



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

MIN H. KAO DEPARTMENT OF
ELECTRICAL ENGINEERING &
COMPUTER SCIENCE

ANNUAL REPORT 2018



Meet the new faculty members of the Min H. Kao Department of Electrical Engineering and Computer Science on **Page 6**.

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Published by
Min H. Kao Department of Electrical Engineering
and Computer Science
The University of Tennessee
Min Kao Building
1520 Middle Drive, Suite 401
Knoxville, TN 37996-2250

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On the Cover: (back row, L-R) Dr. Dan Wilson, Dr. Amir Sadovnik, Dr. Scott Ruoti; (middle row, L-R) Dr. Josh Dunn, Dr. Hua (Kevin) Bai, Interim Department Head Dr. Greg Peterson; (front row, L-R) Dr. Arun Padakandla, Dr. Austin Henley, Dr. Michela Taufer.



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The artwork on the inside cover of this publication was created by artist Dana Potter, a graduate student in The University of Tennessee's School of Art. Her artistic interest cultivates in the exponential integration of technology into daily life. Four of her art pieces grace the atrium of the Min Kao Building, home of the Min H. Kao Department of Electrical Engineering and Computer Science. (art.utk.edu/dana-potter/)

DEPARTMENT AT A GLANCE

DEGREES OFFERED

Bachelor of Science

Electrical Engineering
Computer Engineering
Computer Science

Master of Science

Electrical Engineering
Computer Engineering
Computer Science

Doctor of Science

Electrical Engineering
Computer Engineering
Computer Science

ENROLLMENT FIGURES

Enrollment (Full-Time)

Academic Year 2018-2019

Undergraduate	834
M.S.	71
Ph.D.	174
Total	1079

Degrees Granted

Academic Year 2017-2018

Undergraduate	149
Graduate	87
Total	236

Faculty

Academic Year 2018-2019

Professors	24
Associate Professors	11
Assistant Professors	10
Lecturers	4
Total	49

Fall 2018 Freshman Enrollment

Computer Science	120
Computer Engineering	75
Electrical Engineering	60
Total EECS Freshmen	255

ACCREDITATION

All undergraduate degree programs under the Department of Electrical Engineering and Computer Science are accredited by ABET.

2017 ASEE SURVEY DATA

- 13th nationally among public EECS programs in research expenditures per tenure-line faculty member. Research expenditures grew 66% from FY15 to FY18.
- 5th nationally among public EECS programs in Ph.D. enrollment per tenure-line faculty member.

(Survey data from the American Society for Engineering Education)

Current Faculty Includes:

2

UNIVERSITY
DISTINGUISHED
PROFESSORS

3

ENDOWED
CHAIRS

10

ENDOWED
PROFESSORSHIPS

4

NAE
MEMBERS

17

IEEE
FELLOWS

11

NSF
CAREER
AWARDEES

3

NAI
MEMBERS

DEPARTMENT LEADERSHIP



Gregory Peterson
Interim Department
Head



Jens Gregor
Associate Department
Head
*External Relations and
Graduate Affairs*



Hairong Qi
Associate Department
Head
Academic Affairs

AWARDS FOR 2017-2018

Faculty Awards

Dr. Michael Berry

Charles and Julie Wharton Teaching Fellow Award, 2018

Dr. Josh Dunn

Graduate Student Senate Excellence in Teaching Award, 2018

Dr. Austin Henley

Honorable Mention Award from IEEE VL/HCC, 2017

Dr. Fangxing (Fran) Li

TCE Faculty Research Fellow, 2018

Dr. Garrett Rose

TCE Professional Promise in Research Award, 2018

Dr. Scott Ruoti

John Karat Usable Privacy And Security Research Award, 2017

Dr. Michela Tauffer

J.P. Morgan Chase Faculty Scholar, 2017-2018

Dr. Kevin Tomsovic

Research and Creative Achievement Award, University of
Tennessee Chancellor's Honors, 2018

Dr. Fred Wang

IEEE IAS Industrial Power Conversion Systems Department
Gerald Kliman Innovator Award, 2018
TCE Faculty Research Fellow, 2018

Paper Awards

Best Paper Award, **Qing "Charles" Cao** and graduate students
Yunhe Feng and Zheng Lu, "Secure Sharing of Private Locations
through Homomorphic Bloom Filters," 2018 IEEE BigDataSecu-
rity, the 4th IEEE International Conference on Big Data Security
on Cloud, Omaha, NE.

Best Oral Paper Presentation Award, Electrical Engineering
graduate student **Frances Garcia**, "A SPICE Model for GaN-Gate
Injection Transistor (GIT) at Room Temperature," 2018 Connecti-
cut Symposium on Microelectronics & Optoelectronics (CMOC),
New Haven, CT.

Best Paper Award, **Scott Ruoti**, "Layering Security at Global
Control Points to Secure Unmodified Software," 2017 IEEE
Secure Development Conference, Boston, MA.

Student Awards

2018 The University of Tennessee Chancellor's Honors:

Extraordinary Academic Achievement

*Extraordinary Academic Achievement honors are awarded
to undergraduates who exhibit extraordinary scholarship.*

- **Chandler Jackson Bauder**
- **Grant Bruer**

Extraordinary Professional Promise

*Extraordinary Professional Promise honors are awarded to
undergraduate and graduate students who demonstrate
professional promise in teaching, research or other
contributions.*

- **Shaghayegh Aslanzadeh**
- **Farnaz Foroughian**
- **Mohammad Aminul Haque**
- **Ava Hedayatipour**
- **Shahram Hatefi Hesari**
- **Gerald (J. T.) Liso**
- **Ali Mohsin**
- **Rania Oueslati**
- **Farhan Quaiyum**
- **Mohammad Ehsan Raoufat**
- **Samira Shamsir**
- **Mst Shamim Ara Shawkat**
- **Jordan E. Shurmer**
- **Farshid Tamjid**
- **Taylor Anne Woodward**

Top Collegiate Scholar Awards

*The Top Collegiate Scholar Awards honor undergraduates
who exhibit extraordinary scholarship.*

- **Grant Richard Bruer**
- **Luke Johnston Mills**
- **Phuc Tran Hoang Pham**
- **Sophie Elizabeth Wardick**

A Message from the Interim Department Head



2018 is an exciting time for the Min H. Kao Department of Electrical Engineering and Computer Science, filled with opportunities and change. The cover photo of this report shows one noteworthy update: we have eight new faculty added to the department starting this fall. Pages 6-9 include brief biographies to introduce each of our new faculty members.

I would like to express my deepest gratitude to Dr. Leon Tolbert for his stellar service to the department as head for the previous 5½ years, starting in January 2013. The department's growth under his leadership has been phenomenal. As illustrated in the figures on page 29, under his leadership the number of EECS undergraduate students has grown more than 30% and research expenditures have increased over 50%. At the end of July, he returned to the faculty to once again pursue his research in power electronics, participate in the CURENT center, and work with students as a teacher, advisor, and mentor.

To continue with the theme of change this past year, the Tickle College of Engineering's dean, Dr. Wayne Davis, transitioned to become the interim chancellor for UTK. In his stead,

Dr. Lynne Parker of EECS became the interim dean for TCE until August, when she became Assistant Director of Artificial Intelligence at the White House Office of Science and Technology Policy (OSTP), a particularly exciting opportunity for her. At that point, Dr. Mark Dean became the interim dean for TCE, where he currently serves.

The EECS department continues to grow, with undergraduate enrollment growing to 834 students in the fall of 2018. Once again, the departmental research expenditures set a new record, with nearly \$23M during FY2018 (July 2017 – June 2018). Our research expenditures per tenured/tenure-track faculty exceed those of our aspirational peers, meaning that our department is among the most productive in the country.

We highlight the research of Dr. Jayne Wu and the Initiative for Point Detection and Nanobiosensing (IPN). Her biosensor technology includes a prototype device to help detect diseases and has recently been licensed for commercialization.

We also explore the cybersecurity research of Dr. Jinyuan "Stella" Sun addressing Internet of Things (IoT) devices deployed in the power grid. These smart devices promise to provide better service and reliability, but face challenges to ensure their correct operation, even under attack.

On page 12, we present our featured alumnus, Joel Seligstein, and his career and accomplishments. Having worked at Facebook and founded an investment company, he then created the Parallel Plaid game

studio, while also becoming an Olympic bobsledder.

For nearly three decades, Dr. Brad Vander Zanden has been a pillar of the department, providing leadership and passionate teaching to countless computer science students. In our faculty spotlight on "BVZ," we share some of the impact he has had throughout his career.

As the culmination of the undergraduate educational experience, the capstone senior design class acts as the "finishing school" for students who get to apply the theory from throughout their curriculum to a significant team project, along with many of the practical challenges in working on real-world electrical and computer engineering or computer science problems. We showcase interesting aspects of this class and how it helps complete the undergraduate educational experience for our students.

On August 1, after 18 years as a professor in EECS and director of the supercomputing center at The University of Tennessee, I began serving as the interim head for EECS. I will seek to build on the momentum of the past 5 years and am particularly excited about our amazing potential for continued growth. I look forward to working with faculty, staff, students, and alumni as we strive to maintain the Volunteer spirit of excellence in education, research, and service. Best regards,

A handwritten signature in black ink, appearing to read "Greg Peterson".

Greg Peterson

EECS Professor and Research Team Develop Potentially Life-Saving Technology

It may sound like science fiction - a hand-held device that can quickly diagnose diseases and pathogens in the field - but Dr. Jayne Wu, a professor in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee, is working to make it a reality. Dr. Wu, who was recently promoted to full Professor, and Dr. Shigetoshi Eda, professor in the Department of Forestry, Wildlife, and Fisheries at the UT Institute of Agriculture, have been collaborating since 2009 to develop a low-cost diagnostic device that is easy to use, portable, and can detect infectious diseases, pathogens, and physiological conditions in humans and animals in a matter of minutes.

Drs. Wu and Eda, along with researchers from UT and other universities, have since established an organized research unit called the Initiative for Point Detection and Nanobiosensing (IPN). The vision/overarching objective of this collaborative initiative is to use nanobiosensing technology to design, detect, and validate rapid tests at the “point of need” (PON) and/or “point of care” (POC) to facilitate clinical microbial diagnosis and monitoring of environmental, food or water safety.

The focus of IPN is to fully exploit a UT-developed “ACEK capacitive sensing” technology and develop novel “sample in-result out” diagnostics for on-site detection of small molecules, proteins, biomarkers and pathogens from practical samples. Some of IPN’s objectives include diagnosing diseases during office visits, quickly and inexpensively, pro-



Dr. Jayne Wu

viding easy identification of infectious pathogens or toxins in the field, and generating point-of-care triage devices that can speed delivery of lifesaving treatment.

Most of the diagnostic devices that have been available to date are large, expensive, and most importantly, slower and less accurate. Historically, the process of sending samples away for evaluation could take up to a week, and even newer devices can take hours to provide results. Moreover, similar diagnostic tests can cost anywhere from \$10 to \$100 per sample and require the use of expensive benchtop equipment, whereas this reusable, handheld device will only cost a few hundred dollars and uses a microchip that will cost only a few dollars per sample.

Dr. Wu spoke to IEEE Pulse Magazine in 2013, comparing

IPN’s research to the prevailing technology. “Today, the main tool for diagnosing infectious disease is the enzyme-linked immunosorbent assay (ELISA), which tests a patient sample, usually a drop of blood. ‘ELISA demands several steps that typically include incubation, washing, labeling with an antibody, a second incubation, and a final wash to get a result,’ Wu said. ‘That’s a sophisticated process that takes several hours and requires the expertise of trained technicians.’ These are all luxuries that may well be lacking during a disease outbreak. It can also be expensive.”

“In comparison, the device that we are developing is cheap and easy to implement, doesn’t require a lot of preparation, and can be used in the field by laypersons,’ Wu said.” The smartphone-sized device is also portable.

“Time is of the essence when treating infectious diseases, and this device not only can detect



illness early so treatment can begin but also can help to identify potential outbreaks,' Wu said. 'These can both save lives.'"¹

The new device that Dr. Wu and her collaborators have developed is a small, handheld instrument called an ACEK-based capacitive biosensor (ABC biosensor). It uses a technology called Alternating Current ElectroKinetics (ACEK) capacitive sensing, which was developed at The University of Tennessee. ACEK is a way of manipulating particles through the application of electrical fields. This technology uses microelectrode sensor chips to directly detect very minute levels of a specific analyte from complex samples, and therefore is more sensitive and significantly faster than traditional detection methods.

Users place a sample onto a chip in the ABC biosensor, and results can be ready in less than two minutes. Body fluids like blood, milk or saliva are used to detect disease and evaluate health conditions.

The IEEE Pulse Magazine interview with Dr. Wu describes this process: "To test a sample for infectious disease, the user takes a drop of blood from the patient and places it on a microchip that has already been treated with specific antibodies or probe molecules for one or more infectious diseases, slides the microchip into the device, and then waits. In as little as two minutes, the device reads out the results."

"A lot happens inside the device in that short amount of time. The device contains microelectrodes, which are coated with antigens extracted from an infectious agent. These antigens act as the probe molecule and bind with specific antibodies that occur in the patient sample as a response to infection. The micro-

electrode array then employs a precisely determined ac electrical signal to the patient sample to induce bioparticle movement and draw the antibodies toward the bound antigens on the microelectrodes. When the antibodies bind with these antigens, a small current shift resulting from the changes in electrical impedance occurs, and that small shift is enough to signify that the infec-



tion is present."

