectronics, Nanostructures, Micro-Optoelectromechanical and Micro-Electromechanical systems.

The research is sponsored by National Science Foundation, Office of Naval Research, NASA, Army Research Office, Air Force Office of Scientific Research and Defense Advanced Research Projects Agency.

Nanomagnetic Memory
Professors Metlushko’s research group has demonstrated that nanometer-sized rectangular permalloy rings can store and access memory almost instantly. Advantages of Magnetic Random Access Memory include the lack of a need for constant refreshing—resulting devices having longer battery life—and insensitivity to radiation, which is beneficial to harsh environments typical of space and military applications.

The UIC research team collaborates with researchers at international universities, as well as Argonne and Los Alamos National Laboratories.

Thin Films Research
Multiferroic oxide films on semiconductor substrates are being grown by Professor Ghosh and his group using an RF Plasma-assisted oxide Molecular Beam Epitaxy machine. These films are both ferroelectric and ferromagnetic occurring rarely in nature. By growing alternate layers of ferroelectric and ferromagnetic materials, the resulting material contains magnetic properties that can be tuned by applying an electric field. These thin film devices have commercial, space and military applications, including advanced RADAR and SONAR systems for the U.S. Navy.

Micro-Optoelectromechanical Systems
MOEMS are the result of the combination of micro-machine devices and micro-optics. The devices manipulate light for signal sensing and processing. Micrometer-sized mirrors are mechanically controlled. Professor Feinerman is collaborating with mechanical engineering on the development of a tethered liquid drop to apply force and torque to a mirror.

Terascale Integration of Semiconductor Nanocrystals
Numerous manmade semiconducting nanostructures have been synthesized and integrated semiconductor quantum dots have been assembled and their interactions modeled in the Nanoengineering Research Laboratory. The ultimate goal is massive integration of semiconductor nanostructures in functional electronic and optoelectronic networks.

Nanoscale Concepts and Devices
Electron transport and carrier scattering processes are being studied in carbon nanotubes, DNA and other conducting biomolecular chains, as well as in quantum dots and wires in wide band gap materials for novel electronic and optoelectronic devices. The graduate students in the Nanoengineering Research Laboratory are pursuing both experimental and theoretical research.
Biotechnology

Professors Dutta, Graupe, Lin, Priemer, Stroscio and Zefran

The mission of the Biotechnology area is to develop new ways to detect and treat disease through advanced diagnostic techniques. Our relationship with the University of Illinois Medical Center at Chicago facilitates many unique research endeavors.

The research is sponsored by federal agencies including the National Science Foundation and the Army Research Office. Other sponsors include the UIC College of Dentistry and private organizations.

Major areas of interest within Biotechnology include: Intelligent and Adaptive Systems, Rehabilitation Engineering, Bio-Signal Processing, Bioelectromagnetics, Biomedical Imaging and BioSensors.

Cardiac Sound Separation and Analysis
A group of researchers led by Roland Priemer is developing new ways to diagnose heart dysfunction. This group applies blind source separation algorithms in order to isolate delayed components of heart sounds. Next, clinically relevant features are isolated to perform a diagnosis.

Teaching Sensorimotor Skills with Haptics
A haptic simulator tool being developed in the Computer Vision and Robotics Lab, under the instruction of Professor Zefran, is intended to be used in training dentistry students. The tool provides friction when the tooth is contacted and guides the dental tools to the optimal angle to access a particular area of the tooth. Challenges include the need for new models and faster haptic rendering.

Integrating Nanostructures with Biological Structures
Professors Stroscio and Dutta have developed techniques to bind manmade nanostructures to biological structures. Biological cell membranes are around eight nanometers thick. A semiconductor quantum dot is attached to a transmembrane protein (an integrin), which spans the cellular membrane. A biomolecule is utilized to bind the integrin to the quantum dot. The ultimate goal is monitoring and controlling biological processes, and possibly treating diseases such as cancer.

Chemical and Biological Toxin Detectors
Chemical and biological toxin sensors are being investigated by Professors Stroscio and Dutta in collaboration with external researchers to develop sensors that can detect single molecules of chemical and biological toxins.

Fetal Electrocardiogram Imaging
Professor Graupe has developed a noninvasive technique for extracting a fetal electrocardiogram from the maternal electrocardiogram as early as the 12th week of pregnancy. Early and accurate diagnosis of arrhythmia helps identify underlying fetal cardiac abnormality or disease. This permits treatment and administering of medications directly to the mother.

