THE UNIVERSITY OF TENNESSEE KNOXVILLE

DEPARTMENT OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE

Annual Report 2015

ELECTRICAL ENGINEERING & COMPUTER SCIENCE

Annual Report 2015 Contents

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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 2015-2016

Undergraduate	747
Graduate	249
(Ph.D. Students: 200)	
Total	**996**

Degrees Granted
Academic Year 2014-2015

Undergraduate	99
M.S.	24
Ph.D.	31
Total	**154**

Faculty
Academic Year 2015-2016

Professors	21
Associate Professors	13
Assistant Professors	9
Professors of Practice	4
Total	**47**

Fall 2015 Freshman Enrollment

Computer Science	72
Computer Engineering	54
Electrical Engineering	42
Total EECS Freshmen	**166**

ACCREDITATION

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

2014 ASEE SURVEY DATA

- 24th nationally among public EECS programs in research expenditures per tenure-line faculty member. Research expenditures grew 76% from FY 2011 – FY 2014.
- 22nd nationally among public EECS programs in PhD enrollment per tenure-line faculty member. PhD enrollment grew 22% from Fall 2011 – Fall 2014.

(Survey data from the American Society for Engineering Education)

Current Faculty Includes:

- 3 ENDOWED CHAIRS
- 8 ENDOWED PROFESSORSHIPS
- 2 UNIVERSITY DISTINGUISHED PROFESSORS
- 8 IEEE FELLOWS
- 2 NAE MEMBERS
- 1 DOD/ONR YOUNG INVESTIGATOR
- 6 NSF CAREER

Department Leadership

Leon Tolbert
Department Head

Jens Gregor
Associate Department Head
External Relations & Graduate Affairs

Syed Kamrul Islam
Associate Department Head
Academic Affairs

Awards For 2014-2015

Faculty Awards

- 2015 IEEE Robotics and Automation Society Distinguished Service Award – **Dr. Lynne Parker**
- R&D 100 Award in 2014 for Continuously Variable Series Reactor – Alexandar Dimitrovski, Gylfi Olafsson, **Kevin Tomsovic**, Raj Ahuja, paul Lefeber, **Yilu Liu**, Burak Ozpineci
- NAI Fellow, National Academy of Inventors (NAI), 2015 – **Dr. Mark Dean**
- Fellow, National Academy of Forensics Engineers, 2015 – **Dr. David Icove**
- UT COE Allen & Hoshall Engineering Faculty Award, 2015 – **Dr. Jens Gregor**
- UT COE Translational Research Award in 2015 – **Dr. Jayne Wu**
- UT COE Professional Promise in Research Award, 2015 – **Dr. Fran Li**
- UT COE Professional Promise in Research Award, 2015 – **Dr. Gong Gu**
- UT COE Research Achievement Award, 2015 – **Dr. Ben Blalock**
- UT COE Research Achievement Award, 2015 – **Dr. Kevin Tomsovic**
- UT COE Outstanding Faculty Advisor Award, 2015 – **Dr. Ben Blalock**

