Graduate Study *at*

RICE

GRADUATE STUDY IN ELECTRICAL AND COMPUTER ENGINEERING

Rice University

WWW.ECE.RICE.EDU

For admission in 2016

At Rice, the Department of Electrical and Computer Engineering (ECE) is a dynamic and broad discipline that uses principles in mathematics, physics, and chemistry to address the challenges in engineering materials, electronic devices, neuroengineering, data science, photonics, signals, and systems. The domain of applications, which is equally dynamic and broad, includes healthcare, energy, computing, wireless communication, networked computing, and security. Distinguished by a collaborative culture and global perspective, ECE offers students a wealth of opportunities to form close relationships with outstanding faculty who redefine the limits of curricula and integrate the best technology into the learning experience. Students gain access to an excellent computing infrastructure and gain valuable research experience in technologically advanced laboratories. The department offers numerous opportunities for interaction and knowledge exchange with partners throughout industry and academia through colloquia, workshops, and student forums — both informal and formal.

THE PROGRAMS

The Electrical and Computer Engineering graduate program is the third largest at Rice. The quality of students in the program is outstanding, with graduates placed in highly visible positions throughout academia and industry. The department offers three graduate degrees: Master of Electrical Engineering (M.E.E.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D). These degrees are offered in two separate programs, M.E.E. and M.S./Ph.D. The Master of Electrical Engineering is a terminal, non-thesis degree intended primarily for students who wish to strengthen their academic background through 30 hours of additional course work. The M.S./Ph.D. program is a continuing program that offers first an M.S. followed by a Ph.D. Both of these degrees require a thesis.

The M.S./Ph.D program consists of formal courses and original research conducted under the guidance of faculty advisors. The first academic year concentrates on foundation course work and focuses on a research area. Each student must successfully complete a project in a chosen research area. This project is in lieu of an oral or written "qualifying exam." In addition to enabling the faculty to evaluate the student's research potential, the project encourages timely completion of the M.S. degree. After the first year, research occupies the majority of the student's time and is conducted on a full-time basis. The ECE department does not offer a terminal M.S. degree.

Students who have acquired a master's degree elsewhere are still required to complete a first-year project. Previous M.S. degrees are approved or denied upon completion of ELEC 599 in the first year. Denied previous M.S. degrees require the student to obtain a Rice ECE M.S. before continuing onto the Ph.D. The student must complete a master's thesis and successfully defend it in an oral examination. This examination along with satisfactory performance in course work and a statement from the prospective Ph.D. advisor determines selection for Ph.D. candidacy. A candidate for the Ph.D. degree must demonstrate independent, original research in electrical and computer engineering.

CURRENT RESEARCH

The electrical and computer engineering faculty conduct transformational research in a number of areas.

Computer Engineering: The Computer Engineering group at Rice University has a long track record of innovative research in physical modeling and characterization, VLSI signal processing, computer architecture, computer-aided design, and storage and network systems. Spanning the spectrum of computing from low-power personal devices to large-scale parallel information systems, networked computing solves a myriad of technology challenges. Future computing technologies, including the on-chip integration of systems and networks, will move us beyond current methods in silicon.

Faculty: Babakhani, Cavallaro, Kemere, Koushanfar, Simar, Varman, Zhong

Data Science: Data Science is an emerging discipline that integrates the foundations, tools and techniques involving data acquisition (sensors and systems), data analytics (machine learning, statistics), data storage and computing infrastructure (GPU/CPU computing, FPGAs, cloud computing, security and privacy) in order to enable meaningful extraction of actionable information from diverse and potentially massive data sources. Data scientists seek to collect and understand the structure in data, looking for compelling patterns, telling the story that's buried in the data. They get at the questions at the heart of complex problems and devise creative approaches to making progress in a wide variety of application domains.
Faculty: Aazhang, Baraniuk, Kemere, Koushanfar, Orchard, Pitkow, Robinson, Sabharwal, Varman, Veeraraghavan, Zhong