The IPN team "has already successfully used the prototype device to identify bovine tuberculosis and Johne's disease, an especially dangerous disease

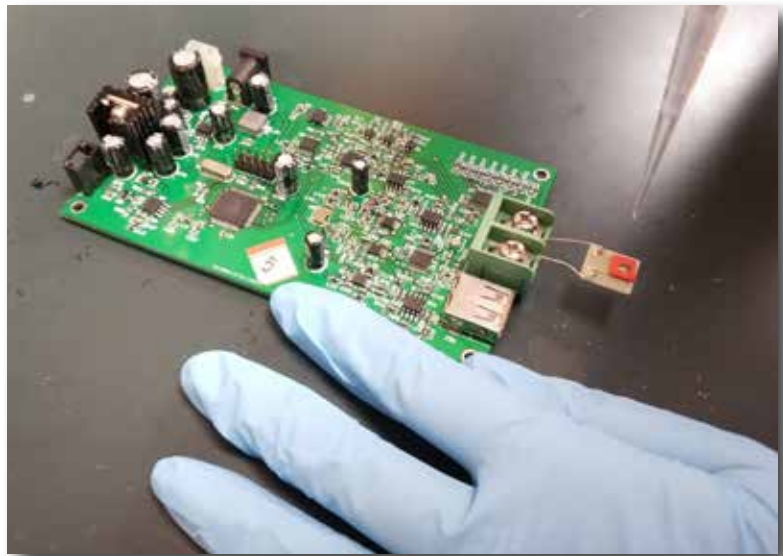
in cattle." They "have also used it to identify tuberculosis in humans, and they now hope to further develop the device to diagnose many additional diseases and widely varying physiological conditions, eventually extending to pregnancy, AIDS, cancer, Alzheimer's disease, and food-borne pathogens."¹

In August 2017, The University of Tennessee Research Foundation licensed this innovative point-of-care diagnostic device to Vortex BioTech, a Knoxville-based startup company that focuses on in-vitro diagnostic technologies.

Vortex BioTech aims to offer a beta product in the next few months. Thereafter, the company anticipates partnering with a strategic company to scale up production and make the device available around the globe.

At a time when they are needed more than ever, the ABC biosensors developed by Dr. Wu and the researchers of IPN may soon be deployed worldwide in an effort to help detect diseases and save lives.

1. Mertz, Leslie. "Preparing for the Unthinkable, and Taking Action When It Happens." *IEEE Pulse Magazine* May/June 2013.



FRESH FACES

The Newest EECS Faculty Members



Dr. Hua "Kevin" Bai

Associate Professor

Ph.D.: Tsinghua University, Beijing, China, 2007

Research Areas: Power Electronics with Motor Drive System, Battery Chargers for Electric Vehicles, Accessory Power Module, Battery Management System, Wide-bandgap Devices

Dr. Hua "Kevin" Bai received B.S. and Ph.D. degrees from the Department of Electrical Engineering of Tsinghua University, Beijing, China in 2002 and 2007, respectively. Dr. Bai was a postdoctoral fellow in University of Michigan-Dearborn from 2007 to 2010. In 2010, he joined the Department of Electrical and Computer Engineering, Kettering University (former General Motor Institute) as an Assistant Professor and earned his early tenure as Associate Professor in 2015. He became the Associate Professor in CECS, UM-Dearborn from January, 2017 to 2018. In all his Michigan life since 2007, he devoted himself and his research team to electric vehicle-related power electronics, particularly on high-power-density and high-efficiency EV battery chargers and motor drive inverters. His industrial partners include major vehicle companies like GM, Ford, Chrysler, and Daimler and suppliers like Magna, Bosch, and Hella. In August 2018, he became an Associate Professor in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee. He is the associate editor of SAE International Journal of Alternative Powertrains, Guest Associate Editor of Journal of Emerging and Selected Topics of Power Electronics, and IEEE Access.

Dr. Bai frequently teaches microelectronics, power electronics, battery/energy storage systems, and analogue and digital signals and systems.



Dr. Joshua Dunn

Lecturer

Ph.D.: Computer Science, The University of Tennessee, 2018

Research Areas: Computer Vision, Image Registration and Segmentation, Medical Imaging

Dr. Joshua Dunn is a lecturer in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee. He is currently finishing his Ph.D. in Computer Science at The University of Tennessee. His interests include computer vision, image registration and segmentation, and medical imaging. Before starting as a lecturer, Dr. Dunn served The University of Tennessee as a graduate teaching assistant and received the Graduate Student Senate Excellence in Teaching Award in 2018 and the Gonzalez Family Graduate Teaching Assistant Award in 2015.



Dr. Scott Emrich
Associate Professor

Ph.D.: Iowa State University, 2007

Research Areas: Genome-Focused Bioinformatics, High-Throughput and Parallel Computing, Life Science Applications

Dr. Scott Emrich obtained his B.S. in Biology and Computer Science from Loyola College in Maryland and his Ph.D. in Bioinformatics and Computational Biology from Iowa State University, where he was the recipient of the 2008 Zaffrano Prize for Graduate Research. Prior to joining the faculty of The University of Tennessee, Dr. Emrich was the Director of Bioinformatics at the University of Notre Dame with a primary faculty appointment in Computer Science and Engineering and a courtesy appointment in Biological Sciences.

His research focuses on computational genomics/sequence analysis and related informatics with an emphasis on global health and ecological applications. He has published over 75 peer-reviewed publications including venues such as Science (2 covers), PNAS, Nature and Genome Research. He has four active awards from the NIH including leading roles on a NIAID contract (VectorBase) and a 2017 funded PO1 (malaria genetics).



Dr. Austin Henley
Assistant Professor

Ph.D.: Computer Science, University of Memphis, 2018

Research Areas: Software Engineering, Human-Computer Interaction

Dr. Austin Henley is an Assistant Professor in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee, Knoxville. He received his Bachelor's degree in 2011 from Austin Peay State University in Clarksville, Tennessee, before attending the University of Memphis where he received his Master's in 2013 and Ph.D. in 2018, all in Computer Science.

Dr. Henley's research focuses on the human aspects of software engineering. He conducts empirical studies to better understand the behavior of software developers, and then builds software tools to make developers more productive. In particular, his dissertation addressed problems developers face when navigating source code by extending code editors with more efficient affordances for navigation. He has applied his research to industrial settings during his five internships, which included Microsoft Research, National Instruments, and IBM Research. His current research interests include supporting collaborative software development as well as the learnability of software development tools.



Dr. Arun Padakandla
Assistant Professor

Ph.D.: University of Michigan, 2013

Research Areas: Data Science, Privacy-Preserving Data Analysis, Security, Information Theory, Cybersecurity, Communication Networks, Optimization, Statistical Inference, Computation Complexity

Dr. Arun Padakandla received his M.S. degree in Electrical Communication Engineering (ECE) from the Indian Institute of Science (IISc), Bangalore in 2008. He received an M.S. degree in Mathematics in 2013 and a Doctorate in Electrical Engineering (Systems) in 2014, both from The University of Michigan at Ann Arbor. Following a short stint as a postdoctoral researcher at Michigan, Dr. Padakandla worked as a research engineer at Ericsson Research from November 2014 to August 2015. Dr. Padakandla held a center-wide postdoctoral research fellowship from 2015 to 2018 at the Center for Science of Information – an NSF funded science and technology center located at Purdue University. Dr. Padakandla's research interests lie in information theory, optimization, learning and estimation, and computational complexity.



Dr. Scott Ruoti
Assistant Professor

Ph.D.: Computer Science, Brigham Young University, Provo, UT, 2016

Research Areas: Systems Security, Web Security, Usable Security, Blockchain

Dr. Scott Ruoti is an Assistant Professor in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee. He received his Ph.D. degree in Computer Science from Brigham Young University in 2016. For the next two years, Dr. Ruoti was a researcher at MIT Lincoln Laboratory. While there, he led a range of efforts, including acting as the chief architect for the Department of Homeland Security's Cyber.gov program, which is tasked with creating a next-generation cybersecurity architecture for all non-DoD federal departments and agencies. He also led a research team exploring non-cryptocurrency usages for blockchain technology. Prior to his time at MIT Lincoln Laboratory, he had worked at Microsoft, Microsoft Research,

Google, Blue Coat Systems (Symantec), and Sandia National Laboratory.

Dr. Ruoti researches computer security and privacy, human-computer interaction, and usable security and privacy. In particular, he is interested in researching how systems can be designed to ensure correct and secure operation when deployed to actual users. In practice, Dr. Ruoti tries to conduct holistic, interdisciplinary research that not only creates novel systems, but also addresses real-world human needs.

His dissertation focused on designing email systems that are both secure and easy-to-use, especially for novice users. In his work, he designed a secure email system that outperforms other similar systems in terms of usability, ranking in the top 15% among the hundreds of software systems subjected to a standard usability test. His design reduced user errors from 25% to 2%, and increased user understanding and trust in secure email.

Dr. Ruoti is also interested in exploring how to increase the security of password-based authentication and two-factor authentication, both in terms of theoretical security and real-world security. He is also researching using blockchain technology to secure non-cryptocurrency systems, with an emphasis on low-connectivity environments—for example, using blockchain technology to enable multi-national and multi-organization information sharing for humanitarian aid and disaster relief efforts. Dr. Ruoti is also interested in exploring how to help developers create secure software.



Dr. Amir Sadovnik
Assistant Professor

Ph.D.: Electrical & Computer Engineering, Cornell University, Ithaca, NY, 2014

Research Areas: Computer Vision, Machine Learning, Natural Language Generation, Human-Computer Interaction

Dr. Amir Sadovnik is an Assistant Professor in the Min H. Kao Department of Electrical Engineering and Computer Science at The University of Tennessee. He received his Ph.D. from the School of Electrical and Computer Engineering at Cornell University and was advised by Professor Tsuhan Chen as member of the Advanced Multimedia Processing Lab. Prior to arriving at Cornell, he received his Bachelor's in Electrical and Computer Engineering from The Cooper Union.

Prior to arriving at The University of Tennessee, Dr. Sadovnik was an Assistant Professor at Lafayette College in Easton, PA. He spent four years mostly teaching undergraduate level courses in addition to working on undergraduate research. During his time at Lafayette, he taught a variety of both introductory and advanced computer science courses. In addition, he helped redesign the introductory computer science course to make it more inclusive and was an active advocate for women in the field.

His research in the field of computer vision has been mostly driven by the way humans understand and interact with images. This human centered view has led him to work on new and exciting projects, which utilize tools from different fields, such as computer vision, signal processing, natural language processing, and machine learning and apply them in new ways.

His current research is mostly centered on using deep neural networks for tasks which tend to be more subjective such as evoked emotions, face similarity, and fashion compatibility. The subjective nature of these problems presents many interesting obstacles and opportunities which he explores in his research.



Dr. Michela Taufer
Dongarra Professor

Ph.D.: Swiss Federal Institute of Technology, Zurich, Switzerland, 2002
Research Areas: High Performance Computing; Scientific Applications and Their Programmability on Multi-Core and Many-Core Platforms; Numerical Reproducibility and Stability of Multithreaded Applications

Dr. Michela Taufer is an ACM Distinguished Scientist. She was a J.P. Morgan Chase Scholar at the University of Delaware where she led the Global Computing Lab to promote the use of high performance computing to advance sciences. Dr. Taufer joined the University of Delaware in 2007 where she was promoted to Associate Professor with tenure in 2012 and full Professor in 2017. She earned her M.S. in Computer Engineering from the University of Padova and her Ph.D. in Computer Science from the Swiss Federal Institute of Technology (ETH). She was a post-doctoral researcher supported by the La Jolla Interfaces in Science Training Program (also called LJIS) at UC San Diego and The Scripps Research Institute. Before she joined the University of Delaware, Dr. Taufer was faculty in Computer Science at the University of Texas at El Paso.

Dr. Taufer has a long history of interdisciplinary work with high-profile computational biophysics groups in several research and academic institutions. Her research interests include software applications and their advance programmability in heterogeneous computing (i.e., multi-core platforms and GPUs); cloud computing and volunteer computing; and performance analysis, modeling and optimization of multi-scale applications. She has been serving as the principal investigator of several NSF collaborative projects. She also has significant experience in mentoring a diverse population of students on interdisciplinary research. Dr. Taufer's training expertise includes efforts to spread high-performance computing participation in undergraduate education and research as well as efforts to increase the interest and participation of diverse populations in interdisciplinary studies.

Dr. Taufer has served on numerous program committees for the Institute of Electrical and Electronics Engineers (SC and IPDPS, among others) and has reviewed for most of the leading journals in parallel computing. She served as the IEEE Cluster 2015 General Co-Chair and the IEEE IPDPS 2017 General Chair. She is the ACM/IEEE SC19 General Chair.



Dr. Dan Wilson
Assistant Professor

Ph.D.: Mechanical Engineering, University of California, Santa Barbara, 2016
Research Areas: Model Reduction of Nonlinear Dynamical Systems, Limit Cycle Oscillators, Optimal Control, Applications to Neurological Disorders and Cardiac Arrhythmia.

Dr. Dan Wilson earned his Ph.D. in Mechanical Engineering from the University of California, Santa Barbara in 2016. He received a B.S. in Mechanical Engineering from the University of Washington in 2011 and a B.A. in Natural and Mathematical Sciences from Whitman College in 2011. Most recently, he was a National Science Foundation Postdoctoral Research Fellow at the University of Pittsburgh.