My research involves analysis of physiological signals by using advanced digital signal processing techniques to develop smart medical systems that can perform automated diagnosis with high accuracy. The small student-to-faculty ratio at UIC provides more contact hours with research advisors resulting in the development of fruitful and motivating relationships.

Vivek Prakash Nigam, PhD Candidate
Information Technology

Professors Ansari, Banerjee, Ben-Arie, Chowdhury, Dutt, Erricolo, Khokhar, Lee, Liu, Schonfeld, Tuninetti, Wu, Yao, Yu, Zefran and Zhu

The Information Technology area focuses on identifying opportunities to apply a broad range of knowledge to challenges in the areas of parallel and quantum computing, signal and image processing, and VLSI/CAD and computer architectures.

This research is sponsored by the National Science Foundation, Air Force Office of Scientific Research, U.S. Department of Energy, Neomagic Corporation and NASA.

Adaptive Waveform Diversity for Full Spectral Dominance

This Multi-University Research Initiative involves collaboration with research universities at Arizona State, Harvard, Maryland, Princeton and Purdue. The ultimate goal of this effort is to substantially increase radar resolution, detection and accuracy, as well as communications systems capacity.

Neural Dynamic Programming for Automatic Engine Control

The complexity of both modern automobile engines and the fuel combustion process make vehicle emissions difficult to control. Professor Liu leads a team of researchers in developing algorithms that can simultaneously control engine exhaust air–fuel ratio and engine torque. These algorithms will be capable of learning and subsequently adjusting to different systems.

Human Motion Recognition

Professor Ben-Arie has developed an innovative method for human motion recognition from videos, using indexing and sequencing. It is being extended to recognition of speech and objects. Potential applications include security surveillance systems and sports analysis.

Preservation and Protection of Online Multimedia Contents

Research efforts led by Professors Khokhar and Ansari include: efficient watermarking techniques that can imperceptibly embed information; independent component analysis-based detector to identify embedded information despite the presence of extreme noise; digital asset management system using data hiding for fingerprinting and authentication; and distributed protocols for content validation and recovery of compromised data.

Multimedia Communications

Graduate students and faculty collaborate with industry leaders—such as Motorola, NTT DoCoMo, Neomagic and R2 Technology—to improve global multimedia mobile communications. Projects involve video tracking, retrieval, foveation, networks, processors and security.

Incremental Placement and Routing Algorithms of FPGA and VLSI Circuits

Efficient algorithms are being created for incrementally replacing and rerouting small portions of circuits to correct problems like signal integrity, speed and high-heat density. The challenge, faced by Professor Dutt and his students, is to quickly re-layout only the affected part of the circuit, while minimizing any layout changes to the remaining portion of the circuit.

Multi-Core Architecture for System-on-Chip Platform

Professor Lee is working on a heterogeneous multiprocessor core for System-on-Chip platforms. The multiprocessor design is based on ARM (32-bit RISC) architecture.
Infrastructure and Energy Technology

Professors Dutt, Erricolo, Mazumder, Uslenghi, Yang and Yao

Infrastructure and energy technology creates new developments in wireless and wired networks, power and sensor networks, and information assurance.

Research sponsors include the Office of Naval Research, Department of Defense and the Air Force Office of Scientific Research.

Adaptive Waveform Design in Complex Maritime Environments

This DARPA award addresses improvements in detecting, resolving, and tracking low grazing angle and low radar cross section targets under conditions of severe clutter. UIC leads this investigation working with Australian researchers, Raytheon, and research universities at Arizona State, Maryland, Princeton, Purdue and Washington in St.Louis.

Microwave Pulse Interactions with Electronics Systems

Professor Uslenghi is leading a Multi-University Research Initiative for the U.S. Department of Defense. The diverse team of researchers will be involved with the analysis and design of ultrawide band and high-power microwave pulse interactions with electronic circuits and systems that are contained in fixed or moving platforms. The purpose is the analysis of the effects of electromagnetic pulses on digital systems in avionics, with the ultimate goal of protecting such systems from unwanted electromagnetic interference.

Next Generation Power Electronics

Power electronics innovations spanning a multitude of industries are being developed by Professor Mazumder and his graduate and undergraduate students. They are devising a robust electrical system that will allow flexible, reconfigurable wireless control of the U.S. Navy’s spatially-distributed Advanced Electrical Power Systems.