Neuroengineering: Neuroengineering is the analysis and control of the nervous system in order to enhance and restore neuronal function. At Rice, we develop technologies to understand, repair, replace, enhance, or treat the diseases of the nervous system. We also design, construct and study devices that interface with living neural tissue. Current neuroengineering research in ECE includes: Nanotechnology for measuring and manipulating neural cells and circuits; Optogenetic and photonic neural interface technology; Computational microscopy and functional neural imaging; Neural recordings in behaving animals; Cutting-edge tools and algorithms for systems neurobiology; Information theory and signal processing methods for neuroengineering; Closed-loop neuromodulation and real-time deep brain stimulation; Theoretical and computational neuroscience.
Faculty: Aazhang, Babakhani, Baraniuk, Halas, Kemere, Pitkow, Robinson, Veeraraghavan

Photonics, Electronics and Nano-devices: The focus of this program is the improved understanding of electronic, photonic, and plasmonic materials, optical physics, the interaction of light and matter, along with the application of that knowledge to develop innovative devices and technologies. The specific areas of interest cover a broad range: nanophotonics and plasmonics, optical nanosensor and nano-acutator development, studies of new materials, in paricular nanomaterials and magnetically active materials; imaging and image processing, including multispectral imaging and terahertz imaging; ultrafast spectroscopy and dynamics; laser applications in remote and point sensing especially for trace gas detection; nanometer-scale characterization of surfaces, molecules, and devices; organic semiconductor devices; single-molecule transistors; techniques for optical communcations; and optical interactions with random, nanoengineered and periodic media; and applications of Nanoshells in biomedicine.
Faculty: Halas, Kelly, Kono, Robinson, Thomann, Tittel, Woods

Systems: Communications, Control, Networks and Signal Processing: The understanding of how to analyze and restructure signals is applied to a wide range of areas, including image and video analysis, representation, and compression; wavelets and multiscale methods; statistical signal processing, pattern recognition, and learning theory; distributed signal processing and sensor networds; communication systems; and computational neuroscience. Emergent applications include high-performance, scalable and widely deployed wireless Internet and expanding "broadband" services for residences and public spaces.
Faculty: Aazhang, Antoulas, Baraniuk, Cavallaro, Clark, Frantz, Knightly, Koushanfar, Orchard, Sabharwal, Simar, Veeraraghavan.

FACULTY

The Department of Electrical and Computer Engineering is committed to excellence and leads innovative research programs that have significant global and societal impact. The department currently has 21 tenure-track faculty, three professors emeriti, and three professors in the practice. In addition, ECE has a number of lecturers, joint faculty, adjunct faculty, postdoctoral researchers, and various visitors. The breadth of awards and honors demonstrate our diversity and commitment to research excellence, including fellows of the IEEE, DoD National Security Science and Engineering Faculty, Optical Society of America, American Association for the Advancement of Science (AAAS), the American Physical Society, the Sloan Foundation, and SPIE International Society for Optics and Photonics. In addition, there are U.S. patent holders, awardees of National Science Foundation (NSF) CAREER awards, ONR and NSF Young Investigator awards, and the Defense Advanced Research Projects Agency Young Faculty awards, a member of the National Academy of Sciences and the National Academy of Engineering, a recipient of a Top 50 Nano Researchers Award and the Defense Advanced Projects Research Agency Young Faculty Award, a member of the American Academy of Arts and Sciences, and a Jack Kilby medalist. Several faculty members have received multiple teaching awards at Rice.

Behnaam Aazhang. J.S. Abercrombie Professor of Electrical and Computer Engineering. B.S. (1981), M.S. (1983), Ph.D. (1986) University of Illinois at Urbana. Communication theory, information theory, and their applications to wireless communication with a focus on the interplay of communication systems and networks; including network coding, user cooperation, spectrum sharing, and opportunistic access. Signal processing, information processing, and their applications to neuro-engineering with foci on (i) modeling neuronal circuits connectivity and the impact of learning on connectivity (ii) real-time closed-loop stabilization of neuronal systems to mitigate disorders such as epilepsy, Parkinson, depression, and obesity.