Using tools from dynamical systems and control theory, Dr. Wilson's research focuses on understanding the mechanisms of biological dysfunction in order to develop better treatments than those that are currently available. A significant focus of this research is on the development of model reduction techniques that can be used to reduce the dimensionality of complicated biological models so that further analytical progress can be made on problems that would otherwise be intractable from both an analytical and system control perspective.

Current applications of interest include the development of control strategies to eliminate and prevent arrhythmias that ultimately lead to cardiac arrest, a leading cause of death in industrialized nations. Also of interest is the treatment of neurological disorders characterized by excessive synchronization of neural firing patterns where the ultimate goal is to develop better Deep Brain Stimulation protocols for patients afflicted with Parkinson's disease.

Grid Cybersecurity- IoT Security in Power System Applications

“The Internet of Things (IoT) consists of billions of connected devices ranging in size from micro-sensors to connected vehicles,” says Dr. Jinyuan “Stella” Sun, a professor in the Min H. Kao Department of Electrical Engineering and Computer Science.

The concept of the Internet of Things (IoT) is the idea of “connecting any device (so long as it has an on/off switch) to the Internet and to other connected devices. The IoT is a giant network of connected things and people – all of which collect and share data about the way they are used and about the environment around them. Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs.

“These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations, and detect possible problems before they occur. With the insight provided by advanced analytics comes the power to make processes more efficient. Smart objects and systems mean you can automate certain tasks, particularly when these are repetitive, mundane, time-consuming or even dangerous.”¹

In recent years, Internet service providers and other commercial entities have been victims of what are called Distributed Denial of Service

(DDoS) attacks. “A distributed denial-of-service (DDoS) attack occurs when multiple systems flood the bandwidth or resources of a targeted system, usually one or more web servers. Such an attack is often the result of multiple compromised systems (for example, a botnet) flooding the targeted system with traffic. A botnet is a network of zombie computers programmed to receive commands without the owners’ knowledge. When a server is overloaded with connections, new connections can no longer be accepted. The major advantages to an attacker of using a distributed denial-of-service attack are that multiple machines can generate more attack traffic than one machine, multiple attack machines are harder to turn off than one attack machine, and that the behavior of each attack machine can be stealthier, making it harder to track and shut down. These attacker advantages cause challenges for defense mechanisms. For example, merely purchasing more incoming bandwidth than the current volume of the attack might not help, because the attacker might be able to simply add more attack machines. This, after all, will end up completely crashing a website for periods of time.”²

These attacks have been carried out by a diverse network of “botnets” made up of individually compromised set-top devices and other such consumer-grade products. Botnets work in this way: “when you or one of your employees clicks a dangerous link, downloads infected software or watches a contaminated video, a piece of malware is

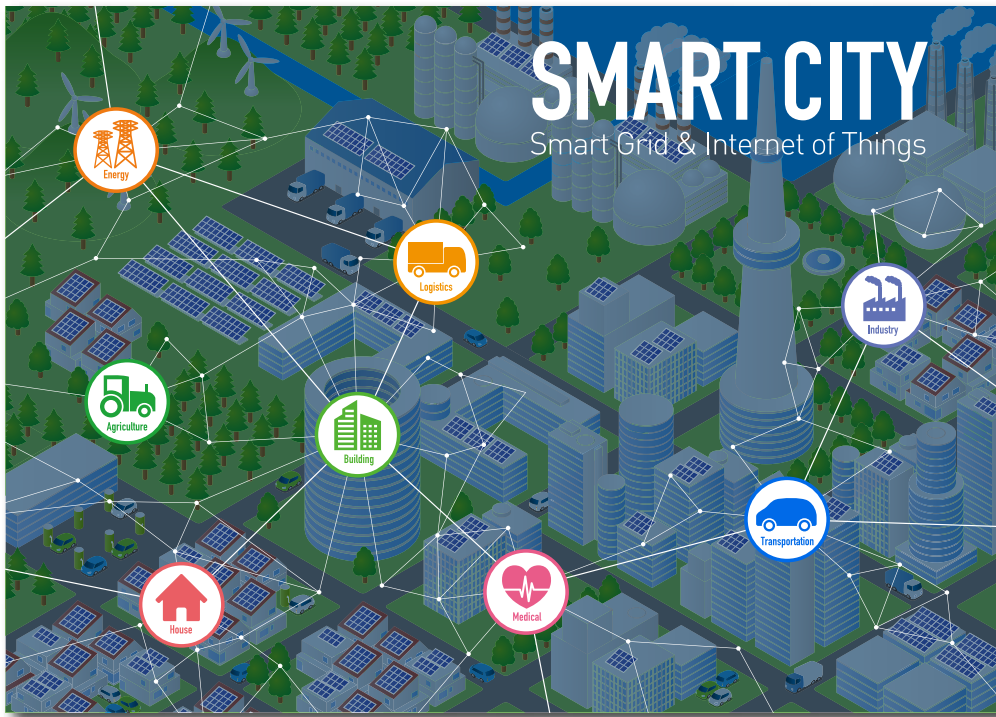
installed on that computer. The malware allows a cyber-criminal to take control of the PC, turning it into a zombie. The PC becomes one of many linked into a network of robots—a botnet. Such networks are used by hackers in a number of ways, to send out thousands of “phishing” emails, to create denial of service attacks or to infect other computers for the purpose of stealing sensitive data.”³

This illustrates the devastating impact of hidden vulnerabilities in this IoT space. It also suggests the potential for disaster to the electrical grid, the network of transmission lines, substations, transformers and more that deliver electricity from the power plant to your home, school or business.

In other words, if such an attack can happen to an Internet service provider, for example, it’s possible that it could also happen to the electrical grid upon which we all rely, especially as it evolves into what is becoming known as the Smart Grid.

The Smart Grid can be described as “the digital technology that allows for two-way communication between the utility and its customers, and the sensing along the transmission lines is what makes the grid smart. Like the Internet, the Smart Grid will consist of controls, computers, automation, and new technologies and equipment working together, but in this case, these technologies will work with the electrical grid to respond digitally to our quickly changing electric demand.”⁴

The IoT “ecosystem” of the smart grid presents a number of unique challenges. Three such



challenges are:

- Heterogeneity in the capabilities and architecture of smart grid IoT devices and the network technologies used to interconnect such devices;
- Difficulties in detecting and mitigating multiple, distributed attacks (likely to be more common with the rapidly growing number of IoT devices) that could cause cascading failures in the power system; and
- Stringent real-time performance requirements of certain power system applications, which add to the difficulty in designing and implementing a robust security solution.

With the growing number of IoT devices being added and their potential impact to grid reliability and stability, grid infrastructure requires specialized security.

Dr. Sun and her colleagues propose a technical approach aimed to mitigate increasingly sophisticated attacks on the smart grid from penetrating and destabilizing the system. EECS has received a grant of \$100,000 from Cisco to further this research.

The first layer of protection

detects ongoing attacks if the conventional network-layer protections have been bypassed or compromised (e.g., through host compromises via physical attacks or bypassing cryptographic protections at higher layers) by analyzing power signals and identifying the location of these attacks.

The second layer of protection complements the first by leveraging native power system controls to mitigate and recover from such attacks.

More specifically, Dr. Sun and her colleagues have proposed the following research tasks:

- **Research of Relevant Signal Processing Algorithms (first layer):** “We propose novel signal processing techniques to detect the onset of attacks, both cyber and physical,” said Dr. Sun. “In the context of power systems, such attacks often manifest themselves within operational measurements, such as voltage or frequency. By analyzing these parameters, we can eliminate the likelihood of a particular attack source and redirect efforts to other sources of attack.”
- **Use of Existing Power System Controls as Mitigation (sec-**

ond layer): “We will design and construct testbeds to study the use of power system controls and loads as an attack mitigation technique,” said Dr. Sun. “Furthermore, we will investigate how the deployment of our layered security approach enhances system operations while improving the overall security and operational posture. We believe we can leverage power system controls and networked grid infrastructure to mitigate and recover from attacks, which can be crucial when critical and time-sensitive operations are affected.”

Dr. Sun continued, “Typically, power systems operate within capacity margins to withstand credible contingencies. However, IoT attacks can introduce new, unexpected considerations. Without enhanced security, power systems would require increased margins, leading to higher costs and reduced reliability. To counteract such events, a power system would traditionally be designed with either spare capacity or controllers, which would reduce such impacts in the event of a disturbance. In our mitigation approach, we propose to use controls such as these in conjunction with other security layers to reduce the potential impact of an attack and limit the costly overdesign needed in the system.”

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FEATURED ALUMNUS

Joel Seligstein

Most students come to The University of Tennessee with a plan: enroll in classes, get a degree, and land a job directly out of school. Joel Seligstein came on a mission. During his time at UT, he enrolled in honors coursework, declared two majors, and landed a job that allowed him to graduate ahead of schedule. "I grew up in Memphis," Seligstein said. "I ended up choosing to go to UT because it was a high quality in-state college with generous scholarships. I was excited to stay close to home and get a great education. I had an amazing time during my 3.5 years at UT. The EECS program prepared me for a successful career; playing lacrosse for UT taught me life lessons; and I made friends for life that I see regularly twelve years later." He graduated summa cum laude from the College of Engineering with a B.S. degree in Computer Science in 2006.

Seligstein had a remarkable rise through the tech ranks after graduating from UT, beginning with his first job at a small social media company named Facebook. There he managed the development of several major software projects as the company grew from fifteen million to more than one billion users. "I was on track to get a second degree in Mathematics," he said, "but when I was given the Facebook offer, I graduated with my CS degree early and joined the company two weeks later. I started in January 2007, when there were around 150 employees and left in mid-2013, when there were over 8,000 employees. During my time there, I worked on a variety of engineering projects: internal tools, database internals, Facebook

Platform, Messages, News Feed, the Facebook Android app, and a host of other projects. I spent my last 4 years there managing teams, coaching new managers, and running the new hire program Bootcamp."

Ever since he was a child, Seligstein has never considered failure to be an option. He grew up believing that he was in full command of his destiny and continues to determine it by being proactive and intentional



about where he invests his time. In line with using his time intentionally, Seligstein and a friend and colleague, Justin Mitchell, founded A# Capital Startup Investing in 2014. In this venture, they invest in small companies and mentor their management teams on taking their products to market. Seligstein works mostly with software engineers, young CEOs, and new managers and loves the human aspect that coaching brings to the engineering field. "We've invested in 15-20 companies and continue today," Seligstein said, "albeit

slowly in a market that is rapidly shifting back from online to real-world products. We've had a couple companies do well - two have been on Shark Tank and a number of them have had small exits, but none yet are runaway successes. We recently invested in One Medical, an amazing new healthcare business that we are really excited to watch grow."

Two things Seligstein always incorporates into his coaching are empathy and hustle. He emphasizes the importance of building teams and forming partnerships through empathy and stresses that a big part of startup success is the "hustle" attitude. The entrepreneurial spirit is essential to achieve the sort of high arching goals for which Seligstein reaches, and he exhibits it well.

That spirit has also led him to his next venture. In May of 2016, Seligstein founded an independent games studio, Parallel Plaid, headquartered in Salt Lake City, Utah. "I started programming at age 14 so I could make fun video games. Over the course of my career, I had gotten away from games as a passion - so when I had the means to start a company, I decided to get back to my roots. We're a small startup with five full-time employees and a few contractors working on mobile games that are challenging and beautiful," he said.

Seligstein began growing Parallel Plaid in the summer of 2017, and the company released its first mobile game, Wobbly Words, this year. Featuring a character named Plaidy the Platypus, it's a twist on the classic crossword game. "We just launched Wobbly Words in the USA and have a couple thousand players," Seligstein said. "We're about to start a marketing drive. This game is exciting for us - it was an idea started by one of our engineers during a

hack week to take a break from a game we were working on. We loved the prototype, so we worked on it for three months to get it out to the world. It was our first experience really coming together as a team and learn what it takes to take an idea all the way through to production." Parallel Plaid intends to keep on creating more games, and has one in the works. "We're working on a new game for mobile that we're really excited about. We're not quite talking about it yet, but we are in full production mode and it should launch early 2019."

Parallel Plaid's headquarters is close to Seligstein's new home of Park City, Utah, and another one of his driving passions- skeleton. No, not a bunch of bones- skeleton is a high-speed, winter sliding sport similar to bobsled and luge that involves a single rider sledding down a frozen track while lying face down.

"My favorite Olympic sport since I was a child was bobsled," Seligstein said. "I looked forward to watching it every winter Olympics. I had just left a job when the 2014 games were on, and I was looking for a new challenge in life. My sister and good friend Bob encouraged me to go for the Olympics and found there was a driving school a week after the games. While talking to coaches, I found out I was way too small for bobsled, and since I didn't have a brakeman for training anyway, they suggested skeleton. A week later, I was in skeleton school and fell in love with the sport. I trained the first year in Park City, and it was a rough year. I had bruises all over my body, but had a blast learning. The second year was just as rough since I traveled to many other tracks in other countries and had to learn each track separately. It wasn't until year three until I started to



Joel Seligstein races down the track on his skeleton sled.

feel comfortable and really start to dial in my skill."

Seligstein now races for the national team of Israel, Bobsled Skeleton Israel (BSI). "I joined BSI for the 2015-2016 season and have been on the team for three years. The team is small, so there was no selection process, but I needed to become an Israeli citizen first. I am very blessed to be able to represent my heritage on the international stage, and I am very grateful for the opportunity from BSI and organizations in Israel. I compete in 10-12 races a year on different circuits. Last year, I had 5 top-10 finishes on the North American Cup, my best being a 5th place in Calgary. It is an absolutely exhilarating experience to see your hard work over years pay off. Each year, I have moved up in races and overall ranking, and I am absolutely thrilled with the progress."