Energy Efficient Design of Wireless Networks

Novel communication and signal processing schemes are being developed under Dr. Yao to improve the energy efficiency of wireless communication systems. Our goal is to create new technologies leading to much longer battery lifetime of mobile multimedia devices and wireless sensor networks.

UIC Students Win First Prize in National Fuel Cell Competition

A team of UIC electrical engineering students placed first in the 2005 IEEE Future Energy Challenge Competition at the National Renewable Energy Laboratory in Colorado. The group built a prototype fuel cell inverter that met tough specifications regarding efficiency, weight, total harmonic output distortion and other factors. Professor Mazumder guided the team in writing its proposal and in developing the device at his Laboratory for Energy and Switching Electronics Systems.

"I am working in the Multimedia Communications Laboratory. Our research addresses the shortcomings in today's multimedia technology. The students in the MCL are encouraged to cooperate by sharing valuable insights in their respective fields of research. UIC has a very friendly and helpful faculty who devote a lot of time and attention to individual students. My advisor’s constructive comments and suggestions help me make strides in my research.

Nidhal Bouaynaya, PhD Candidate"
Department Research Laboratories

Andrew Electromagnetics Laboratory
Professors Erricolo, Uslenghi, Laxpati and Yang
The anechoic room of the Andrew Electromagnetics Lab is equipped for antenna measurements between 2 GHz and 26.5 GHz. Automated radiation pattern measurements are available with a network analyzer connected to a PC.

Communication and Sensing Laboratory
Professor Boerner
Research endeavors in the Communication and Sensing Lab include electromagnetics, direct and inverse scattering, wave propagation, remote sensing, microwave imaging, Fourier optics, holography, radar and polarimetrics.

Computational Intelligence Laboratory
Professor Liu
Computational Intelligence Laboratory research programs bring together the results of academic research in the field of computational intelligence and the problems encountered in engineering practice. Current application areas include traffic control management in telecommunication networks and learning control methodologies for automotive engines.

Computer Vision and Robotics Laboratory
Professor Zefran
Both theoretical and applied research in computer vision and robotics is the focus of Computer Vision and Robotics Laboratory. Resources include a pair of Puma 560 manipulators, several mobile robots and a PHANToM haptic device. Embedded control design software and mobile robot simulators are available for programming the robots.

Design Automation, Reconfiguration and Testing Laboratory
Professor Dutt
The Design Automation, Reconfiguration and Testing Lab facilitates automation projects and the computer-aided design and testing of FPGA and VLSI circuits.

Laboratory for Energy and Switching Electronics Systems
Professor Mazumder
LESES leads power-electronics research with focus on power networks, alternate energy systems, and high-power density using photonic devices and SoCs/SoMs. It is equipped with advanced hardware and software facilities for system design, fabrication, and measurement.

Multimedia Communications Laboratory
Professors Ansari and Schonfeld
The Multimedia Communications Lab is focused on the analysis and processing of multimedia signals in emerging multimedia communication applications. Research spans the areas of speech, image and video processing, and communications. Projects are devoted to multimedia storage, retrieval, processing, communications and networking. The lab has powerful computing facilities, including high-performance computer clusters and a high-capacity storage server.

Machine Vision Laboratory
Professor Ben-Arie
Multimedia Systems Laboratory  
Professors Khokhar, Ansari and Schonfeld  
Computing resources in the Multimedia Systems Lab include a terabyte storage cluster and a Beowulf cluster. Projects involve content-based storage and retrieval for multimedia applications and distributed multimedia database systems and networks.

Nanoengineering Research Laboratory  
Professors Dutta and Stroscio  
The Nanoengineering Research Laboratory involves alteration of carbon nanotubes, nanoscale modifications of DNA and creation of semiconductor nanocrystals. Properties of quantum dots suspended in solution are studied. Atomic force microscopes, fluorescence microscopes and lasers are available to aid in the study of nanostructures.

Signal and Image Research Laboratory  
Professors Ansari and Schonfeld  
Research conducted in the Signal and Image Research Lab spans all areas of signal and image processing, from image analysis and coding, to independent component analysis, video tracking, graphics, computer architecture and bioinformatics. SIRL also contains the Machine Vision and Neural Networks Laboratory.