Athanasios C. Antoulas. Professor of Electrical and Computer Engineering. Diploma (Electrical Engineering) (1975), Diploma (Mathematics) (1975), Ph.D. (1980), Habilitation (1982) ETH Zurich. Large-scale dynamical systems, approximation, computation, linear algebra.

Aydin Babakhani. Assistant Professor of Electrical and Computer Engineering. B.S. (2003) Sharif University of Technology; M.S. (2005), Ph.D. (2008) Caltech. Analysis, design, and testing of integrated sensors and systems with applications in high-speed wireless links, radar, medical imaging, biosensing, and oil/gas monitoring.

Richard G. Baraniuk. Victor E. Cameron Professor of Electrical and Computer Engineering. B.S. (1987) University of Manitoba, M.S. (1988) University of Wisconsin, Ph.D. (1992) University of Illinois. Multiscale, computational signal and image processing; Open access, collaborative scholarly publication.

C. Sidney Burrus. Maxfield and Oshman Professor Emeritus of Electrical and Computer Engineering. B.A. (1957), B.S. (1959), M.S. (1960) Rice University; Ph.D. (1965) Stanford University. Signal processing, DSP algorithms, filter design, wavelets and wavelet-based DSP, technology in education.

Joseph R. Cavallaro. Professor of Electrical and Computer Engineering and Computer Science. B.S.E.E. (1981) University of Pennsylvania, M.S.E.E. (1982) Princeton University, Ph.D. (1988) Cornell University. VLSI Signal Processing, Wireless Communication Systems Architectures, VLSI Systems Design and Prototyping.

John W. Clark, Jr. Professor of Electrical and Computer Engineering and Bioengineering. B.S.E.E. (1962) Christian Brothers College, M.S.E.E. (1965) Case Institute of Technology, Ph.D. (1967) Case Western Reserve University. Electrophysiology (neural, cardiac); mathematical modeling of biological systems; nonlinear system dy-

namics; and electromagnetic field theory.

Frantz, Gene. Professor in the Practice of Electrical and Computer Engineering. B.S.E.E. (1971) University of Central Florida; MSEE (1977) Southern Methodist University; MBA (1982) Texas Tech University. Signal processing systems, innovation, and intrapreneurship.

Naomi J. Halas. Stanley C. Moore Professor of Electrical and Computer Engineering, Professor of Biomedical Engineering, Professor of Chemistry, and Professor Physics and Astronomy. B.S. (1980) La Salle College; M.S. (1984), Ph.D. (1986) Bryn Mawr College. Design and fabrication of optically responsive nano structures, nanophonotics, plasmonics.

Don H. Johnson. J.S. Abercrombie Professor Emeritus of Electrical and Computer Engineering and Statistics. S.B., S.M. (1970), E.E. (1971), Ph.D. (1974) Massachusetts Institute of Technology. Statistical signal processing, information processing, theoretical neuroscience.

Kevin F. Kelly. Associate Professor of Electrical and Computer Engineering. B.S. (1993) Colorado School of Mines; M.S. (1996), Ph.D. (1999) Rice University. Imaging and Spectroscopy at the nanoscale. Understanding the role of mathematics in image acquisition and interpretation. Scanning Probe Microscopy, Electronic Materials, Compressive Infared and Hyperspectral Imaging.

Caleb Kemere. Assistant Professor of Electrical and Computer Engineering. B.A. (1998), B.S. (1998) University of Maryland; M.S. (2000), Ph.D. (2006) Stanford University. Building interfaces with memory and cognitive processes; model-based signal processing; low-power embedded systems.

Edward W. Knightly. Professor and Chair of Electrical and Computer Engineering and Computer Science. B.S. (1991) Auburn University; M.S. (1992), Ph.D. (1996) University of California at Berkeley. Wireless networks, urban-scale testbeds, clean-slate design, diverse spectrum access, multi- antenna systems, hardware platforms, high-performance protocol design, security, and performance evaluation.