He even almost qualified for the 2018 Winter Olympics in South Korea. "Qualification for the Olympics in skeleton is based on points and a country-based quota system," Seligstein said. "I was leading Israel in points going into the last two races of the season when my teammate beat me solidly enough to earn enough points to represent Israel at the Olympics. It was a roller coaster set

of emotions over the course of many months - with my best finishes in each race, but culminating in a soul-crushing defeat right at the end. Half-way through the season, I tore my hamstring as well - so it was quite an experience trying to compete for your Olympic dreams while having a major injury."

His recent trials and tribulations in skeleton will not deter him. He is determined to continue competing and reaching for the highest level of the sport. "I am planning to continue to race for another four years and go for the 2022 Beijing Games, and I am very excited to do so!"

Seligstein was a 2016 University of Tennessee Alumni Promise Award winner. The Alumni Promise Award recognizes alumni no older than 40 who have demonstrated distinctive achievement in a career, civic involvement, or both. This award is presented to acknowledge alumni who are making a mark early on in their career. He also serves on the Board of Advisors for UT's Tickle College of Engineering.

In 2015, he gave to the EECS Department's Excellence Endowment, which is used to enhance the educational experience for students. A faculty office in the Min Kao Building was named in honor of Seligstein's generosity. "I'm blessed to be in a position to give back, to be able to support my college," Seligstein said at the time. "I appreciated my time here and all that I learned here. As a student you don't think you'll ever be in a position to do something like this, so it's gratifying."

Seligstein fell in love with Park City, Utah while training for skeleton, and he and his wife, Erin, have lived there since 2016.

(David Goddard and Xylina Marshall contributed to this story.)

FACULTY SPOTLIGHT

Dr. Brad Vander Zanden



Dr. Brad Vander Zanden is a Computer Science professor in the Min H. Kao Department of Electrical Engineering and Computer Science. He has been at The University of Tennessee for 28 years, and he will be retiring in a year.

The Early Years

He earned his B.S. in Accounting/Computer Science at The Ohio State University in 1982, his M.S. in Computer Science at Cornell University in 1985, and his Ph.D. in Computer Science at Cornell University in 1989.

"When I first came to The University of Tennessee, the computer science department was in Ayres Hall. And then we moved, I think, in 1999 to the Philander P. Claxton Education Building, which had been renovated. And even after the merger, the CS side of things stayed in Claxton until Min Kao was built. Computer

Science used to be part of the College of Arts and Sciences, because it came out of the math department. Bringing us together in one building is what really started to create a single unified whole."

More Power To You

Dr. Vander Zanden's current research is of interest to anyone who carries a smartphone around, which is to say, just about everyone these days.

"Toward the end of my career, my research is focused on trying to reduce the power consumption in mobile devices and the reason for that is that if you put your phone in your pocket you might notice a couple of hours later that the battery has mysteriously run down rather considerably. Meaning, you didn't think you were using it, right and yet your phone went from 80% of the battery to 50% and you didn't think you used it at all. So what happened to that 30% of the battery during that time? What was running to essentially kill it off like that? And it turns out that during that time, the CPU of that device is actually very active. It's constantly looking for events. Whether they're mouse events or voice inputs or wireless events or cell traffic, they are constantly running through the different event cues to see whether something has come in and that keeps using CPU time. And that's pretty inefficient because most of the time there is no event arriving. There's no cellular traffic coming in there's no wireless coming in the user's not poking at it. So ideally, the CPU would actually sleep during that

time.

More modern technology allows the CPU in your mobile device to sleep until an event that it's interested in actually arrives.

But the issue has been that the operating systems for mobile devices haven't taken advantage of this new hardware.

So, in order to take advantage of these new input devices, you have to rewrite the kernel software. My students have been doing that, rewriting the kernel software and they've gotten some very nice results. Some apps that we've looked at, they've gotten up to a 30% reduction in the power consumption of the smartphone. That's been quite successful. It really extends the battery; 30% less battery consumption roughly would translate to 33% or something longer battery life.

That's been the research I've kind of focused on for the last three or four years."

Research Into Graphical User Interfaces

Dr. Vander Zanden's previous research focused on program language design and implementation, especially as it applied to graphical user interfaces. He worked on the development of computer aided drawing tools that made it easier for instructors and students to draw and animate data structures, such as trees and lists, that are commonly presented in undergraduate computer science courses. Such tools can provide presentation aids for instructors in the classroom, allow for the creation of animated notes that might accompany a course, distance course, or textbook, and allow either students or instructors to provide an animated set of homework solutions.

"Most of my career I was actually focused on research into

graphical user interfaces, or GUIs, and what specifically I did was try to develop tools that made it easier for programmers to create graphical user interfaces.”

Teaching

“That was something that literally consumed about 15 years of my research, because you had to come up with better algorithms for doing it, you wanted to add new features, just like you would with Microsoft Word. And so, there was always something to do. And then after about 15 years, I had done as much as I wanted to do in that area, and I got more interested, actually, in teaching. The second half of my career was more interested in how I could leverage what I had been doing with graphical user interfaces to make it easier for students to learn how to program. Because it’s still an unsolved problem, how you really can effectively teach beginning students to program. The way it’s been traditionally done is by doing it in a text oriented way. But another way you could do it is try to teach students how to program pictorially; to use pictures to create programs.

We, over time, would put out a number of papers that did talk about how you could create programs by manipulating pictures, pictures of data structures. So you’d have things like an array or a list, and you could actually choose an icon that represented an array or list and you could drag it out into what looked like an editor, and then you could start doing pictorial operations on those things, and it would be translated into actual program code, without having to write it out by hand.”

Flipping The Classroom

The accomplishment that he

is possibly the most proud of is his success in utilizing a teaching method called the flipped classroom.

“That subsequently led me to an approach that has been very successful for teaching students programming, which was something called inverted classrooms or flipping the classroom. What that means is that you try to have the students read the textbook before they come to class, or watch some kind of videotaped lecture before they come to class. Then when they are in class, you actually have them work small programming problems. And when I do it, I allow them to work with a partner. It’s not for credit in class; they’re simply working with a partner, maybe for about 10 minutes on a small problem. And then we go over the solution.

But, while they’re working on it for 10 minutes, I also circulate through the classroom, and if students are having trouble with something, they can ask me a question and I can help them get over the hurdle so that they’re not just stuck because a big thing with programming is often you’ll get stuck for several hours; you just can’t figure out what’s wrong.

And then after 10 minutes, not everyone is done, but at least they’ve attempted the problem. So then when you go over the solution, they care a lot more about it; they have something invested in it. They’re much more likely to pay attention to what you’re saying. And they may be more frustrated by it, and so it’s like it’s under their skin now, so then when you explain the solution to them, they’re much more motivated to listen because now you’ve kind of solved the puzzle for them that they couldn’t solve.

Doing this increased the letter grades in the introducto-

ry programming course, CS102, by about two thirds of a letter grade, which is quite an accomplishment.

And so that’s what the flipped classroom is doing. You have an experienced person in the classroom can actually circulate and say, “This is what you doing wrong and this is what you have to do to correct it and move forward.

The thing about the flipped classroom that I find beneficial is that when I’m circulating, sometimes two or three students are stuck on the same thing. So, at that point I can actually stop the programming and say, ‘look, several people are having problems with this concept; let me explain what’s going on,’ and then you can move forward again. But by circulating, I start to see what the common problems are and so I can address those. And actually the final thing with the flipped classroom is, because they’re working the problems right then and there, it generates more questions from them. Because, oftentimes when they’re just listening to the lecture, it seems all clear; it’s like, ‘yeah, that makes a lot of sense.’ It’s like if you watch a video of Tiger Woods’ swing, it’s beautiful. There’s nothing to ask a question about. But then you go out and you swing, and you slam the club into the dirt, and it’s like, wait, what did I do wrong? It actually generates a lot more questions when people actually start to go out and try to do something.

Students are more involved, but there’s a difference between active learning and passive learning. So when you’re listening to someone talk, that’s passive learning. You’re just sitting there and you’re listening, but, take the example of tying a knot. I know that when someone shows me

how to tie a knot, I never learn how to do it. I have to actually sit there and fumble with doing it. So, active learning is where you're actually doing it and making mistakes, but the only way you really learn is by doing it and making mistakes. So, the flipped classroom is active learning, whereas the typical lecture approach is passive learning. You're never stumped for too long, or if you've gone down the wrong path, you don't get too far down the wrong path before someone pulls you back onto the right path. That's very valuable.

I think, ideally, this is the approach that would find its way into the classroom.

I think that's the thing that really is where I had the real impact. I mean, when I saw the grades go up by two thirds of a letter grade in CS102, just remember thinking wow, this is a really good way to communicate material to students."

Retirement

Dr. Vander Zanden will be retiring in a year, but don't expect him to slow down anytime soon.

"I am retiring soon because I have a lot of hobbies outside of work. I enjoy hiking and climbing a great deal. I enjoy travel a great deal. I am a competitive bridge player. I'd like to play more golf and I just like to read. And so I want to be able to do that while I'm still young enough to be able. Some of those things, especially climbing, are things I can still do, but if I waited until I was 65 or 70 to retire, it wouldn't be in the cards anymore. In fact, my grandfather once told my dad, don't wait to do the things you want to do until you retire because you may find that you no longer have the energy to do them. You need to do them, make time for them, along the way. It's always been

something that I felt was important.

I want to do phased retirement because I enjoy teaching. With phased retirement, you typically teach one course a semester. I'd still like to do that because I enjoy teaching. So I don't want to go cold turkey; I just want more time for my hobbies right now.

Certainly there will be more travel. For example, in the autumn there's always been leaf foliage. Since class has been in session I've never been able to travel as much as I would've liked, to New England, or out West to hike

and to appreciate the foliage.

Next year the hope is, after I retire, to take a semester off before I start phased retirement and actually kind of do a big trip from Vancouver Canada through the Canadian Rockies into Banff, which is kind of a gateway for the Canadian Rockies. Then, down through glacier national Park, down to Rocky Mountain national Park in the autumn to enjoy the leaf foliage season down there and to watch the leaves.

We'll work our way back to Knoxville and then hopefully start teaching again in January."



Philander P. Claxton Education Building

EECS STUDENT ORGANIZATIONS

The college experience can be intimidating, especially at a college as large as The University of Tennessee. Many students seek out their own communities within the larger whole, and a lot of them find that sense of community in UT's student organizations. There are nine student organizations affiliated with EECS. They cover a broad range of interests, and many EECS students have found their niche at UT in one or more of these organizations.



The Association for Computing Machinery

The student chapter of the Association for Computing Machinery at The University of Tennessee is dedicated to serving its members by providing information about job opportunities, the computer science fields, and a location for our local members to share their knowledge and experience in the world.

ACM is a nationally-recognized student organization. It helps focus on building students' collegiate careers by hosting workshops throughout the year that focus on keys skills that students will be using. ACM also brings in large corporations, such as Google, AT&T and International Paper to speak about work/life culture, prospective job opportunities and internships for which students can apply.



Eta Kappa Nu

Eta Kappa Nu is the International Electrical Engineering Honor Society, with more than 100,000 members and 194 chapters in the United States, Canada and Europe.

To be eligible for induction, a student's scholastic standing must be in the upper quarter of the junior class or the upper third of the senior class in electrical or computer engineering.

As an affiliate of IEEE, Eta Kappa Nu gives students who join a number of benefits, including access to scholarships, conferences and travel grants. They also are able to network with high performers in their fields of study. Eta Kappa Nu participates in events every year, such as Engineers' Day, as well as several seminars on different topics of interest to Electrical Engineering and Computer Engineering students.



HackUTK

Founded in 2015, HackUTK is The University of Tennessee's premier organization for cybersecurity. HackUTK aims to promote student interest in the field of computer security by having members participate in "capture the flag" competitions, which give students problems based on primary security concepts. These concepts include anything from reverse engineering and forensics to cryptography and many others, and they are intended to inspire, develop, and empower the future generation of computer scientists.

HackUTK also hosts skill sessions that aim to teach students more about these concepts. They start at a very basic level and then move on to more advanced material involving all majors, regardless of background. This organization seeks to bridge the gap between industry and academia by hosting talks with industry partners, providing an opportunity for students to learn and network.



The Institute of Electrical and Electronics Engineers

The Student Chapter of the Institute of Electrical and Electronics Engineers (IEEE, “eye-triple-E”) is a professional society seeking to involve students enrolled in the study of electrical and computer engineering at The University of Tennessee.

The Institute of Electrical and Electronics Engineers is the largest technical professional organization dedicated to advancing technology for the benefit of humanity. IEEE and the student members in EECS inspire a global community to innovate for a better tomorrow. The organization is responsible for highly-cited publications, conferences, technology standards and professional and educational activities. “Being a member of IEEE Robotics has been a great opportunity for me to continue the work that I love doing, whether it be programming, engineering or participating in competitions that we go to each year,” said IEEE member, Ben Klein.

Events include learning how to use the Raspberry Pi, how to code in Python, and how to 3-D print. The IEEE student chapter hosts multiple industry sessions each year, allowing students the opportunity to meet with, and potentially even get internships from prospective employers, such as International Paper and Oak Ridge National Laboratory. These events offer students the opportunity to meet with researchers from these companies. Membership in IEEE offers many invaluable benefits. Among them are technical skill sessions and publications, as well as the opportunity to make long-lasting and meaningful relationships with other students and professionals.