Campus Research Centers

Nanotechnology Core Facility  
Professor Metlushko  
The Nanotechnology Core Facility is versatile MEMS/Nano facility and is accessible to nonprofit and industrial researchers. Equipment is available for: photolithography, thin film deposition (metals, semiconductors, and dielectrics) and etching, sample characterization (electrical, optical, and surface), dicing and lead attachment, and computer aided design workstations. NCF is dedicated to application of integrated circuit and fiber optic technology to improve manufacturing methods for MEMS/Nano devices, BioMEMS, Microfluidic, Electromechanical, Mechanical, Chemical, Optical, Photonic and multifunctional devices. The facility also contains a microfabrication laboratory with a 3,000 square-foot Class 100/1000 clean room that enables a broad spectrum of innovative multidisciplinary research. There is also a microfluidics center for studying properties of nanodrops.

Research Resource Center  
The Research Resources Center maintains and supports high-technology scientific equipment, addressing a wide range of problems for chemical, biological and structural characterization. In addition, the availability of computational and statistical services for data handling, interpretation of experimental results and data transfer, together with the accessibility of electronic and mechanical shops further enhance the RRC's mission of contributing to research at UIC. The RRC contains cutting-edge resources critical to departmental research, including the Molecular Beam Epitaxy system, several scanning electron microscopes, nuclear magnetic resonance instruments and protein research systems.
FACULTY

- Ten IEEE Fellows (16 with Adjunct and Emeritus Faculty)
- Past presidents or editors of several IEEE societies
- Seven Fellows of 10 additional peer societies
- Six National Science Foundation and other agency CAREER award recipients
- Two UIC Distinguished Professors
- Society of Women Engineers National Achievement Award recipient
- Two IEEE Harry Diamond Memorial Awardedees
- BME D’Arsonval Awardeee

Rashid Ansari, Professor, PhD, Princeton University, 1981
Image, video, and audio processing, compression, watermarking, packetized transport; multi-modal signal analysis; multimedia signal processing; multi-rate filter banks and wavelets; wireless communications and OFDM

Prith Banerjee, Distinguished Professor and Dean, PhD, University of Illinois at Urbana-Champaign, 1984
VLSI computer aided design, parallel computing and compilers

Robert Becker, Lecturer, MSc, University of Illinois at Chicago, 1989
Network analysis

Jezekiel Ben-Arie, Professor, PhD, The Technion–Israel Institute of Technology, 1986
Computer vision; signal, image, and video processing; neural networks; human activity recognition; bioengineering; verbal summarization and understanding; pattern recognition

Wolfgang–Martin Boerner, Emeritus Professor, PhD, University of Pennsylvania, 1967
Electromagnetics, wave propagation, direct and inverse scattering; radar, microwave imaging, remote sensing, Fourier optics and holography, polarimetrics

Masud H. Chowdhury, Assistant Professor, PhD, Northwestern University, 2004
High-performance issues in deep sub-micron and nanometer scale VLSI circuits

Clifford Curry, Lecturer, PhD, University of Washington, 1997
VLSI, microwave circuits, network theory, digital and analog filters and signal processing

Shantanu Dutt, Associate Professor, PhD, University of Michigan, 1990
VLSI CAD, fault-tolerant computing, testing, parallel computing and computer architecture

Mitra Dutta, Distinguished Professor and Department Head, PhD, University of Cincinnati, 1981
Properties of nanostructures; solid-state electronics and optoelectronics; applications of nanostructures in electrical and bioengineering

Danilo Erricolo, Associate Professor, PhD, University of Illinois at Chicago, 1998
Electromagnetic propagation and scattering, interactions with digital systems

Alan D. Feinerman, Associate Professor, PhD, Northwestern University, 1987
Application of semiconductor processing and fiber-optic technology to manufacturing

Siddhartha Ghosh, Assistant Professor, PhD, University of Michigan, 2003
MBE of compound semiconductors and multifunctional oxides; high-performance optoelectronic devices; characterization of lasers and APDs; electrical and magnetic noise; spintronics

Vladimir Goncharoff, Lecturer, PhD, Northwestern University, 1983
Digital signal processing, speech processing

Daniel Graupe, Professor, PhD, University of Liverpool, 1963
Control systems, signal processing, biomedical control, neural networks, blind adaptive filtering, wavelets and electrical stimulation
Ashfaq Khokhar, Professor, PhD, University of Southern California, 1993
Multimedia systems, networks and applications; parallel and high-performance computing