Junichiro Kono. Professor of Electrical and Computer Engineering, B.S. (1990) University of Tokyo; Ph.D. (1995) State University of New York at Buffalo. Condensed Matter Physics, Optics and Photonics, Nanoscience and Nanotechnology.

Farinaz Koushanfar. Associate Professor of Electrical and Computer Engineering and Computer Science. B.S. (1998) Sharif University; MS (2000) University of California at Los Angeles; M.A. (2004), Ph.D. (2005) University of California at Berkeley. Sensor networks, low power embedded systems, optimization and statistics.

G. Timothy Noe. Lecturer in Electrical and Computer Engineering. B.S. (2004) University of Southern California; B.S. (2006) Sam Houston State University; M.S. (2012), Ph.D. (2013) Rice University. Ultrafast spectroscopy in pulsed, high magnetic fields for materials science research.

Michael Orchard. Professor of Electrical and Computer Engineering. B.S. (1981), M.S. (1986) San Diego State University; M.A. (1988), Ph.D. (1990) Princeton University. Image and video modeling and compression.

Xaq Pitkow. Assistant Professor of Electrical and Computer Engineering. Assistant Professor of Computational Neuroscience, Baylor College of Medicine. A.B. (1997) Princeton University, Ph.D. (2006), Harvard University. Theories of neural computation in animal brains. Topics include: probabilistic inference, control theory, nonlinear dynamics, population codes. Current projects include analyzing behaviors of animals playing video games; designing animal virtual reality environments; simulating and analyzing computation in neural networks.

Deepa P. Ramachandran. Lecturer in Electrical and Computer Engineering. B.S. (1998) University of Utah; M.S. (2002) Carnegie Mellon University; PhD (2011) Rice University. Modeling of biological systems; Electronics for downhole applications.

Jacob Robinson. Assistant Professor of Electrical and Computer Engineering. B.S. (2003) University of California at Los Angeles, MS/PhD (2008) Cornell University. Nanotechnology to measure and manipulate neural activity.

Ashutosh Sabharwal. Professor in Electrical and Computer Engineering. B.Tech. (1993) Indian Institute of Technology, New Delhi; M.S. (1995), Ph.D. (1999) Ohio State University. Wireless networks, information theory, multiple antenna systems, coding and computation.

Ray Simar. Professor in the Practice of Digital Signal Processing Architecture. B.S. Bioengineering (1981) Texas A&M University; M.S.E.E. (1983) Rice University. Digital signal processors; design methodology and programming tools.

James B. Sinclair. Lecturer in Electrical and Computer Engineering. B.S. (1973), M.E.E. (1974), Ph.D. (1979) Rice University. Parallel computer systems, performance evaluation of parallel systems, I/O in high-performance computer systems, multiprocessor scheduling.

Frank K. Tittel. J.S. Abercrombie Professor of Electrical and Computer Engineering. B.A. (1955), M.S., Ph.D. (1959), University of Oxford, England. Quantum electronic devices, laser spectroscopy with applications in environmental monitoring, atmospheric chemistry, industrial process analysis and control, medical diagnostics based on breath analysis, the life sciences, defense applications and homeland security.

Isabell Thomann. Assistant Professor of Electrical and ComputerEngineering. MS (2001) Swiss Federal Institute of Technology, PhD (2009) University of Colorado at Boulder. Energy, photocatalysis, ultrafast spectroscopy and nanophotonics.

Peter J. Varman. Professor of Electrical and Computer Engineering and Computer Science. B.Tech. (1978), Indian Institute of Technology, Kanpur; M.S. (1980), Ph.D. (1983) University of Texas at Austin. Computer Systems, Storage and Memory Systems, Virtualization and Resource Management, Cloud Computing.

Ashok Veeraraghavan. Assistant Professor of Electrical and Computer Engineering. B.A. (2002) Indian Institute of Technology; M.S. (2004), Ph.D. (2008) University of Maryland. Computational imaging, compressive sensing for imaging, signal processing and computer vision.