Systers: Women in EECS@UTK

The mission of Systers: Women in EECS@UTK is to recruit, mentor, and retain women in Electrical Engineering and Computer Science at The University of Tennessee.

All of Systers’ programs aim to create an empowering, encouraging and supportive community to help women grow and develop, both personally and professionally. Through participation in national conferences and alumni and donor connections, Systers members have the opportunity to be part of a large network of strong, successful women across the country who can help them achieve their goals. Many Systers members say that the support and community is one of the most important parts of being in this student organization.



Tau Beta Pi

Tau Beta Pi’s collegiate chapters elect members who have distinguished themselves with outstanding scholarship and character. Tau Beta Pi is the only engineering honor society representing the entire engineering profession. Founded at Lehigh University in 1885, it is the nation’s second-oldest honor society. It recognizes, in a fitting manner, those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as students in engineering, or by their attainments as alumni in the field of engineering. It also fosters a spirit of liberal culture in engineering colleges.

Membership in Tau Beta Pi presents professional network opportunities, is an effective way to meet new people, and looks great on a resume. Tau Beta Pi only accepts the top 1/5 of seniors and the top 1/8 of juniors in the engineering college. All of the engineering disciplines are welcome and represented in Tau Beta Pi. Scholarship and fellowship opportunities are also available.



The University of Tennessee Amateur Radio Club

The University of Tennessee Amateur Radio Club, founded in 1947, is for anyone with an interest in amateur radio: students, faculty, staff and the general public. Club members look forward to participating in contests, foxhunts (hidden transmitter hunts), emergency communications, disaster relief education, National Traffic System (radiogram) message service, satellite and Space Station communications, field expeditions, community service and many fun times in an enriching and enjoyable hobby.

Amateur radio, sometimes called “ham radio,” is an exciting hobby, whether one is technically inclined or not. Technology is just one part of amateur radio; it’s also about having fun, helping people, serving your country, socializing, and making connections that span cultures and continents.



utkML: The Machine Learning Student Organization

utkML, The Machine Learning Student Organization, is a University of Tennessee student driven organization focused on machine learning. It values interdisciplinary collaboration between people of diverse backgrounds.

utkML seeks to apply machine learning applications to real-world datasets that are given through a website called Kaggle. Kaggle is a platform for predictive modeling and analytics competitions in which statisticians and data miners compete to produce the best models for predicting and describing the datasets uploaded by companies and users.

Students learn math-based, theory-based things about how these machine learning applications work and why they work. utkML works to apply this classroom learning to real-world applications. For example, students might try to classify news articles based on the content of the text, the article author and publishing dates, to determine whether they are fake or not, based on a subset of the data for which utkML has the solution. utkML has the opportunity to train these machine learning models and come up with solutions, which can vary from guessing to being accurate. At the end of the semester, they compare everyone’s solutions, and prizes are given.



VolHacks

VolHacks is The University of Tennessee’s premier student hackathon, which brings students together from near and far for an action packed 24-36 hours of hacking. What is a hackathon? A student hackathon is a marathon of innovation, usually 24-36 hours in which students who are passionate about creating concepts and technology form teams and compete with other teams to generate, develop and/or implement a new idea from scratch in order to learn and have fun. Students who attend the hackathon are able to develop any software or hardware project their minds can dream up. The event is free for all students to attend and is hosted every fall.

Join VolHacks for a weekend of student-driven innovation and collaboration on the hallowed hills of The University of Tennessee, Knoxville. During 36 caffeine-filled sleepless hours, students from The University of Tennessee and elsewhere will brainstorm, build, break, test, and deploy whatever they can imagine, for the chance to win amazing prizes. There will also be plenty of time to interact with professional mentors and engineers, meet recruiters, and listen to great tech talks and tutorials from sponsors.

In the Senior Design Courses, EECS Students Integrate What They Have Learned

The Senior Design Sequence courses, COSC 401/402 and ECE 401/402, are the capstone design sequences that must be taken in sequence and are required of all Computer Science, Electrical Engineering, and Computer Engineering majors. The capstone design sequence is designed to round out the student's education and to integrate and apply the software, system, and theoretical skills that have been acquired throughout the EE/CpE/COSC curriculum. The primary goal of the senior design courses is to learn best practices in technical design, project management, leadership, and teamwork by requiring teams of students to select a design task, and develop, test, and evaluate an appropriate solution.

Dr. Mark Dean, one of the professors in the Min H. Kao Department of Electrical Engineering and Computer Science who has taught the Senior Design course, said, "Key topics we cover include ethics, bias, societal impact, intellectual property, innovation and leadership styles. We also have multi-disciplinary teams working on projects from industry and research faculty."

The student outcomes of the COSC/ECE 401/402 capstone design sequence include:

- an ability to apply and integrate knowledge of mathematics, science, and engineering to develop a solution to a problem or opportunity
- an ability to analyze a problem, and identify and define the computing software requirements appropriate to its solution
- an ability to function effectively



Senior Design students demonstrate their project for EECS Industrial Advisory Board members during a poster session.

on multidisciplinary teams to accomplish a common goal

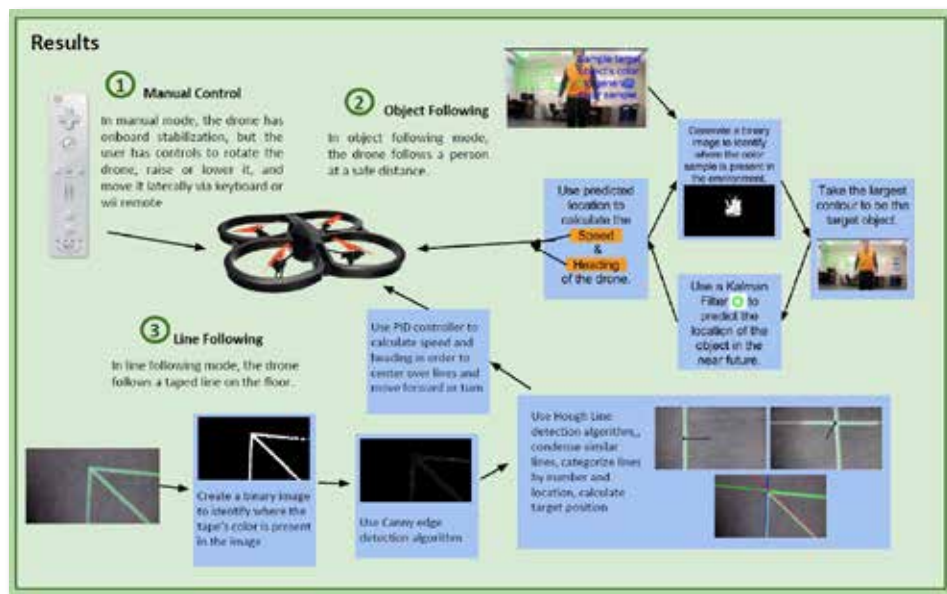
- an understanding of professional, ethical, legal, security and social issues and responsibilities;
- an ability to communicate effectively with a range of audiences
- an ability to understand and analyze the local and global impact of computing solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to, engage in continuing professional development and life-long learning

Topics covered in the course include communications, project planning and management, bias and discrimination in the workplace, the impact of technology, professional development, ethics, intellectual property, business models, confidence intervals, hypothesis testing and entrepreneurship.

In the senior design sequence, students work in teams. In the second semester, COSC/ECE 402, each team works with a project supervisor to specify,

design and implement a project of mutual interest to the team members and the supervisor. The project supervisor should be viewed as the team's "customer" who wants to utilize the design and implement the team produces. The project supervisor is also a mentor who can point to information sources the team members may find useful and will serve as a grader who evaluates the team's work product and approves each product (written or oral presentation materials) for submission to the faculty member in charge of the course for a grade. Each supervisor may be a university faculty, staff member, graduate student, or an individual from an organization external to the university who has received approval from the EECS Senior Design Committee to supervise capstone design teams.

Students have regular meetings with the supervisor. They submit written documents and deliver oral presentations, including a final written and oral report. It is expected that each student will have both technical and ad-



Detail from the Min Kao Drone Tour presentation poster.

ministrative roles in his or her team.

The Senior Design students hold a final poster presentation in the Min Kao Building, placing their work on public display and evaluating each other's posters.

Multidisciplinary projects (participants outside the department) and projects that include participants external to the University are encouraged but are not mandatory. It is recognized that the constraints of projects that include individuals from outside the EECS department may require adjustment of capstone design course requirements for the EECS students who participate. The instructor has the authority to agree to alternative requirements for these students so long as there are substantially equivalent required written, oral, and design experiences.

Examples of past student projects:

Min Kao Drone Tour- This project aimed to create a flying drone that could give visitors a tour of the Min Kao Building autonomously. Traditionally-used GPS lacks the precision necessary for indoor navigation. As an alternative, image recognition and image processing was used

to allow the drone to recognize its surroundings. The output of this computer vision processing would be used as an input to software that directed the drone to fly along a predetermined tour path or to follow a target object. These two drone control components and a stable flight control system would combine to create a quadcopter drone that could navigate the building autonomously.

Urban Wilderness Trail Monitor-

The project was designed to satisfy the desire to keep Knoxville wilderness trails in well maintained condition. This project would allow potential trail users to check and monitor trail conditions before committing to a hike or ride, saving time and trail. The project was subdivided into three main parts: a physical sensor which would measure soil moisture content and transmit that information to a central receiver unit; a central receiver unit which would then upload the data from particular sensors to a database; and a website which would pull data from said database and display a trail map indicating soil moisture levels at various points. This would allow a potential trail user to check the trail condition before making the trek out, sav-

ing time and preserving trails.

The vast majority of capstone design projects will be done as "open source," such that all material and results from the project are openly available to the general public with no constraints from copyrights and patents. But a small number of capstone design projects may lead to the creation by project team members of intellectual property that may have commercial value and that can be protected by patents or copyrights.

Another component of the Senior Design course is a Team Societal Impact essay. Students will be expected to discuss key insights from their research during the societal impacts discussion class. Teams will be discussing their own paper topics during this class.

These essays could cover topics like alternative energy sources, genetic engineering and GMOs, commercialization of space, net neutrality, personal robots, malware and ransomware or evidenced-based health care.

The essay should clearly describe the technology, its use and how the technology will have a positive and/or negative effect on society. Scenarios of use, including pros and cons, should be clearly described.

Societal Impacts include effects, positive or negative, on culturalism, diversity and equality; communications and media; environment and climate; work and operational efficiencies; government; industry; isolationism, globalization, collaboration and nationalism; markets, currency and payment; business models; and individual, family and community economics (wealth, poverty, economic class migration). Ideally, the Senior Design course will inspire students to consider how their chosen fields of study will impact, and be impacted by, the wider world that they will enter upon graduating from UT.

INDUSTRY PARTNERS

Industry members that fund EECS research

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Volkswagen Group
Y-12 National Security Complex

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Accenture
Adrenaline, Inc.
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Electric Power Research Institute (EPRI)
Elo Touch Solutions
Emerson Process Management
Epic Systems
EventBooking
Fast Enterprises
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Garmin International
GEIRI North America
General Dynamics
General Electric
Georgia Pacific
Gerdau Long Steel Knoxville
Google
Green Mountain Coffee Roasters
Haskell Company
Hutchinson Sealing Systems
IBM
IC Thommason
Inteplast Group
Intergraph
International Paper
Invista
Jackson WWS
Jewelry Television (JTV)
Johnson City Power Board
JTEKT
Kimberly-Clark
Knoxville Utility Board
L3 Communications
Logan Aluminum
LTK Engineering Services
Mahle
Maryville City Schools
Maryville College
Memphis Light, Gas and Water
Microsoft
Motorola Solutions
MPI
NASA Johnson Space Center
National Renewable Energy Laboratory
Nissan
Norfolk Southern
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Oak Ridge National Laboratory (ORNL)
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Optum Technology
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Pellissippi State Community College
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University of North Texas
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University of Tennessee Health Science Center
University of Texas at Dallas
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Volkswagen
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White Stone Group, The
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Yik Yak

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Measurement Science and Systems
Engineering Division
Oak Ridge National Laboratory
Oak Ridge, TN

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Georgia Power Company
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Mr. Brian LaRose
Global Technical Architect Specialist
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Maryville, TN

Dr. Brian Worley
President and Chief Executive Officer
PYA Analytics, LLC
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Mr. John McNeely
President and CEO
Sword and Shield Enterprise Security, Inc.
Knoxville, TN

Ms. Angela Yochem
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BDP International
Plano, TX

Mr. John B. O'Dell, Jr.
IT Supervisor of IT Financial Reporting and
Analysis and Contract Relationship Manager
Eastman Chemical Company
Kingsport, TN



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Boeing, *Seattle, WA*
Brixon, Inc., *Baltimore, MD*
Danfoss, *Nordborg, Denmark*
Dominion Virginia Power,
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EPRI (Electric Power Research Institute),
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GEIRI North America, *Santa Clara, CA*
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Grid Protection Alliance, *Chattanooga, TN*
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Keysight, *Santa Rosa, CA*
Knoxville Utility Board, *Knoxville, TN*
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New York ISO, *Rensselaer, NY*
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Power Metrix, *Knoxville, TN*
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Tennessee Valley Authority,
Chattanooga, TN
V&R Energy, *Los Angeles, California*

DEPARTMENT PROFILE

Our Mission:

