The University of Texas at Austin

Electrical and Computer Engineering

Cockrell School of Engineering

Impact Report 2014-2015

From the Chair
Dr. Ahmed Tewfik

The University of Texas at Austin
Electrical and Computer Engineering
Cockrell School of Engineering

I am happy to report that the Department of Electrical and Computer Engineering at The University of Texas at Austin continues to be a national leader in innovation. Texas ECE established a new undergraduate student advisory board, which met for the first time in September 2015 and broadly represents our entire undergraduate student population and the various student organizations in the department. It is actively involved in several academic and nonacademic initiatives that continue to place the department at the forefront of educational innovation.

The department also launched a new tradition of inviting our alumni to our VIP Admitted Undergraduate Students Day in early spring. The event brings together current students, faculty, alumni, and prospective students to give prospective students a glimpse into project-based teaching and the inventions that are taking shape in our highly regarded research centers and laboratories. Our alumni have been involved in contacting admitted students, and I credit their involvement for the almost 30 percent increase in the number of women students in the class of 2019.

Our new professional Master's program was approved this past academic year. The program is unique in that it provides students with online and synchronous access to our entire Master's program, exposes them to CEOs and thought leaders, and trains them to design products within geographically dispersed teams. We will admit our first cohort into the program this coming fall. The program builds on the experience of our extraordinarily successful embedded computing MOOC, which, to my knowledge, remains the only online course with a physical laboratory. We will be announcing the launch of several additional transformational initiatives in the next few months, so stay tuned!

Our faculty members continue to earn the highest of accolades, including most recently a National Science Foundation Waterman Award, an Emmy Award, and a Franklin Institute Medal. The department is now recognized as a leader for change and innovation within The University of Texas at Austin and the Cockrell School of Engineering, and the university continues to make substantial investments into expanding our faculty and enhancing our infrastructure.

I would like to close by thanking our faculty, students, staff, and alumni. Our accomplishments and continuing rise in rankings are due to the unrelenting efforts and creativity of our faculty, students and staff. Their work is sustained by the generous time and financial support of our friends and alumni.

Program Rankings

Undergraduate Program

Electrical Engineering **# 8**

Computer Engineering **# 8**

Source: U.S. News and World Report - Top Engineering Schools 2016

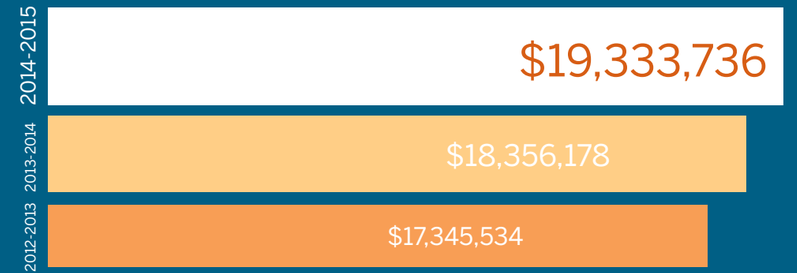
Graduate Program

Electrical Engineering **# 10**

Computer Engineering **# 9**

Source: U.S. News and World Report - Top Engineering Schools 2015

Total Research Expenditures

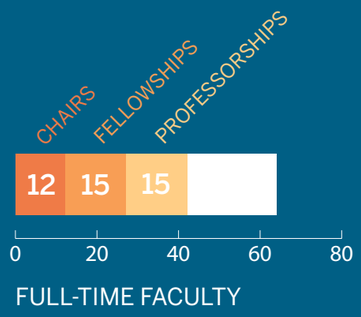


+11% since 2012

Current Faculty Includes

ENDOWMENTS

$28 Million in Endowed Positions



66% of full-time faculty hold an endowed position

FACULTY HONORS

24 IEEE FELLOWS	2 ACM FELLOWS	2 NAE MEMBERS
28 NSF CAREER AWARDS	14 DOD/ONR YOUNG INVESTIGATOR AWARDS	2 NSF PECASE AWARDS

The Compass Center

Texas ECE formed **The Compass Center**, a comprehensive educational support system designed to graduate a more diverse, proficient, and well-rounded labor force. Initiatives include K-12 outreach, student recruitment, summer bridge activities, mentoring and tutoring, and an incentivized Master of Science in Engineering degree.

Top 10 MOOC

Embedded Systems - Shape the World
One of the Top 10 most popular Massive Open Online Courses (MOOCs) based on registration numbers. This course stands out by taking a lab-based hands-on approach to online courses.