Paper Awards

- William Portnoy Paper Award (First Prize) of the IEEE Industry Applications Society Power Electronics Devices and Components Committee, 2015, **Zheyu Zhang, Fred Wang, Leon M. Tolbert, Ben Blalock, Daniel Costinett**
- Best Paper Award at the 2015 Spring Simulation Multiconference /23rd High Performance Computing Symposium (HPC 2015), "Performance Analysis and Design of a Hessenberg Reduction using Stabilized Blocked Elementary Transformations for New Architecture," **Khairul Kabir, Azzam Haidar, Stanimire Tomov, Jack Dongarra**
- Best Paper Award at the 2015 IEEE High Performance Extreme Computing Conference (HPEC '15), "MAGMA Embedded: Toward a Dense Linear Algebra Library for Energy Efficient Extreme Computing," **Azzam Haidar**, **Stanimire Tomov**, **Piotr Luszczek**, **Jack Dongarra**
- 2015 EURASIP Best Paper Award for the Journal on Advances in Signal Processing, based on the contribution of the following paper: **W. Wang, Husheng Li, Y. Sun and Z. Han**, "Securing Collaborative Spectrum Sensing against Untrustworthy Secondary Users in Cognitive Radio Networks"
- Best Paper Award, **Rui Guo, Wei Wang, Hairong Qi**, "Hyperspectral image unmixing using cascaded autoencoder," IEEE Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensor (WHISPERS), Tokyo, Japan, June 2-5, 2015
- Top 50 Best Papers Award by IEEE PES General Meeting 2015 for paper "Application of Adomian Decomposition for Multi-Machine Power System Simulation," G. Gurrala, A. Dimitrovski, P. Sreekanth, S. Simunovic, M. Starke, **K. Sun**
- Top 50 Best Papers Award, IEEE PES General Meeting 2015, "Reactive Power Planning with Transient Process Stability Constraint," Yurong Wang, Hao Chen, **Fangxing Li**.
- Top 50 Best Papers Award, IEEE PES General Meeting, 2015, "Universal Grid Analyzer Design and Development," **Lingwei Zhan, Jianyang Zhao**, Shengyou Gao, **Jerel Culliss**, **Yong Liu, Yilu Liu**
- Top 50 Best Papers Award, IEEE PES General Meeting, 2015, "Measurement Accuracy Limitation Analysis on Synchrophasors," **Jiecheng Zhao, Lingwei Zhan, Yilu Liu, Hairong Qi**, Jose R. Garcia, Paul D. Ewing
- Top 50 Best Papers Award, IEEE PES General Meeting, 2015, "A GPS-free Power Grid Monitoring System over Mobile Platforms," **Haoyang Lu, Lingwei Zhan, Yilu Liu, Wei Gao**
- Top 10% Papers, **Shuangjiang Li, Wei Wang, Hairong Qi, Bulent Ayhan, Chiman Kwan, Steven Vance**, "Low-rank tensor decomposition based anomaly detection for hyperspectral imagery," IEEE International Conference on Image Processing (ICIP), Quebec City, Canada, September 27-30, 2015.

Student Awards

- **Benjamin Brock**, undergraduate in computer science, Goldwater Scholar, 2015
- **John Reynolds**, senior, computer science, placed 2nd in the undergraduate poster competition at the Consortium for Computing Sciences Southeastern Conference
- **Bo Liu**, Ph.D. student in electrical engineering, received an Outstanding Poster Presentation Award from the IEEE Applied Power Electronics Conference and Exposition in Charlotte, North Carolina, in 2015
- **Yutian Cui**, Ph.D. student in electrical engineering, received an Outstanding Presentation Award from the IEEE Applied Power Electronics Conference and Exposition in Charlotte, North Carolina, in 2015
- **Ben Guo**, Ph.D. student in electrical engineering, received first place for his poster in the IEEE Energy Conversion Congress & Expo 2014
- **Sanjib Das**, Ph.D. student, Gold award for the poster "High-Performance Flexible Perovskite Solar Cells by Using a Combination of Ultrasonic Spray-Coating and Photonic Curing" at the Center for Nanophase Materials Sciences (CNMS) gathering at Oak Ridge National Laboratory, 2015

A message from the department head

The Department of Electrical Engineering and Computer Science at The University of Tennessee continues to enhance its reputation as a Top 25 public university department with its large research and education enterprise. Research expenditures for the department exceeded $15 million for the latest fiscal year. Our faculty continue to do leading edge research in many disciplines and receive national and international acclaim for their activities as shown by the many awards that they have garnered (page 3).

Our undergraduate enrollment continues to increase. In Fall 2015, we welcomed 166 new freshman students, and our undergraduate enrollment is now 747 students. We have 200 Ph.D. students pursuing degrees and performing research with our 43 tenured and tenure-track faculty members. For the first time, our department had >30 Ph.D. graduates in an academic year.

We have established some new minors starting this Fall 2015. We are offering a minor in cybersecurity and also a minor in data center technology and management, and courses related to these minors have attracted a high enrollment (page 19). We will also be adding a new faculty member in cybersecurity in 2016.

Dr. Doug Birdwell (page 8), a professor in our department for 37 years, retired in May, but he leaves a lasting teaching and research legacy that continues in senior design and neuromorphic computing research (page 17).

Our NSF/DOE Engineering Research Center, CURENT, continues its impressive work on research and education to improve the future electric grid to accommodate a higher penetration of renewable energy (page 21). The center now has 29 industry members and has more than 100 graduate student participants from the member universities. With the installation of a 20 kW photovoltaic array and several electric vehicle charging stations on the nearby 11th Street Parking Garage, CURENT's capabilities have been expanded to provide more research in renewable energy integration with the grid and intelligent and connected vehicles (page 13).