The mission of The Min H. Kao Department of Electrical Engineering and Computer Science (EECS) is:

- To provide high quality education in computer science, computer engineering, and electrical engineering at the undergraduate, masters, and doctoral levels through a creative balance in academic, professional and extracurricular programs
- To foster and maintain mutually beneficial partnerships with our alumni, friends, industry and local, state and federal governments through public services assistance and collaborative research
- To be a major contributor to our nation's technology base through scholarship and research to grow beyond disciplines by participation in ethics and leadership programs

Our Vision:

The Min H. Kao Department of Electrical Engineering and Computer Science is resolved to become one of the country's top 25 public departments. To bring this vision to reality, the department is committed to these five charges:

- ✓ Attaining national and international recognition among peer institutions for excellence in both research and teaching
- ✓ Assembling a dynamic body of faculty who exemplify excellence and innovation in the pursuit and delivery of knowledge and will perpetuate the highest standards of engineering education for future generations
- ✓ Graduating students who are well educated in technical knowledge, who have solid communication and teamwork skills, and who can compete successfully in the global business world and contribute significantly to the national base of engineering education and technology
- ✓ Investing strategically in the department's most important resources—students, faculty and programs—through the vigorous acquisition of private gifts from individuals, corporations and foundations
- ✓ Partnering with academic, industrial and government entities that share and enhance the mission of EECS, so that our educational and collaborative efforts result in the maximum, positive, economic impact locally, regionally, nationally and globally

DEPARTMENTAL SCHOLARSHIPS 2018-2019

Min H. Kao Scholarship

Kendra Marie Anderson
Katelyn A. Bolinsky
Jeremiah "Jerry" Duncan
Carl N. Edwards
Daniel Felipe Enciso Gonzalez
Gary B. "Brent" Hurst
Idan George Kanter
Andrey Karnauch
Hunter Lee Mann
Abigail Jane Prorise
Charles Peter Rizzo
Benjamin Franklin Sergent
Michaela D. Shoffner
Roy Leander Tan
Kelsey Veca
Alec Yen

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Michael Robert James Butler
Ian Douglas Lumsden
Sean Michael Toll

Beta Phi Chapter, EKN Scholarship

Carlos P. Romero

Casey Electrical and Computer Engineering Scholarship

Daniel Wynne Sylwestrowicz

Grace O. Davis Memorial Scholarship

Yaw Mensah

Department of Electrical Engineering and Computer Science Scholarship

Brian Lundell
Carlos P. Romero

Weston Miller Fulton Memorial Engineering Scholarship

Shivam Thakor Patel

Christopher and Michelle Gentry Scholarship

Shivam Thakor Patel

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Bryson Lloyd Howell
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Ankush V. Patel
Rachel Marie Weeks

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Jared Junichi Colburn

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Cara J. Scott

Fred Smith Vreeland Scholarship

Jared Junichi Colburn

Charles Weaver Memorial Scholarship

Ian Douglas Lumsden

Arthur F. Woods Scholarship

Michael Robert James Butler
Christopher Miller Dean
Joshua Martin Dunkley
Aaron James Johnson
Trey Isaac Mingee
David Alan Rainbolt
Jon A. Reesman

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Anita Borg Scholarship

Ava Hedayatipour
Rania Oueslati
Tasmia Rahman
Firoozeh Sepehr

Blalock Award

William Edward Norton
Spencer Truman Raby

Bodenheimer Fellowship

Quillen Vaughn Blalock
Samuel Denis Brown
Richard Joseph Connor
Summer Francesca (Church) Fabus
Aaron Reed Young

Chancellor's Honors Award

Sherif Hassanein Amer
Gangotree Chakma
Mihaela Dimovska
Tanner Christian Hobson
Taher Naderi
Firoozeh Sepehr
Aysha Siddique Shanta
Mst. Shamim Ara Shawkat
Joseph Townley Teague
Abigail Ellice Till
Paige Williford

CURRENT Fellowship

Ibukunoluwa Olayemi Korede
Phuc Tran Hoang Pham
Taylor Lee Short
Yinfeng Zhao

DOE Trainee Award

Jared Baxter
Quillen Vaughn Blalock
Spencer Cochran
Benjamin Roy Dean
Andrew Foote
Frances Garcia
James Everette Palmer
Taylor Lee Short
Nathan Strain
Paxton Wills

Fulbright Scholar

Zainab Dheyaa Mohammed Al-Taweel

GEM Consortium Fellowship

Elvis Offor

Government Support from Home Country

Abdulelah Yousef Alharbi
Mustafa Sadiq Al Jumaily
Okan Ciftci

Graduate Fellowship Award

Zihan Gao
Brandon Joseph Kammerdiener
Razieh Kaviani Baghbaderani
Jordan Sangid
James Kenneth Senter
Chengwen Zhang
Yifan Zhang
Liyan Zhu

Min H. Kao Fellowship Award

Mohammad Reza Ahmadzadeh Raji
Eric John Auel
Yang Song
Shuyao Wang
Shuoting Zhang
Zhifei Zhang

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Tasmia Rahman Tumpa
William James Whiteley

Tennessee Fellowship for Graduate Excellence

Spencer Pierce Cochran
Andrew Paul Foote
Alan Regan Grant
Matthew Benjamin Olson
Ruiyang Qin
Jared Michael Smith
Tianwei Xia

Tickle Fellowship

Zhihao Jiang
Dustin Colten McAfee
Daniel William Schultz
Fanqi Wang

BY THE NUMBERS

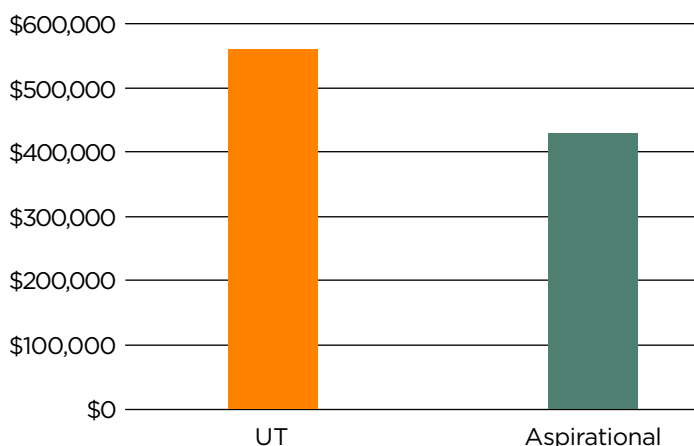
How EECS at UT compares to aspirational institutions

We've collected data from universities we consider aspirational peers over the past year to see how our EECS program compares. The data* from our aspirational universities has been averaged and displayed in the following charts.

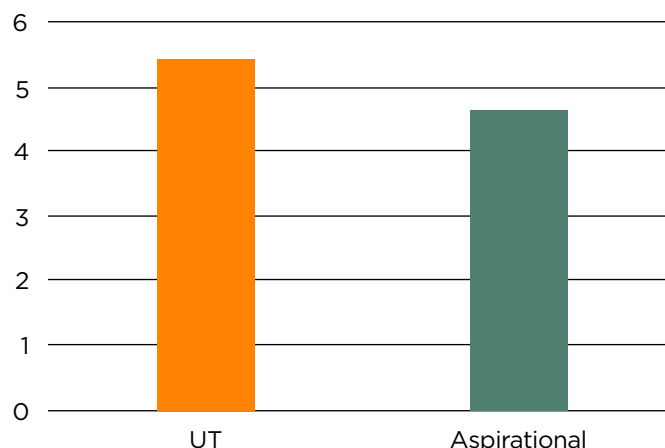
Our aspirational peers are: California-Davis, Colorado, Florida, Maryland, Minnesota, North Carolina State, Penn State, Utah and Wisconsin.

(*2017 data- the most up-to-date information on aspirational universities available from ASEE.)

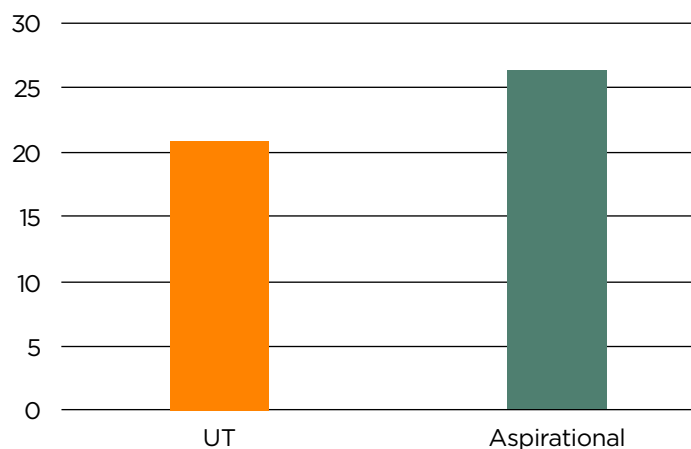
Research expenditures per T/TT faculty



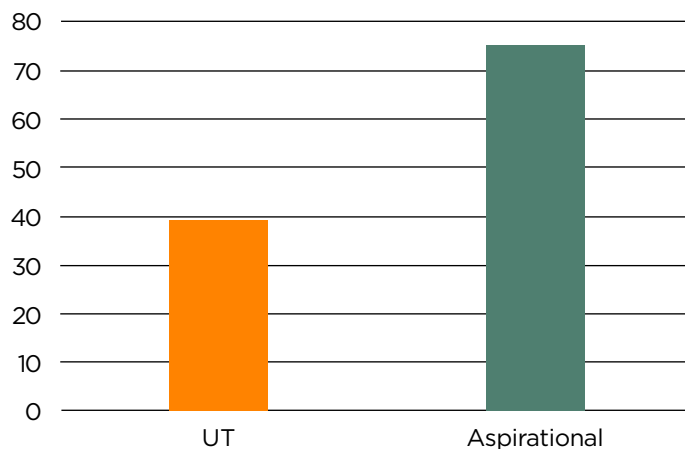
Ph.D. enrollment per T/TT faculty



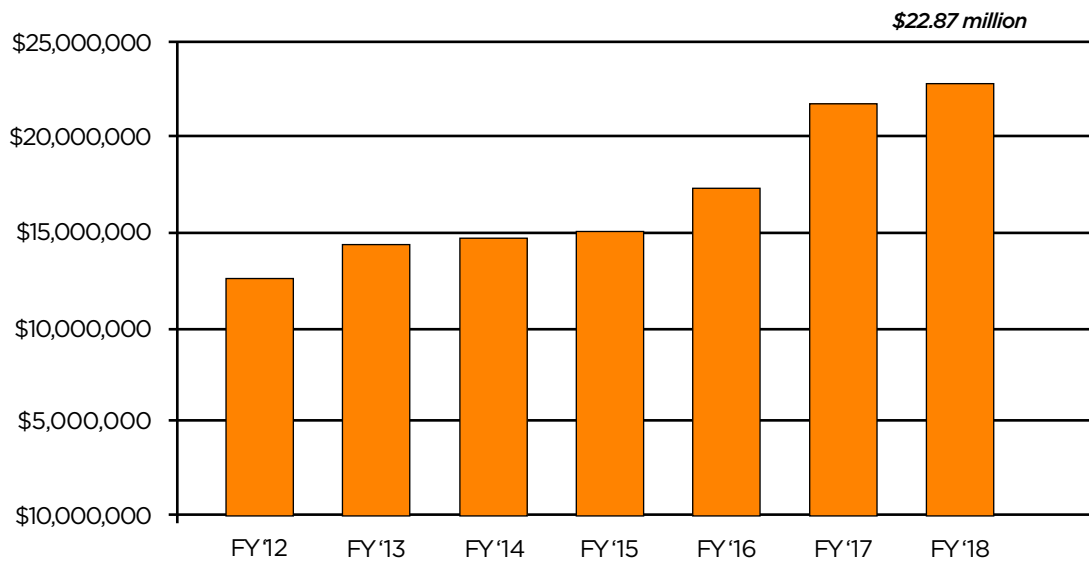
Undergraduate enrollment per T/TT faculty