Gary L. Woods. Professor in the Practice in Computer Technology. B.A., B.S.E.E. (1988) Rice University; Ph.D. (1991) Stanford University. Compressive Sensing, Semiconductor Failure Analysis, Mobile Health. Optical probing and debugging of advanced integrated circuits.

James F. Young. Emeritus Professor of Electrical and Computer Engineering. B.S. (1965), M.S. (1966) Massachusetts Institute of Technology; Ph.D. (1970) Stanford University. Experimental quantum electronics, particularly fiber optics, communication networks, and the development of vacuum ultraviolet sources and their application to microscopic imaging.

Lin Zhong. Associate Professor of Electrical and Computer Engineering and Computer Science. B.S. (1998), M.S. (2000) Tsinghua University; MA (2002), Ph.D. (2005) Princeton University. Mobile and embedded systems, human-computer interaction, and nanoelectronics.

FACILITIES

Anne and Charles Duncan Hall is designed to promote the sharing of resources among engineering departments, facilitating multidisciplinary research and education. Private offices, classroom, laboratories, lecture halls, an auditorium, conference rooms, and courtyards surround an atrium. The atrium, Martel Hall, is where many poster sessions, conference receptions and engineering events are held. Departments, research institutes, and centers in Duncan Hall include electrical and computer engineering, as well as computational and applied mathematics, statistics, and computer science, the Ken Kennedy Institute for Information Technology, and the Center for Multimedia Communication (CMC) which is situated in a dedicated Texas Instruments Wing. The Abercrombie Building, located adjacent to Duncan Hall, houses part of electrical and computer engineering, as well as chemical engineering and civil and environmental engineering.

All research programs in the department use the extensive computing facilities available for education and research, including two state of the art clean rooms, an undergraduate lab, and a DSP "Elite" Lab. Resources are on a local area network of heterogeneous machines running variations of UNIX operating systems, Windows, and various networking software. The computational hardware available to our faculty and students includes the Rice Computational Research Cluster, a 3 TeraFLOP Cray XD1 Linux cluster, and the Rice Terascale Cluster, a 1 Teraflop HP Integrity Linux cluster. In addition to these large scale shared resources, individual research groups and departments have access to and manage various parallel machines and small clusters of workstations and PCs.

RESEARCH INSTITUTES, CENTERS, LABORATORIES, GROUPS

Rice ECE maintains a number of research entities that foster collaborative research on multidisciplinary projects that attract faculty from other departments and schools on campus and outside of Rice. Depending on size, these entities are referred to as institutes, centers, laboratories or groups.

Institutes

Ken Kennedy Institute for Information Technology

The Ken Kennedy Institute for Information Technology is dedicated to the advancement of research in the fields of computing and information technology. Their goal is to provide broad support for a strong community of research experimentation that challenges traditional disciplinary limits. They see their most important role as being a catalyst for research collaboration across the conventional boundaries of school, department, center and laboratory. They work to encourage partnerships with industry, government and other universities to help solve real-world problems. For more information: k2i.rice.edu

Institute of Biosciences and Bioengineering (IBB)

The mission of the Institute is to promote cross-disciplinary research and education encompassing the biological, chemical, and engineering disciplines. The Institute represents a unique educational environment in which to prepare students to meet the complex scientific, technological, and ethical challenges we face in the twenty-first century. The Institute of Biosciences and Bioengineering seeks to facilitate interdisciplinary research and education, foster ties with the Texas Medical Center, create partnerships with industry, promote the translation of research, and continue to facilitate strong research and training programs. The IBB is a leading pathfinder for faculty members, students, and corporate affiliates, and serves as a catalyst for collaboration and change. IBB members have established dynamic programs and processes to seize opportunities and gather key personnel in interdisciplinary collaborations in the course of research excellence. For more information: ibb.rice.edu

Smalley-Curl Institute (SCI)

