Electrical and Computer Engineering

Master of Science in Engineering
Doctor of Philosophy

For More Information

Campus address: Engineering Education and Research Center (EER), phone (512) 232-1458, fax (512) 471-3652; campus mail code: C0803

Mailing address: The University of Texas at Austin; Chandra Department of Electrical and Computer Engineering Graduate Program; Engineering Education and Research Center, Stop C0803, Austin TX 78712

E-mail: ecegrad@ece.utexas.edu

URL: https://www.ece.utexas.edu/academics/graduate

Objective

The objective of the faculty of the Chandra Department of Electrical and Computer Engineering and its Graduate Studies Committee is to provide a graduate program that continues to produce exceptional graduates via an education that is both broad and deep and access to world-class research facilities while advancing the state of the art within diverse subfields spanning electrical and computer engineering.

Facilities for Graduate Work

Facilities are available for graduate work in almost all areas of study within electrical and computer engineering, and for both experimental and theoretical/computational research. Graduate activities of the department are housed in the Engineering Education and Research Center, and in several special-purpose laboratories located in the Peter O'Donnell Jr. building and on the J. J. Pickle Research Campus. Numerous facilities for experimental research are provided within these well-equipped research laboratories. Among the resources available for computationally intensive research is the Texas Advanced Computing Center, also housed on the J. J. Pickle Research campus. In addition, The University of Texas Libraries provide a rich source of literature to support graduate activities in electrical and computer engineering, including free online access to essentially all important journals.

Faculty of the Chandra Department of Electrical and Computer Engineering also participate in several widely-recognized centers for research including: the Center for Advanced Research in Software Engineering, the Center for Electromechanics, the Center for Identity, the Center for Perceptual Systems, the Center for Transportation Research, the Microelectronics Research Center, the Oden Institute for Computational Engineering and Sciences, the Texas Materials Institute, and the Wireless Networking and Communications Group.

Areas of Study

There are eight named academic tracks spanning electrical and computer engineering which admissions, course offerings, and advising are organized, as listed below. However, the interests and work of students and faculty alike may overlap more than one track.

Architecture, Computer Systems, and Embedded Systems. Computer architecture is at the interface of computer hardware and software. Its practitioners are responsible for specifying, designing, and implementing at the architecture level the hardware structures that carry out the work specified by computer software. Computer architects share the responsibility for providing mechanisms that algorithms, compilers, and operating systems can use to enhance the performance and/or energy requirements of running applications. Computer architecture spans many dimensions, such as the scope of a processor (embedded processors, desktop systems, servers, and supercomputers); the target application (general-purpose versus domain-specific); the characteristics of the design objectives (speed, power consumption, cost, reliability, availability, and reconfigurability); and the measurement and analysis of resulting designs.

bioECE. Understanding, engineering, and interfacing with biological systems are among humanity's most important challenges, impacting numerous fields from basic science to health. Motivated by this larger vision, the bioECE track is focused on the intersection of electrical and computer engineering with biology and medicine. It includes biomedical instrumentation, biophotonics, health informatics, bioinformatics, neural engineering, computational neuroscience, and synthetic biology. Associated faculty have expertise in diverse topics: cardiovascular instrumentation, neuroscience, neural engineering and the machine-brain interface, image and signal processing (feature extraction and diagnostic interpretation), health information technologies (data mining, electronic medical records analysis), VLSI biomedical circuits (biosensing, lab-on-a-chip), algorithms for large-scale genomic analysis, and molecular programming (engineering molecules that compute).

Decision, Information, and Communications Engineering. This track involves research and design in the following fields: (1) Communications and networking: all aspects of transmission of data, including: wireless communications, communication theory, information theory, networking, queueing theory, stochastic processes, sensor networks; (2) Data science and machine learning: all aspects of extraction of knowledge from data, including: algorithms, data mining, optimization, statistics, pattern recognition, predictive analytics, artificial intelligence; and (3) Controls, signals, and systems: estimation and detection; signal, image and video processing; linear and nonlinear systems.

Electromagnetics and Acoustics. This track includes the study of electromagnetic and acoustic phenomena ranging from ultralow frequencies to the visible spectrum. The activities in electromagnetics involve research in antenna design, radar scattering, computational methods, wave-matter interaction, bioelectromagnetics, wave manipulation using artificial materials, wireless propagation channels, microwave and millimeter-wave integrated circuits, guided wave devices and systems, electromagnetic forces (including electrostrictive and magnetostrictive forces), and Maxwell's stress tensor. The activities in acoustics involve research in transducers, microelectromechanical systems, atmospheric and underwater acoustics, and noise and vibration control.

Electronics, Photonics, and Quantum Systems. This track focuses on the development and improvement of electronic, photonic, optoelectronic, spintronic and micro-electromechanical (MEMS) materials, devices and systems for a variety of applications. Electronic device examples include transistors for nano-CMOS, back-end-of-the-line silicon, power transistors and post-CMOS logic, memory, analog, and mixed-signal applications based on quantum mechanical tunneling and electron spin. Photonic devices include photodetectors, LEDs and lasers, including topological photonics, metamaterials, metasurfaces, and other novel nanophotonic structures, optical interconnects for short and long-range communication, displays and solar cells. There is research on acoustic, chemical and biological sensors, as well as quantum transport devices such as Josephson junctions. Material systems include unstrained and strained column IV and III-V semiconductors grown by molecular beam epitaxy or various types of chemical vapor deposition, organics and polymers, thin-film and novel 0D, 1D and 2D materials such as quantum dots, nanowires, graphene and other 2D layered materials such as

transition metal dichalcogenides, as well as insulators such as high-dielectric-constant materials. Research in systems includes those for quantum information processing, optical systems for signal processing and very-high-speed communications, and electronic systems such as compute-in-memory and neuromorphic computing.