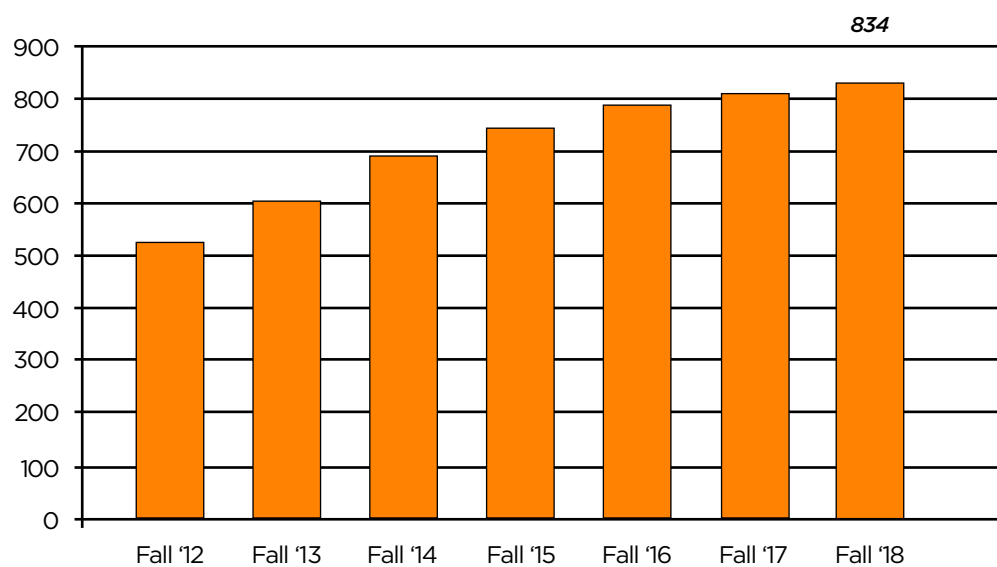
Number of T/TT faculty



EECS Research Expenditures

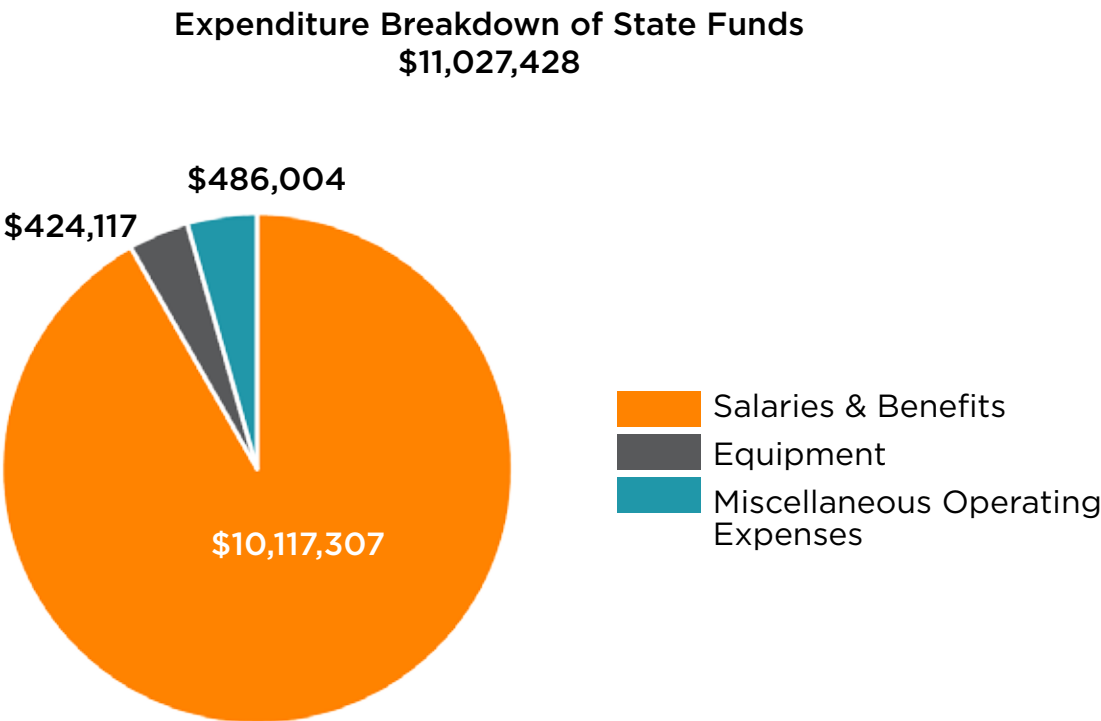
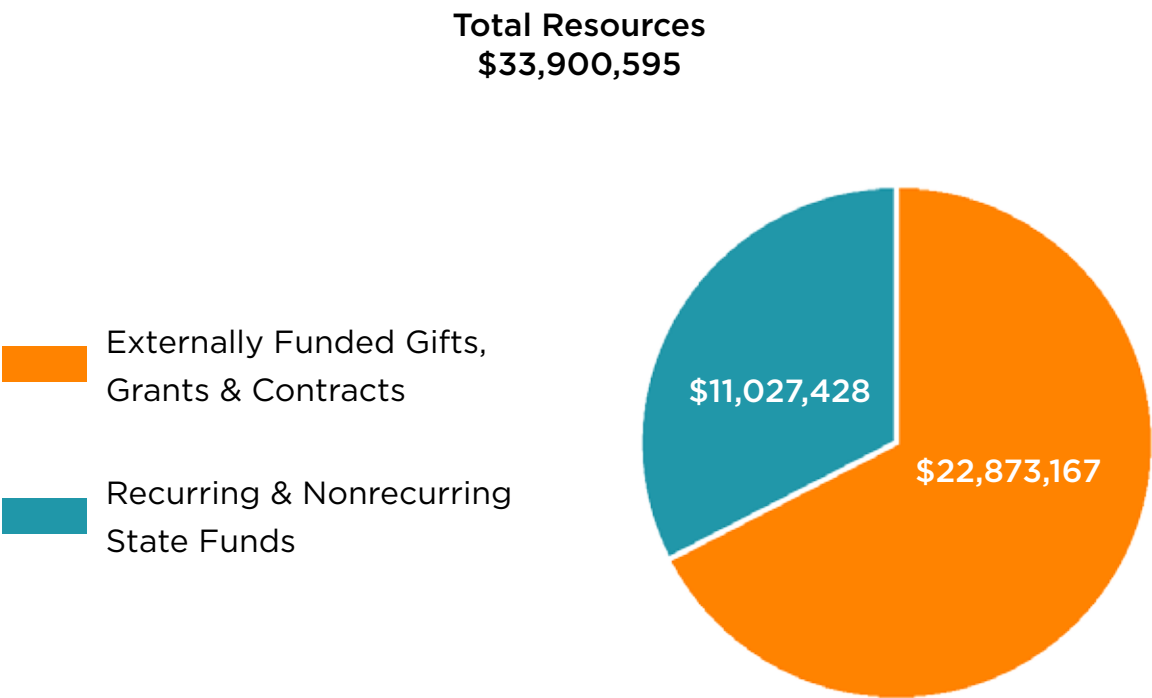


EECS Undergraduate Enrollment



Financial Information

Numbers reflect the department’s financial information for FY18.



FACULTY PROFILE

EECS has 45 tenured and tenure-track faculty members who are all leaders in their fields. Each year they successfully compete for and receive prestigious awards and accolades. Their research and scholarship are not only helping keep the department on the cutting edge of its disciplines, but also teaching and training the engineers of tomorrow.

Strength Area

Tenured/Tenure-Track Faculty

Power Systems, Power Electronics

Bai
Costinett
Li, F.
Liu
Pulgar
Sun, K.
Tolbert
Tomsovic
Wang

Microelectronics, Microwaves

Blalock
Fathy
Gu
McFarlane
Wu

Signal & Image Processing, Communication, & Control

Abidi
Djouadi
Li, H.
Materassi
Padakandla
Qi
Wilson

High Performance Computing

Beck
Berry
Dongarra
Emrich
Gregor
Huang
Langston
Peterson
Taufer
Vander Zanden

Data Analytics, Intelligent Systems, Machine Learning

Henley
Huang
Langston
MacLennan
Mockus
Parker
Ruoti
Sadovnik

Sensors, Networked & Embedded Systems, Cybersecurity

Cao
Dean
Jantz
Plank
Rose
Ruoti
Schuchard
Sun, J.

EECS FACULTY 2018-2019



Mongi Abidi
Ph.D. The University of Tennessee
Cook-Eversole Professor
Pattern Recognition, Image Processing, Robotics



Daniel J. Costinett
Ph.D. University of Colorado
Assistant Professor
Power Electronics, Electric Vehicles



Hua (Kevin) Bai
Ph.D. Tsinghua University Beijing
Associate Professor
Power Electronics, Battery Management Systems, Wide-Bandgap Devices



Judy Day
Ph.D. University of Pittsburgh
Assistant Professor
Model Predictive Control, Translational Medicine



Micah Beck
Ph.D. Cornell University
Associate Professor
Networks, Distributed Computing



Mark Edward Dean
Ph.D. Stanford University
Fisher Distinguished Professor
Interim Dean, Tickle College of Engineering
Neuromorphic Computing, Data Center Reliability



Michael W. Berry
Ph.D. University of Illinois
Professor
Bioinformatics, Information Retrieval



Seddik M. Djouadi
Ph.D. McGill University (Canada)
Professor
Automatic Control, Smart Grid Applications



Benjamin J. Blalock
Ph.D. Georgia Institute of Technology
Kennedy-Blalock-Pierce Professor
Analog and Mixed-Signal Circuits



Jack Dongarra
Ph.D. University of New Mexico
University Distinguished Professor
High Performance and Scientific Computing



Qing (Charles) Cao
Ph.D. University of Illinois
Associate Professor
Wireless and Distributed Sensor Networks



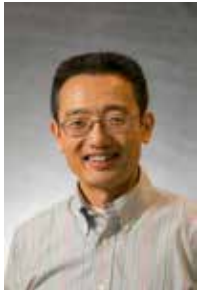
Scott Emrich
Ph.D. Iowa State University
Associate Professor
Genome-Focused Bioinformatics, High-Throughput and Parallel Computing, Life Science Applications



Aly E. Fathy
Ph.D. Polytechnic Institute of New York
James W. McConnell Professor
Antennas and Microwaves



Jens Gregor
Ph.D. University of Aalborg (Denmark)
Professor
Image Processing, Biomedical Data Visualization



Gong Gu
Ph.D. Princeton University
Associate Professor
Graphene, Electronic Materials



Austin Henley
Ph.D. University of Memphis
Assistant Professor
Software Engineering, Human-Computer Interaction



Jian Huang
Ph.D. The Ohio State University
Professor
Data Analytics and Visualization



David Icove, P.E.
Ph.D. The University of Tennessee
UL Professor of Practice
Fire Protection and Forensics



Michael Jantz
Ph.D. University of Kansas
Assistant Professor
Software Systems, Compilers



Michael A. Langston
Ph.D. Texas A&M University
Professor
Bioinformatics, Data Analytics, Graph Theory



Fangxing (Fran) Li, P.E.
Ph.D. Virginia Tech
James W. McConnell Professor
Power Systems Modeling and Economics



Husheng Li
Ph.D. Princeton University
Associate Professor
Wireless Communications and Networks



Yilu Liu
Ph.D. The Ohio State University
Governor's Chair Professor
Power Systems Monitoring and Control



Bruce J. MacLennan
Ph.D. Purdue University
Associate Professor
Bio-inspired Computation, Artificial Morphogenesis



Stephen Marz
Ph.D. The University of Tennessee
Lecturer
Operating Systems, Programming Languages



Gregory D. Peterson
D.Sc. Washington University (St. Louis)
Professor
Interim Department Head, Min H. Kao
Department of Electrical Engineering
and Computer Science
High Performance Computer Architectures, Computational Science, Performance Evaluation



Donatello Materassi
Ph.D. Università degli Studi di Firenze (Florence)
Assistant Professor
Stochastic Systems, Control and System Identification



James S. Plank
Ph.D. Princeton University
Professor
Neuromorphic Computing, Data Storage



Nicole McFarlane
Ph.D. Maryland University
Assistant Professor
Bio-electronics, Mixed Signal Circuits



Hector Pulgar
Ph.D. University of Illinois at Urbana-Champaign
Assistant Professor
Power System Dynamics and Control



Audris Mockus
Ph.D. Carnegie Mellon University
Ericsson Harlan Mills Chair Professor
Data Analytics, Software Engineering



Hairong Qi
Ph.D. North Carolina State University
Gonzalez Family Professor
Collaborative Sensor Signal and Image Processing



Arun Padakandla
Ph.D. University of Michigan
Assistant Professor
Data Science, Privacy-Preserving Data Analysis, Security, Information Theory



Garrett Rose
Ph.D. University of Virginia
Associate Professor
Memristors, Nanoelectronics, Hardware Security



Lynne E. Parker
Ph.D. Massachusetts Institute of Technology
Professor
Robotics, Distributed Intelligence



Scott Ruoti
Ph.D. Brigham Young University
Assistant Professor
Systems Security, Web Security, Usable Security, Blockchain



Amir Sadovnik
Ph.D. Cornell University
Assistant Professor
*Computer Vision, Machine Learning,
Natural Language Generation, Human-
Computer Interaction*



Kevin Tomsovic
Ph.D. Washington University
CTI Professor
Power System Modeling and Control



Max Schuchard
Ph.D. University of Minnesota
Assistant Professor
*Computer Security and Privacy,
Censorship Circumvention Systems,
Crypto-currencies*



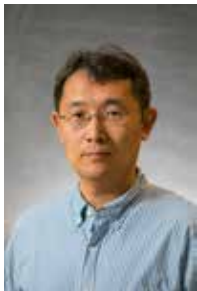
Bradley T. Vander Zanden
Ph.D. Cornell University
Professor
*Graphic Programming, Instructional
Technology*



Jinyuan (Stella) Sun
Ph.D. University of Florida
Assistant Professor
Cybersecurity, Network Privacy



Fei (Fred) Wang
Ph.D. University of Southern California
Professor and Condra Chair of Excel-
lence in Power Electronics
*Power Electronics, Aerospace
Applications*



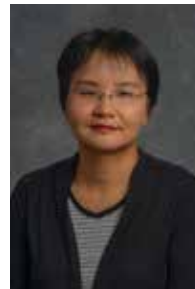
Kai Sun
Ph.D. Tsinghua University (China)
Assistant Professor
*Power System Dynamics, Stability,
Control*



Dan Wilson
Ph.D. University of California, Santa
Barbara
Assistant Professor
*Model Reduction of Nonlinear Dynam-
ical Systems, Limit Cycle Oscillators,
Optimal Control*



Michela Taufer
Ph.D. ETH Zurich
Dongarra Professor
*Computer and Information Sciences,
Biomedical Engineering, Center for Bio-
informatics and Computational Biology*



Jie (Jayne) Wu
Ph.D. Notre Dame
Associate Professor
Bio-electronics, Microfluidics, MEMs



Leon M. Tolbert, P.E.
Ph.D. Georgia Institute of Technology
Min H. Kao Professor
Power Electronics, Renewable Energy

UNDERGRADUATE GRADUATES 2017-2018

Douglas M. Aaser
Michael Blake Adams
Sara Nicole Agle
Ronald Garret Agresta
Rawan Alghamdi
Jacob Scott Allen
Jeremy D. Anantharaj
Alexander M. Antonas
Eric J. Auel
Aaron David Baas
Daniel P. Barry
James Miner Bates
Chandler Jackson Bauder
Brandon Bilbrey
Madison Irena Blake
Quillen Vaughn Blalock
Chad Wesley Blaylock
Natalie Elizabeth Bogda
Charles Dylan Boggs
Justin Cade Boling
Joshua K. Bolinsky
Kevin T. Brandel
Michael David Breakey
Alexander Hawk Brelsford
Samuel Denis Brown
Grant Richard Bruer
Rafael Cervantes Camarillo
Steven Lawrence Campbell
Dylan T. Carlson
Matthew Beau Carpenter
Isaiah Christian Cash
Jesus A. Chavez
Jun-Cheng Chin
Brian Malachy Coghlan
Jacob Brent Cross
Evan Thomas Czupka
Chad Aaron Davidson
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Lauren Elizabeth Flader
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Austin Reid Freels
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Luke Johnston Mills
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Savannah Austin Norem
Demi Marie Obenour
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Daniel Street Sawyer
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Andrew R. Wintenberg
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David Bryant Young
Jiajia Zhao
Jiaming Zhao

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Ibrahim Abdullah Altarjami

Non-thesis M.S.