Sharad R. Laxpati, Associate Professor, PhD, University of Illinois at Urbana-Champaign, 1965
Electromagnetic radiation, scattering and propagation; design and development of antennas and arrays for application in wireless and satellite communication

Gyungho Lee, Professor, PhD, University of Illinois at Urbana-Champaign, 1986
Computer architecture, microprocessor and networking hardware design, compiler optimization, computer security

James C. Lin, Professor, PhD, University of Washington, 1971
Electromagnetics in biology and medicine, electromagnetic imaging and sensing, telemedicine

Derong Liu, Professor, PhD, University of Notre Dame, 1994
Wireless communications and networks, intelligent and learning control, computational intelligence

Sudip Mazumder, Associate Professor, PhD, Virginia Tech, 2001
Power electronics: networks and wireless control, alternative-energy systems, power density using photonic power devices and SoCs/SoMs

Vitali Metlushko, Associate Professor, PhD, Moscow State University, 1990
Advanced recording media, new magnetic materials and nanotechnology

Roland Priemer, Associate Professor, PhD, Illinois Institute of Technology, 1969
Optimal and adaptive digital signal processing; neural networks; fuzzy logic; speech and image processing; microprocessor-based applications in communications, control and instrumentation

Dan Schonfeld, Associate Professor, PhD, The Johns Hopkins University, 1990
Signal, image, and video processing; video communications; video retrieval; video networks; image analysis and computer vision; pattern recognition; genomic signal processing

Michael Stroscio, Professor, PhD, Yale University, 1974
Properties of nanostructures; quantum transport; phonons in nanostructures; nanostructures in electronics, optics and bioengineering

R. Michael Tanner, Professor, Provost, and Vice Chancellor for Academic Affairs, PhD, Stanford University, 1971
Information and communication theory; theory of algorithms and computational complexity

Daniela Tuninetti, Assistant Professor, PhD, Ecole Nationale Supérieure des Télécommunications, 2002
Information and coding theory; applications in multiuser networks and wireless communications

Piergiorgio L. E. Uslenghi, Professor, PhD, University of Michigan, 1967
Electromagnetics, optics, scattering models, frequency-selective sheets, imperfect conductors, anisotropic optical fibers, radar cross sections

Kaijie Wu, Assistant Professor, PhD, Polytechnic University, 2004
VLSI CAD, cryptanalysis countermeasures, secure communications acceleration

Hung-Yu Yang, Associate Professor, PhD, University of California, Los Angeles, 1988
Electromagnetics applications to microwave circuits and antennas

Yingwei Yao, Assistant Professor, PhD, Princeton University, 2002
Communications, signal processing, information theory; applications to wireless communication

Oliver Yu, Assistant Professor, PhD, University of British Columbia, 1997
Optical switched and wireless networks; adaptive middleware; mobile Internet and computing

Milos Zefran, Associate Professor, PhD, University of Pennsylvania, 1996
Robotics, control of hybrid systems, haptics, human-robot interfaces, rehabilitation devices

Zhichun Zhu, Assistant Professor, PhD, College of William and Mary, 2003
Computer architecture, parallel and distributed computing, performance modeling and evaluation
Your Kind of Town

Chicago is:

• The third largest city in the United States with nearly 3 million in population and more than 9 million people residing in the greater metropolitan area
• An affordable big city, ranking eighth in the cost of living index
• A city of diverse neighborhoods representing many nationalities from around the world
• 29 miles of lakeshore with Lake Michigan and its beaches adjacent to downtown
• A city known for its great nightlife, restaurants, shopping, culture, museums and sports
• The home to 30 of the Fortune 500 companies including Baxter International, Boeing, Motorola, Abbott Laboratories and Exelon

UIC is:

• Home to a College of Engineering that takes pride in its academic excellence and its 115 outstanding faculty, including two members of the National Academy of Engineering, 40 Fellows of professional societies and 20 National Science Foundation CAREER award recipients
• The engineering school of choice for 1550 undergraduate and 850 graduate students
• The largest university in the Chicago area with 25,000 students, 15 colleges and more than $290 million in annual research expenditures
• The home of the Great Cities Commitment in which students join faculty and staff in community, corporate, government and civic partnerships to improve the quality of life around the world
• Among the top 50 universities in federal research funding
• Located within walking distance of the vibrant Chicago Loop business district providing distinct ties with many companies hiring UIC graduates

www.ece.uic.edu