The Smalley-Curl Institute is the home of the Applied Physics Graduate Program and of several endowed postdoctoral research fellowship. They strive to establish strong industrial collaborations, and foster new educational and outreach programs. It assists its members in forging new, cross-cutting and interdisciplinary research areas, and in seeking new means of supporting their work. Research in SCI encompasses advanced materials, quantum magnetism, plasmonics and photonics, biophysics and bioengineering, ultracold atom physics, condensed matter and chemical physics, and all aspects of nanoscience and nanotechnology. For more information: sci.rice.edu

Centers

The Center for Multimedia Communication (CMC)

The multidisciplinary Center for Multimedia Communication is a group of faculty and students in the Departments of Electrical and Computer Engineering and Computer Science who conduct research in wireless communications and VLSI signal processing architecture. CMC is supported by a significant commitment of facilities and equipment from Rice University, the National Science Foundation, National Instruments, Nokia, Texas Instruments, Intel, Xilinx, the State of Texas. Students working in the CMC lab explore power efficiency and complexity issues in wireless communication systems. The CMC lab is equipped with multiprocessor workstations, digital signal processing hardware and tools, field programmable gate array (FPGA) hardware and tools, RF radio hardware, RF and digital test equipment, research design and simulation environments, and CAD software suites. The Rice Wireless Open Access Research Platform (WARP) hardware testbed provides support for evaluation and performance analysis of FPGA and ASIC structures for digital baseband processors.
For more information: cmc.rice.edu

The Laboratory for Nanophotonics (LANP)

A team of graduate students and faculty in the Laboratory for Nanophotonics perform groundbreaking research of near and long-term societal benefit in the broad multidisciplinary field of nanophotonics. The research spans the physical, chemical, biological and information sciences, with applications in medicine, energy, and computing. They are a resource for research breakthroughs and advances in the broad, multidisciplinary field of Nanophotonics, spanning the physical, chemical, biological and information sciences of near and long-term societal benefit. They are a resource for team-building and collaborative opportunities in the field of Nanophotonics both nationally and internationally. For more information: lanp.rice.edu

Rice Center for Neuroengineering

In addition to the ongoing neuroengineering research efforts in individual laboratories across campus, the university has established the Rice Center for Neuroengineering (RCNE). The center's goal is to integrate state-of-the-art research and technologies developed by individual research teams into broader research efforts to interrogate and understand neural systems. The mission of the RCNE is to apply engineering principals to neuroscience in a way that advances both the science and technology related to neural systems. RCNE is uniquely

positioned as a leader in neuroengineering thanks to the broad, interdisciplinary research performed in conjunction with the world's largest medical center (Texas Medical Center), steps away from the Rice University campus.
For more information: neuroengineering.rice.edu

Groups

Adaptive Computing and Embedded Systems (Aces) Laboratory
Our society is increasingly dependent on computing machines that have permeated virtually most aspects of our lives. These ubiquitous computing systems run our clouds, servers, personal computers, tablets, and mobile phones as well as medical devices, Mars Rovers, smart grids, modern transportations, drones, and several emerging or yet unanticipated applications. The Internet-of-Things (IoT) further spreads the reach of traditional networks of computing machines to tiny devices that are embedded within the physical world objects. Despite our increasing reliance on computing machines, they remain resource-constrained, inefficiently used, and prone to security breaches as well as malicious attacks. The Adaptive Computing and Embedded Systems (ACES) Lab is focused on building more intelligent embedded computer systems, those that are able to ensure low-overhead security and trust, reduce energy usage, and/or improve performance within the physical resource constraints. Our work creates novel hardware constructs, algorithms, automated tools, and security primitives/protocols that pave the way for the next generation efficient and secure embedded computing. A distinguishing characteristic of our research is bridging the divide between the theory and implementation.
For more information: aceslab.org

Digital Signal Processing (DSP) Group
The DSP group has assembled an innovative team of faculty, staff and graduate students that solves modern signal processing problems; ranging from compressive sensing, distributed signal processing on sensor networks, multiscale geometric analysis, network modeling and inference, to single pixel cameras.
For more information: dsp.rice.edu