Advisor: Dr. Yilu Liu

Alexander Meadows Asbury

Analysis of NFIRS Data for Sensitivity to Foreclosure and Other Select Features.

Advisor: Dr. David J. Icové

Andrew Jeremy August

Non-thesis M.S.

Advisor: Dr. Hairong Qi

Albraa Adnan Bahour

Data Analytics for Privacy in Smart Grids.

Advisor: Dr. Kevin Tomsovic

David Andrew Basford

Design and Evaluation of a Sub-1-Volt Read Flash Memory in a Standard 130 Nanometer CMOS Process.

Advisor: Dr. Jeremiah H. "Jeremy" Holleman

Abdulrahman Mohammed Bin Ghannam

Non-thesis M.S.

Advisor: Dr. Aly Fathy

Mwamba Bowa

3D Printed Electronics.

Advisor: Dr. Mark Edward Dean

Michael John Breuhl

Locating Regulating Resources in the WECC to Damp Electromechanical Oscillations.

Advisor: Dr. Héctor A. Pulgar Painemal

Brett Harrison Brownlee

Non-thesis M.S.

Advisor: Dr. Donatello Materassi

Ksenia Olegovna Burova

Non-thesis M.S.

Advisor: Dr. James S. Plank

Spencer Pierce Cochran

A GaN-Based Synchronous

Rectifier with Reduced Voltage Distortion for 6.78 MHz Wireless Power Applications.

Advisor: Dr. Daniel J. Costinett

Christopher Alexander Antone Craig

Cloud Anchor: An Exploration of Service Integrity Attestation with Hardware Roots of Trust.

Advisor: Dr. Maxfield Joseph "Max" Schuchard

Camille Channell Crumpton

Non-thesis M.S.

Advisor: Dr. Bruce J. MacLennan

Clayton Daniel Davis

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Advisor: Dr. Jinyuan "Stella" Sun

Jacob Lloyd Davis

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Jonathan Devadason

Modeling and Analysis of Variable Reactive Power Limits of a Doubly Fed Induction Generator (DFIG) Used in Variable Speed Wind Turbines.

Advisor: Dr. Héctor A. Pulgar Painemal

Joseph Parker Diamond

The Effect of Modern Web Content and Caching on the Tor Onion Router.

Advisor: Dr. Maxfield Joseph "Max" Schuchard

Mihaela Dimovska

Non-thesis M.S.

Advisor: Dr. Donatello Materassi

Joshua Daniel Fagan

Non-thesis M.S.

Advisor: Dr. Lynne E. Parker

Jordan Alexander Gamble

Design Space Evaluation for Resonant and Hard-charged Switched Capacitor Converters.

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Dallas Wayne Hamlin

A Low Power Mid-Rail Dual Slope Analog-To-Digital Converter for Biomedical Instrumentation.

Advisor: Dr. Syed K. Islam

Saajid Al Haque

An Efficient Partial-Order Characterization of Admissible Actions for Real-Time Scheduling of Sporadic Tasks.

Advisor: Dr. Donatello Materassi

Md. Munir Hasan

Fundamental Limit of Analog Multiplication in Linear Discriminant Classifier.

Advisor: Dr. Jeremiah H. "Jeremy" Holleman

Jordan Alexander Holland

Quantifying Irregular Geographic Exposure on the Internet.

Advisor: Dr. Maxfield Joseph "Max" Schuchard

Adam Palmer Howard

Automated Program Profiling and Analysis for Managing Heterogeneous Memory Systems.

Advisor: Dr. Michael Jantz

Harry Norman Hughes

Non-thesis M.S.

Advisor: Dr. Jack Dongarra

Nedas Jakstas

Analysis of Multiple Signal Attacks on Control Systems.

Advisor: Dr. Seddik M. Djouadi

Corey Michael Johnson

Peer Attention Modeling with Head Pose Trajectory Tracking Using Temporal Thermal Maps.

Advisor: Dr. Lynne Parker

Jie Li

Wireless Power System Design for Maximum Efficiency.

Advisor: Dr. Daniel J. Costinett

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Tyler Eugene Marshall

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Andrew Kenneth Messing

Circle Packing as a Space Decomposition Method for Robot Path Planning and Coverage.

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John Parker Mitchell

DANNA2: Dynamic Adaptive Neural Network Arrays.

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Sara Mousavicheshmehkaboodi

A Delayed Parity Generation Code for Accelerating Data Write in Erasure Coded Storage Systems.

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Sabikun Nahar

Design and Implementation of a Stepped Frequency Continuous Wave Radar System for Biomedical Applications.

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George Earl Niemela

An Ultra-Low-Power Track-and-Hold Amplifier.

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Ellias Palcu

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Paul Joseph Proctor

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Divyani Rao

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Maxwell Hunter Robinson

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Manashi Roy

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Advisor: Dr. Leon M. Tolbert

Firoozeh Sepehr

Non-thesis M.S.

Advisor: Dr. Donatello Materassi

Jared Michael Smith

Taking Back the Internet: Defeating DDoS and Adverse Network Conditions via Reactive BGP Routing.

Advisor: Dr. Maxfield Joseph "Max" Schuchard

Montie Edwin Smith

Evaluation of IEEE 802.1 Time Sensitive Networking Performance for Microgrid and Smart Grid Power System Applications.

Advisor: Dr. Leon M. Tolbert

Sharon Anna Soleman

Non-thesis M.S.

Advisor: Dr. Mark Edward Dean

Craig Timms

Gate Drive Design for Paralleled SiC MOSFETs in High Power Voltage Source Converters.

Advisor: Dr. Fei "Fred" Wang

Philip Gerald Vaccaro

Power-cognizant Computing.

Advisor: Dr. Jack Dongarra

Andrew Demitte Valesky

Non-thesis M.S.

Advisor: Dr. Audris Mockus

William Tyler Vaughan

Non-thesis M.S.

Advisor: Dr. Michael W. Berry

Trevor Andrew Watson

An Analog CMOS Particle Filter.

Advisor: Dr. Jeremiah H. "Jeremy" Holleman

Ryan John Weiss

Analog Axon Hillock Neuron Design for Memristive Neuromorphic Systems.

Advisor: Dr. Garrett Rose

Nathan Paul Wilder

Non-thesis M.S.

Advisor: Dr. Audris Mockus

Clarence Kin-Fung Wong

Non-thesis M.S.

Advisor: Dr. Garrett Rose

Austin Richard Wyer

The Synthesis of Memristive Neuromorphic Circuits.

Advisor: Dr. Garrett Rose

Fei Yang

Design Considerations for Parallelizing Multiple Chips in SiC Power Modules.

Advisor: Dr. Fei "Fred" Wang

Le Yu

Non-thesis M.S.

Advisor: Dr. Fangxing "Fran" Li

Qiwei Zhang

Extension of Zigzag Search Algorithms for Power System Multi-Objective Optimization.

Advisor: Dr. Fangxing "Fran" Li

Xuemeng Zhang

Dynamic Equivalent Modeling and Stability Analysis of Electric Power Systems.

Advisor: Dr. Yilu Liu

Tong Zhou

Slot-based Calling Context Encoding.

Advisor: Dr. Michael Jantz

DOCTORAL GRADUATES 2017-2018

Ouassim Bara

Nonlinear Control and Estimation of an Inflammatory Immune Response.

Co-Advisor: Dr. Seddik M. Djouadi

Wan Deng

Novel Applications of Graphene and Other Two-Dimensional Materials in Optoelectronic and Electronic Devices.

Advisor: Dr. Gong Gu

Adam Wayne Disney

Software Support for Dynamic Adaptive Neural Network Arrays.

Advisor: Dr. James S. Plank

Jeffery Michael Dix

Configurable Low Power Analog Multilayer Perceptron.

Advisor: Dr. Benjamin J. Blalock

Nan Duan

Towards Faster-than-real-time Power System Simulation Using a Semi-analytical Approach and High-performance Computing.

Advisor: Dr. Kai Sun

Weihong Huang

Optimal Allocation of Dynamic Var Sources Addressing FIDVR Issues.

Advisor: Dr. Kai Sun

Edward Andrew Jones

Characterization Methodology, Modeling, and Converter Design for 600 V Enhancement-Mode GaN FETs.

Advisor: Dr. Fei "Fred" Wang

Mohsen Judy

Digitally Interfaced Analog Correlation Filter System for Object Tracking Applications.

Advisor: Dr. Jeremiah H. "Jeremy" Holleman

Liu Liu

Binary Representation Learning for Large Scale Visual Data.

Advisor: Dr. Hairong Qi

Robert Earl Lowe

Textual Influence Modeling Through Non-Negative Tensor Decomposition.

Advisor: Dr. Michael W. Berry

Yidan Lu

A Wide Area Hierarchical Voltage Control for Systems with High Wind Penetration and an HVDC Overlay.

Advisor: Dr. Kevin Tomsovic

Meimanat Mahmoudi

Wide-Area Control Schemes to Improve Small Signal Stability in Power Systems.

Advisor: Dr. Kevin Tomsovic

Dian Irene (Witter) Martin

A Semantic Unsupervised Learning Approach to Word Sense Disambiguation.

Advisor: Dr. Michael W. Berry

Ali Mohsin

Synthesis, Characterization, and Device Applications of Two-Dimensional Materials.

Advisor: Dr. Gong Gu

Taeho Oh

Design and Implementation of Energy Harvesting Circuits for Medical Devices.

Advisor: Dr. Syed K. Islam

Ying Qu

Hyperspectral Image Analysis through Unsupervised Deep Learning.

Advisor: Dr. Hairong Qi

Mohammad Ehsan Raoufat

Decentralized and Fault-Tolerant Control of Power Systems with High Levels of Renewables.

Co-Advisor: Dr. Seddik M. Djouadi

Lingyun Ren

Noncontact Vital Signs Detection.

Co-Advisor: Dr. Aly Fathy

Bin Wang

Nonlinear Oscillation Analysis

and Modal Decoupling for Power Systems.

Advisor: Dr. Kai Sun

Hanfeng Wang

A Resilient Micro-Power Charge Amplifier for Biomedical Applications.

Advisor: Dr. Syed K. Islam

Ling Wu

Power System Frequency Measurement Based Data Analytics and Situational Awareness.

Advisor: Dr. Yilu Liu

Wenxuan Yao

Development and Application of Synchronized Wide-Area Power Grid Measurement.

Advisor: Dr. Yilu Liu

Zhuo Yao

A FORTRAN Kernel Generation Framework for Scientific Legacy Code.

Co-Advisor: Dr. Jinyuan "Stella" Sun

Shutang You

Electromechanical Dynamics of High Photovoltaic Power Grids.

Advisor: Dr. Yilu Liu

Song Yuan

A Flexible, Highly Integrated, Low Power pH Readout System with Wide Range.

Advisor: Dr. Syed K. Islam

Jiecheng Zhao

Performance Improvement of Wide-Area-Monitoring-System (WAMS) and Applications Development.

Advisor: Dr. Yilu Liu

Yongli Zhu

Control and Placement of Battery Energy Storage Systems for Power System Oscillation Damping.

Advisor: Dr. Kai Sun



Join Kelsey.
Join the Journey.

As an active member of several EECS student organizations, I get excited about all the opportunities for community and growth that I have found at UT. I have gotten especially involved in UT's annual hackathon because I love how it provides an outlet to generate awesome projects within 36 hours, work in teams with fellow students, apply concepts learned in class, and learn new topics. Private support has made hands-on learning like this and the scholarship awards I received possible. It means so much to me that donors are willing to help fund my education. I am extraordinarily grateful for the generosity enabling opportunities in my life.

—Kelsey Veca, Senior, Computer Science

Thanks to generous donors, Kelsey received the Leonard and Betty Shealy Scholarship. Invest in the journey and you'll make dreams come true for students like Kelsey. journey.utk.edu/scholarships

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