Undergraduate Program

Student Population

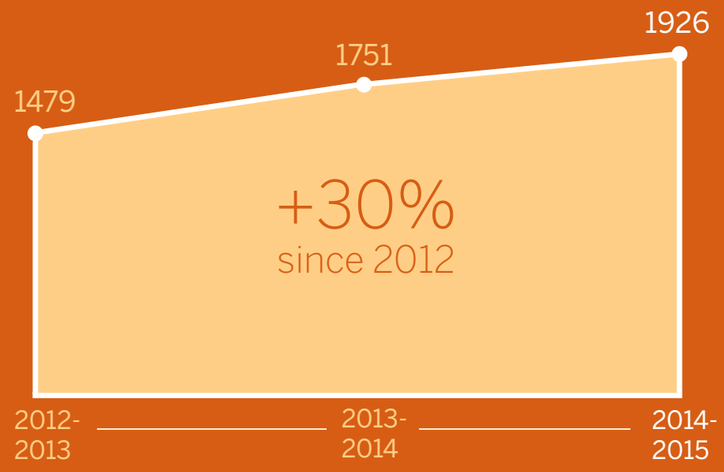
1484
BS

15% Female

88% Texas Resident

URM 18%
Percentage of Underrepresented Minorities

Applicants



Graduate Program

Student Population

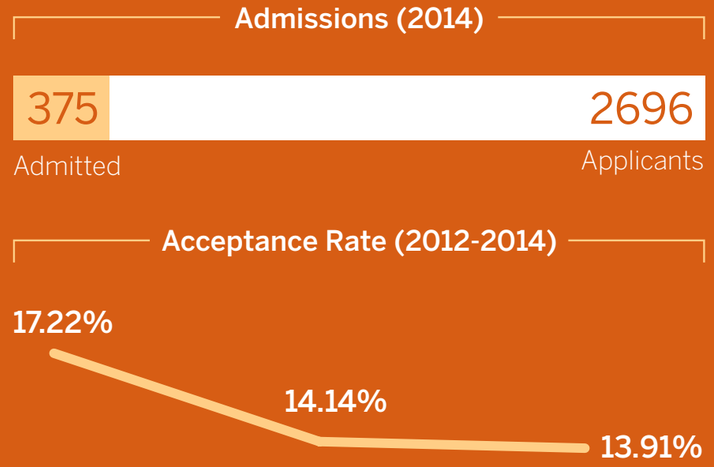
210 **MS** 373 **PhD**

16% Female

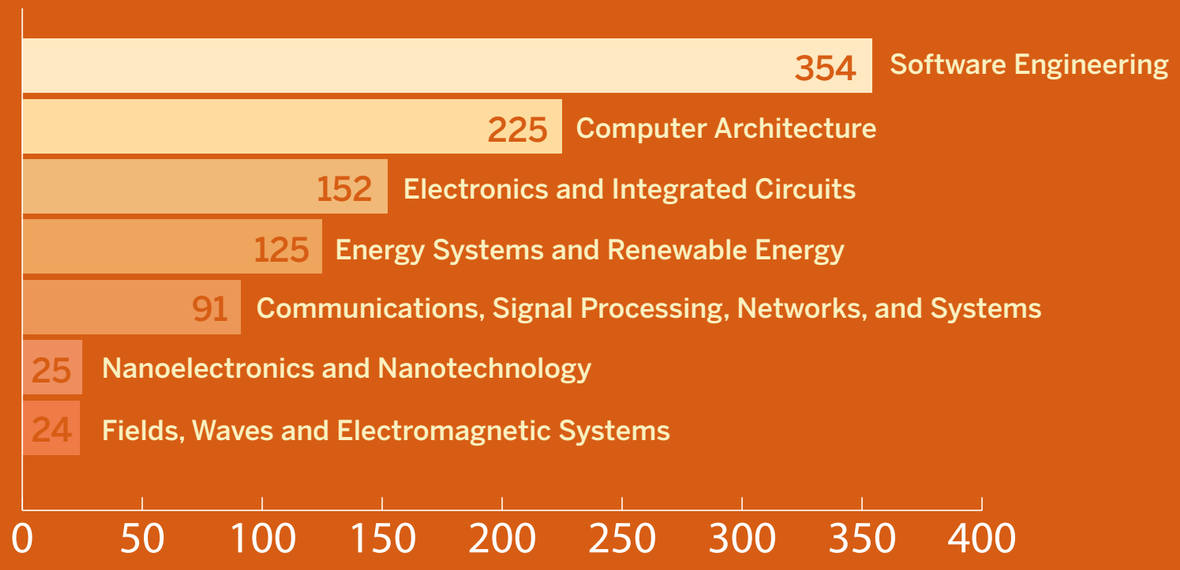
64% International

URM 4%
Percentage of Underrepresented Minorities

Applicants vs. Admissions

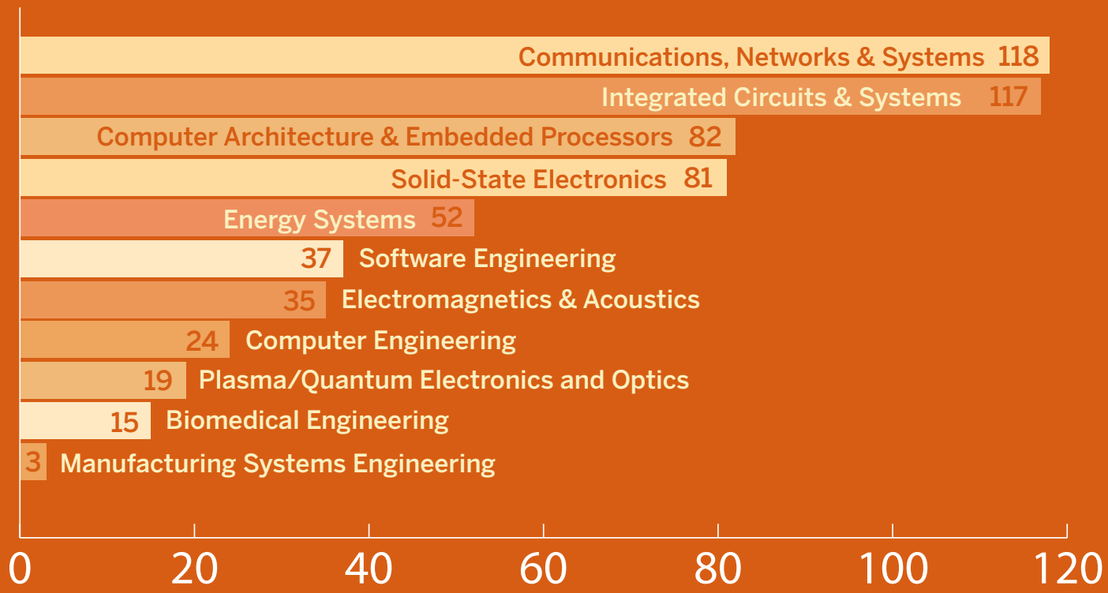


Student Technical Core Concentration*



*Represents completed tech core elections (sophomore/junior)

Student Research Area Concentration



Lighter, Cheaper Radio Wave Device Could Transform Telecommunications

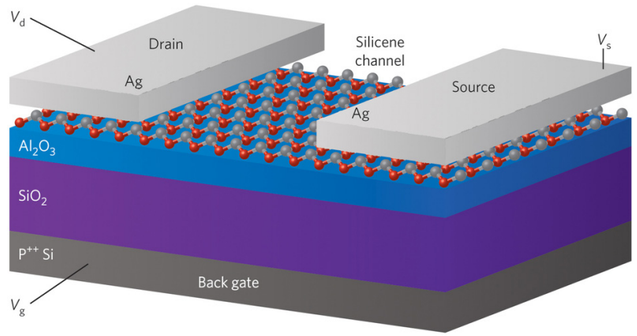
Prof. Andrea Alù and his research team have achieved a milestone in modern wireless and cellular telecommunications, creating a radically smaller, more efficient radio wave circulator that could be used in cellphones and other wireless devices. The new circulator has the potential to double the useful bandwidth in wireless communications by enabling full-duplex functionality, meaning devices can transmit and receive signals on the same frequency band at the same time. The key innovation is the creation of a magnetic-free radio wave circulator.

Prof. Andrea Alù Wins $1 Million National Science Foundation Waterman Award

The annual award, one of the highest given to scientists and engineers in the United States, recognizes an outstanding young researcher (35 years old or younger) in any field of science or engineering supported by the National Science Foundation (NSF).

Atom-Thick Silicon Makes Crazy-Fast Transistors

Prof. Deji Akinwande and his research team have created the first transistors out of silicene, the world's thinnest silicon material. This new "wonder material" could make computers and other electronics more efficient.



The transistor is made of a one-atom-thick layer of silicon atoms, Akinwande and his team's first-of-their-kind devices represent the thinnest of any semiconductor material, a long-standing dream of the chip industry, and could pave the way for future generations of faster computer chips.