Laser Science Group
The Laser Science Group is a multidisciplinary team with members from the Schools of Natural Sciences and Engineering at Rice. This group conducts research and development in quantum electronics, in particular laser spectroscopy applied to sensitive, selective and real-time trace gas detection, and laser applications in environmental monitoring, chemical analysis, industrial process control, and medical diagnostics.
For more information: lasersci.rice.edu

Mid-Infrared Technologies for Health and the Environment (MIRTHE)
Work performed by the Mid-Infrared Technologies for Health and the Environment center (MIRTHE) will span from fundamental science to applied technology. The research transforms aspects of the way doctors care for patients, local agencies monitor air quality, governments guard against attack and scientists understand the evolution of greenhouse gases in the atmosphere.
For more information: mirthe-erc.org

OpenStax College (formerly Connexions)
Dr. Richard Baraniuk founded OpenStax (then Connexions) in 1999 at Rice University to provide authors and learners with an open space where they can share and freely adapt educational materials such as courses, books, and reports. Today, OpenStax CNX is a dynamic nonprofit digital ecosystem serving millions of users per month in the delivery of educational content to improve learning outcomes. There are tens of thousands of learning objects, called pages, that are organized into thousands of textbook-style books in a host of disciplines, all easily accessible online and downloadable to almost any device, anywhere, anytime.
For more information: openstax.org

Realtime Neural Engineering Laboratory
The lab designs systems to interact with complex neural circuits in vivo. These systems enable researchers to explore how information is processed, stored, and retrieved in both healthy brains and in models of human neurological diseases and disorders. The lab focuses on two areas: memory and deep brain stimulation.
For more information: rnel.rice.edu

Rice Computer Architecture
The Rice Computer Architecture group focuses on the design, analysis, and implementation of high-performance computing systems for such demanding tasks as networking, communications, multimedia, and scientific computing. Our group draws faculty and students from the Computer Science and Electrical and Computer Engineering departments.
For more information: cs.rice.edu/CS/Architecture/

Rice Efficient Computing Group (RECG)
The Rice Efficient Computing Group (RECG) develops efficient technologies for future computing, communication and interfacing, with a focus on mobile systems.
For more information: ruf.rice.edu/~mobile/

Rice Integrated Systems and Circuits (RISC)
RISC focuses on analysis, design, and testing of integrated sensors and systems with applications in high-speed wireless links, radar, medical imaging, biosensing, and oil/gas monitoring. Current research includes: Optoelectronic Systems and Devices in Conventional CMOS; Silicon-based Sensors for Electron Paramagnetic Resonance (EPR) Spectroscopy and Imaging; Large-Scale Radiating Integrated (LSRI) Circuits and On-chip Antennas; Silicon-based mm-Wave and THz Transceivers Self-Healing Mixed-Signal Integrated Circuits; CMOS-based Medical Imaging Devices and Sensors.
For more information: ece.rice.edu/~ab28/

TeraNano PIRE: Terahertz Dynamics in Nanostructures
Directed by Prof. Junichiro Kono, the TeraNano PIRE project at Rice University is a unique U.S. – Japan partnership focused on research on terahertz dynamics in nanostructures. This PIRE project seeks to (a) advance our quantitative understanding of THz dynamics in nanostructures, (b) fabricate novel nanostructures for THz study and applications, (c) advance cutting-edge experimental techniques in THz spectroscopy and imaging, and (d) provide new knowledge useful for developing novel THz devices. The projects explore THz dynamics in carbon nanomaterials, namely, nanotubes and graphene. The U.S. and Japan are global leaders in both THz research and nonotechnology and stimulating cooperation is critical to further advance THz science and develop commercial products from new ideas in the lab. The key educational initiative of TeraNano PIRE is the NanoJapan: International Research Experience for Undergraduates program which has been nationally recognized as a model for international education programs for science and engineering students. TeraNano PIRE Graduate Research Assistants at Rice may also apply to participate in the TeraNano PIRE International Research Experience to conduct 1 – 2 month research internships with collaborating research laboratories in Japan.
For more information: nanojapan.rice.edu