Integrated Circuits and Systems. This track involves all aspects of analysis, design, synthesis, and implementation of digital, analog, mixed-signal, and radio frequency (RF) integrated circuits and systems for applications in computing, sensing, and communications. Research in the area spans levels of abstraction from devices to systems-on-chip (SoC), and involves transceiver architectures, data converters, memory technologies, signal processing systems, integrated bio-chips, neuromorphic computing, high-performance and low-power design, fault tolerance, design for manufacturability (DFM), design for test (DFT), verification, computer-aided design (CAD) and electronic design automation (EDA).

Power Electronics and Power Systems. This track involves research in the generation, transmission, distribution, conversion, storage, and management of electric energy. Research activities include but are not limited to advanced power semiconductor devices; high-frequency-power-electronic conversion systems; high-frequency magnetics; medium voltage power electronics for applications in renewable energy, energy storage and smart grid systems; dc power grids; power system analyses; modeling and simulation of power systems; grid data analytics; security and resilience of power grid infrastructures; microgrids; protection systems; energy system economics and optimization; electricity markets; power system harmonics; power quality; and distributed generation.

Software Engineering and Systems. This track involves all aspects of engineering software systems. In addition to the problem of requirements, research and study in the area addresses architecting, designing, building, testing, analyzing, evaluating, deploying, maintaining, and evolving software systems. Problems investigated include theory, techniques, methods, processes, tools, middleware, and environments for all types of software systems in all types of domains and applications. This area of study also is available to working professionals through the Alternatively Scheduled MSE program with a concentration in Software Engineering administered by Texas Engineering Executive Education (TxEEE).

Graduate Studies Committee

The following faculty members served on the Graduate Studies Committee (GSC) in the spring 2023 semester.

Jacob A Abraham
Deji Akinwande
Andrea Alu
Jeffrey G Andrews
Chandrajit L Bajaj
Sanjay K Banerjee
Seth Robert Bank
Suzanne Barber
Adela Ben-Yakar
Alan C Bovik
Constantine Caramanis
Ray T Chen
Sandeep Chinchali
Derek Chiou
Shwetadwip Chowdhury
Michael Arthur Cullinan
Gustavo A De Veciana
Inderjit S Dhillon
Georgios-Alex Dimakis
Ananth Dodabalapur
Andrew K Dunn
Mattan Erez
Brian L Evans
Donald S Fussell
Vijay K Garg
Andreas Gerstlauer
Joydeep Ghosh
Milos Gligoric
John B Goodenough
Kristen L Grauman
Neal Hall
Mark F Hamilton
Alex Hanson
Robert W Heath Jr
Qin Huang
Todd E Humphreys
Warren A Hunt Jr
Jean Incorvia
Yaoyao Jia
Lizy K John
Brian Johnson
Christine L Julien
Sarfraz Khurshid
Hyeji Kim
Jaydeep Prakash Kulkarni
Jack C Lee
Xiuling Li
Calvin Lin
Nanshu Lu
Ruochen Lu
Diana Marculescu
Radu Marculescu
Mia K Markey
Jose del R Millan
Aryan Mokhtari
Evdokia Nikolova
Michael E Orshansky
Zhigang Pan
Yale N Patt
Keshav K Pingali
Emily Porter
Lili Qiu
Leonard F Register
Christopher J Rossbach
Sujay Sanghavi
Samantha Rose Santacruz
Surya Santoso
Sanjay Shakkottai
Shyam Shankar
August Wang Shi
David Soloveichik
S V Sreenivasan
Peter H Stone
Earl E Swartzlander Jr
Jon I Tamir
Ahmed Hossam Tewfik
Edison Thomaz Jr
Mohit Tiwari
Ufuk Topcu
Nur A Touba
James W Tunnell
Emanuel Tutuc
Jonathan W Valvano
Haris Vikalo
Sriram Vishwanath
Atlas Wang
Jun Wang
Rachel A Ward
Daniel M Wasserman
Preston S Wilson
Neeraja Jayant Yadwadkar
Ali E Yilmaz
Edward T Yu
Amy Zhang
Yuebing Zheng
Mingyuan Zhou
Hao Zhu

Admission Requirements

Admission to the graduate programs in ECE is highly competitive and based on a holistic review of all application materials by the chosen academic track's admission committee, which is composed of faculty within that track. Standards for admission generally exceed the minimum standards established by the University. The Chandra Department of ECE neither requires nor considers GRE scores in the selection of students for admission.

Applicants to the graduate program of the Chandra Department of Electrical and Computer Engineering normally will have an undergraduate degree in this field. Applicants with a degree in another field also may be considered if their background is appropriate for the chosen area of specialization. However, if admitted, the student may be required

to complete additional coursework (outside their Program of Work, discussed below) to address any academic deficiencies. Another exception exists for students in the Integrated BSECE/MSE program who receive their BSECE and MSE degrees simultaneously.

Graduate students in the Chandra Department of Electrical and Computer Engineering are expected to be proficient in English. An applicant who does not meet the English proficiency standards of the University may be admitted, but then may be required to complete a three-hour English course. The course is counted toward the student's course load for the semester but is not counted toward the fulfillment of course requirements for the graduate degree.