Prof. Yale Patt Awarded Benjamin Franklin Medal

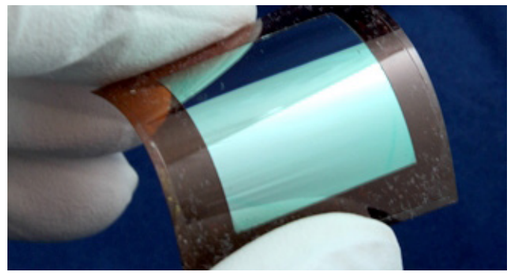
Prof. Yale Patt was awarded the Franklin Institute's 2016 Benjamin Franklin Medal in Computer and Cognitive Science "for his work on exposing and exploiting instruction-level parallelism to improve computer performance."

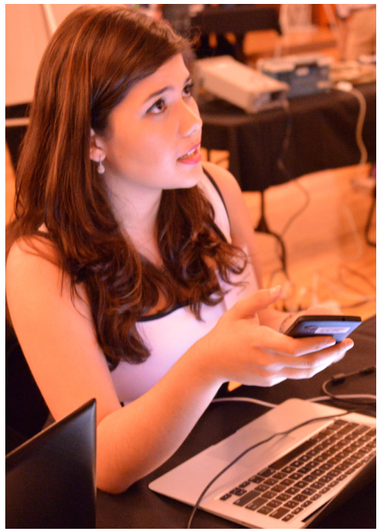
And the Emmy goes to...

Prof. Al Bovik and his team of former students and collaborators were awarded television's highest honor, a Primetime Engineering Emmy Award for Outstanding Achievement in Engineering Development, for their work on the development of video quality prediction models which have become standard tools throughout the television industry.

Researchers Create First Flexible Silicon Photonic Crystal Cavity

Prof. Ray T. Chen and his research team have created the first silicon nanomembrane based flexible photonic crystal cavity. This new form of silicon photonic devices could have numerous applications in wearable devices and biomedical instruments.





Senior Design: Collaboration with Industry Emphasizes Finding Creative Solutions to Real-World Problems

The Senior Design Project program is a win-win program where students, The University of Texas at Austin, and the corporation greatly benefit through collaboration, diversity, real-world knowledge, and successful outcomes.

"The AT&T U-verse Labs partnered with five Texas ECE students through a senior design project which resulted in a 50% testing time reduction in spite of the 50% increase in tests which reduces the verification cycle and allowing a faster time to market." ~ AT&T/The University of Texas at Austin Partnership 2014-15

"Participating in the education of these students is as much a valuable experience for us as it is for them," *said Laura Kelly, Chief Product and Data Solutions Officer at Dun & Bradstreet.*

Senior Design Spotlight: ChemSense

ChemSense is a portable system for detecting hazardous airborne chemicals. The project integrated a tunable, mid-infrared laser spectrometer in a portable low power package. The device replaces hundreds of pounds of laboratory equipment normally used in absorption spectroscopy with a single, handheld unit. The team designed and integrated the laser driver and photodetector post amplifier circuits on a printed circuit board, to enable miniaturization of the system. For increased flexibility the device incorporates Bluetooth low energy connectivity and a dedicated Android application.

Finding Hidden Connections in Complex Data

The goal is to model data as multiple, interconnected relationships, such as the relationship between a patient and their medication and diagnosis, or a patient and their symptoms.

Prof. Joydeep Ghosh is developing a computational framework to model data in the healthcare field. The goal is to model data as multiple, interconnected relationships, such as the relationship between a patient and their medication and diagnosis, or a patient and their symptoms. His research team will develop scalable algorithms to analyze these relationships and derive hidden concepts from the available data. Clinical experts will refine these concepts into specific phenotypes.

Prof. Ghosh is also creating a framework to establish efficient solutions for different classes of associated learning problems. This research has widespread applications in the study of diseases, where only a small number of genes associated with certain illnesses are known. The question becomes how to prioritize, simultaneously and for each disease, a small number of additional genes associated with the illness.

Alum Evan Grim and Toopher Authentication

Two-factor authentication is quickly becoming the industry standard for protection against password fraud. Twitter, Google, and Facebook all introduced two-factor authentication, which requires two-steps to identify a user at login, within the past two years.

Toopher is an Austin-based startup created by Texas ECE alumnus Evan Grim and Josh Alexander, an adjunct professor in the McCombs School of Business at The University of Texas at Austin. Evan Grim received his MS at Texas ECE in 2012. He began working on his PhD in Software Engineering in the Mobile and Pervasive Computing Lab before taking leave to launch Toopher in 2011.