Value of Information-Based Sustainable Embedded Nanocomputing (VISEN)
With the many hurdles facing Moore's law—the maxim that states that the sizes of transistors will halve very two years—at the heart of the electronics and information technology industries, sustaining it past the

the next decade is viewed as a serious challenge. Increasingly, electronics and computing devices are being used in contexts where human perception is the primary interface to the (embedded) computing engine: cell phones, bio-prosthetics, sensors, signal processing and search technologies are a few examples. The center's guiding philosophy is to take advantage of the limitations in our ability to perceive quality of information from a computer, and when we do perceive it, our willingness to tolerate it if in return, we are able to have access to devices with much lower cost, energy consumption, heat dissipation and an ability to cope with fluctuations in the "quality" of the transistors. Thus, value of information can be used to guide the design of computing devices, while treating many of the impediments as "features" modeled using probability and randomness, with the goal of sustaining the explosive growth of embedded computing in the nanoscale regime, and be increasingly friendly to the energy footprint of computing systems on a global scale.
For more information: visen.rice.edu

ABOUT RICE AND HOUSTON

Rice is a leading American research university—small, private and highly selective—distinguished by a collaborative, interdisciplinary culture and a global perspective. Only a few miles from downtown Houston, it occupies an architecturally distinctive, 285-acre campus shaded by nearly 4,000 trees. State-of-the-art facilities and laboratories, internationally renowned centers and institutes and one of the country's largest endowments support an ideal learning and living environment.

The university attracts a diverse group of highly talented students and faculty with outstanding graduate and professional programs in the humanities, social sciences, natural sciences, engineering, architecture, music and business. With just 2,324 graduate students and 3,708 undergraduates, it offers an unusual opportunity to forge close relationships with eminent faculty scholars and researchers and the option to tailor graduate programs to specific interests.

Houston offers all the expected educational, cultural and commercial advantages of a large urban center, and more. It's home of the Texas Medical Center, the largest concentration of medical schools, hospitals and research facilities in the world, as well as several other universities. Rice has cooperative programs with the University of Houston, Baylor College of Medicine, the University of Texas Health Science Center and Texas Southern University. Houston is one of the few U.S. cities with resident companies in all four major performing arts—drama, ballet, opera and symphony. It also boasts a museum district featuring exhibits of national and international prominence.

As urban as it is, Houston also is a surprisingly green city. Houstonians enjoy the outdoors in more than 300 municipal parks and 120 open spaces, and many frequent the beach at Galveston Island, only a 45-minute drive away. Other short trips include Austin, the state's capital, and historic San Antonio, both of which are a little more than three hours away.

HOW TO APPLY

Applicants to the ECE Ph.D. and nonthesis programs, go to ecegradapps.rice.edu to apply online. If the link is unavailable, the application deadline has passed.

Deadline for fall admission of Ph.D. and M.E.E. students is the first Tuesday in January.
Deadline for spring admission (M.E.E. only) is October 1.

Students must submit the following materials online with their completed application:

- Transcripts from all colleges and universities attended, including first semester grades for senior year
- The results of the GRE, taken within the last three years
- At least three letters of recommendation from faculty who are familiar with the applicant
- If English is a second language, test scores from the Test of English as a Second Language (TOEFL) are required
- An application fee of $85 (M.E.E. only)

For further information about the department, contact the Graduate Program Coordinator at 713-348-3342 or:

Department of Electrical and Computer Engineering
Rice University
6100 Main Street, MS 366
Houston, Texas 77005
email: elec@rice.edu
ece.rice.edu

FOR ADDITIONAL INFORMATION:

Rice University:
rice.edu
Rice University Office of Graduate and Postdoctoral Studies:
graduate.rice.edu
Graduate Student Association:
gsa.rice.edu
City of Houston:
houstontx.gov
Houston Chronicle:
chron.com
Greater Houston Partnership:
houston.org
Citysearch:
houston.citysearch.com

RICE