Toopher aims to create a significant reduction in password fraud by using a novel approach to two-factor authentication: the physical location of a user's phone. At login, the Toopher system compares the computer they are using to the physical location of the user's phone. Compared to other methods of two-factor authentication, Toopher promises a superior user experience by not requiring a user action every time you log on, but rather only the first time you log on to an individual machine.

Toopher joined the Austin Technology Incubator in January 2013 after closing $2 Million in funding from investors in December 2012. The Austin Technology Incubator is the startup incubator of The University of Texas at Austin. Toopher was acquired by SalesForce in April 2015.

Partners in Industry

Texas ECE is committed to building strong industrial and alumni partnerships with a focus on technology innovation, world-class education and talent, academic excellence, and STEM and diversity initiatives. We work together for the advancement of business and economic goals, department goals, and for the advancement of the electrical and computer engineering fields.

3M
Adobe Systems Incorporated
Advanced Micro Devices Inc.
Alfred P. Sloan Foundation
Alpha Natural Resources
Apple Inc.
Applied Materials Inc.
AT&T Inc.
Autodesk Inc.
Avvasi Inc.
Ayco Charitable Foundation
Baker Hughes
Barclays Capital
The Boeing Company
BP America Inc.
BP Foundation Inc.
Broadcom Corporation
Cameron
Caterpillar Foundation
Centerpoint Energy
Chevron Corporation
CHiP Semiconductor
Chrysler Group LLC
Circuit of the Americas LLC
Cirrus Logic Inc.
Cisco Systems Inc.
Cognitive Scale Inc.
CommScope Inc.
ConocoPhillips Company
Create Technologies Inc.
CSIdentity Corporation
Cura Oceanus
David and Lucile Packard Foundation
Dell Inc.
Design Verification Trade Association
Digiclaim Inc.
DTE Energy Foundation
Dun & Bradstreet
Electric Power Research Institute Inc.
Electronic Polymers Newco Inc.
Entropic Communications Inc.
Environmental Defense Fund
ExxonMobil Corporation
ExxonMobil Foundation
Fluor Enterprises Inc.
Ford Motor Company
Freescale Semiconductor Inc.
Fujitsu Dallas
Fujitsu Laboratories of America Inc.
Futurewei Technologies Inc.
General Motors Foundation
Google Inc.
Halliburton Energy Services Inc.
Halliburton Foundation Inc.
IBM Corporation
Intel Corporation
Intel Foundation
Keste LLC
Lockheed Martin
Maxtena Inc
Mentor Graphics
Microsoft Corporation
Mistubishi Electric Research Laboratories
Nanohmics
National Instruments Corporation
Network for Good
Nissan
Nokia Telecommunications Inc.
Nuvoton Technology Corporation America
NVIDIA Corporation
OAS Design Group Inc.
Oracle Corporation
PayPal
Pecan Street Project Inc.
Pedernales Electric Cooperative
Pestorius
Phillips 66
Plantronics
Qualcomm Incorporated
Quorum Business Solutions
Salesforce.com
Samsung Austin Semiconductor LLC
Sandia National Laboratories
Schlumberger Technology Corporation
Scisense Inc.
SEMATECH Inc.
Semiconductor Research Corporation
Silicon Audio Inc.
Silicon Laboratories
Silicon Valley Community Foundation
Sunpower Corporation
Tenaris
Texas Instruments Foundation
Texas Instruments Incorporated
Texas Motor Sports
Texas Solar Energy Society
TLi Inc.
Toppan Photomasks
TransCanada Pipeline USA Ltd.
Transonic Scisense Inc.
Toyota InfoTechnology Center USA, Inc.
Union Pacific Railroad Company
United States Air Force
University Co-operative Society
Welch Foundation
WF Calohan Ltd.
Williams Companies Foundation Inc.
Xilinx
Yokogawa Electric Corporation

Inside the **Engineering Education and Research Center**

Opening 2017

QUALCOMM®

Funding to develop a faculty/graduate student research laboratory for networking and communications

CAMERON

Funding to support individual student project space

ConocoPhillips

Funding to support individual student project space

Schlumberger

Funding to support space for engineering student organizations

TEXAS INSTRUMENTS

Funding to develop state-of-the-art analog and embedded systems laboratories to promote hands-on learning for students

NATIONAL INSTRUMENTS™

Funding to provide a large interdisciplinary space for student projects to promote practice in innovation

Department of Electrical and Computer Engineering
The University of Texas at Austin
1616 Guadalupe St. Austin, TX 78701

www.ece.utexas.edu

The University of Texas at Austin
WHAT STARTS HERE CHANGES THE WORLD