Systers: women in EECS, that started in 2013, has been a huge success in helping with the recruitment, retention, and mentoring of women in our department and in invigorating the department in general with the many activities that they plan each year (page 15).

I hope you enjoy our feature articles on some of our alumni: UTK electrical engineering father and son alumni Kelly and Wes Milam (page 5), young entrepreneur and computer science alumnus Tommy Nguyen (page 11), and an alumnus that has worked at Apple, Microsoft, and now Google, Mike Dodd (page 9).

The EECS faculty, staff, and students continue to do world class research and to provide impressive course contributions and facilities enhancements that make the Min Kao Building a wonderful place to work and study. I hope that you get a chance to come by and see for yourself some of the exciting activities that are taking place in EECS at UTK.
Best regards,

Leon M Tolbert

Leon Tolbert

Like Father, Like Son For These Electrical Engineers

Wes and Kelly Milam
(photo courtesy of Wes Milam)

Many families have multiple generations who attend the same college, but **Kelly Milam** and his son, **Wes**, went a step further. Both of them received degrees in Electrical Engineering at the University of Tennessee. They even took courses from some of the same professors, only years apart, such as Dr. Vaughn Blalock, Dr. J. Frank Pierce and Dr. Robert Bodenheimer. Theirs is an interesting story of a family legacy of UT engineering.

Kelly Milam's military experience in the 1950s originally sparked his interest in Electrical Engineering. After growing up on a small farm near Fayetteville, Tennessee, he spent four and a half years in the Air Force and was stationed for a time at a communications post on the Black Sea coast in Turkey. One of the people he worked with there was an electrical engineer, who showed Milam how to keep the station's diesel engines and radio antennas operating. As he learned more about radio operations, Milam became interested in pursuing a degree in electrical engineering. He says that he had always been mechanically inclined. "I was raised on a farm, and if anything was wrong, we took it apart and tried to fix it. We didn't pay anyone to take it apart for us. So I had that background of being inquisitive."

Milam had already completed a couple of years at a smaller college, but then he decided that if he was going to take the time to finish his degree, he wanted to graduate from an institution that potential employers had actually heard of. His brother had attended UT, too, and that influenced his decision to come here. Milam earned both his bachelor's and master's degrees in Electrical Engineering here.

Milam says that the Electrical Engineering and Computer Science department has really changed since his time as a student. "It's a difference between night and day right now, what's going on in the department. They basically had the choice, when I was there, you could go in to power or you could go into electronics. I was there at the end of the vacuum tube. Most of my undergraduate education was in vacuum tubes. They had kind of transitioned to transistors before I left, but that was right at the end."

Upon graduating in 1964, Milam's first job was at **Oak Ridge Technical Enterprises Corp. (ORTEC)** in Oak Ridge, Tennessee. "We designed electronics to measure time and energy of radiation, and we also made solid-state detectors." While the products ORTEC made were primarily used by nuclear physicists in laboratory settings, ORTEC eventually got into the business of manufacturing Positron Emission Tomography (PET) scanners. These medical imaging devices are used for the early detection of cancer and other diseases, and the PET technology is based on the types of electronics with which ORTEC was already working at the time. Milam stayed with ORTEC until 1981, when he accepted a job offer to start up manufacturing at **Technology For Energy (TEC)**, a new radiation detector company started by Ron Nutt, a former ORTEC colleague.

By the 1980s, **EG&G ORTEC**, as it was then known, had decided to get out of the medical imaging business, in order to focus on their core customer base of physicists who wanted to measure radiation. Terry Douglass, another of Milam's colleagues who was still at ORTEC, had been trying to sell off the company's medical imaging division. In 1986, he approached Milam, Nutt and another ORTEC colleague, Michael Crabtree, with a bold idea: how about the four of them buying ORTEC's scanner business and starting their own company? Milam says that Douglass told them, "Are you guys up for a little fun, for something

new?" Douglass, Milam, Nutt and Crabtree met to discuss the venture and decided to all go in together. They borrowed everything they could and even put up their houses as collateral to start the new company, known as **CTI Molecular Imaging**. "It gets your attention if you sign everything you got over to the bank, and the bank knows that, too," says Milam. "We all had pretty strong religious beliefs in what we were doing, and there was no real conflict there. What the other three told me, I could take to the bank, between the four of us. And that made a good working relationship. If something came up, we sat down and discussed it, and we came up with a plan to address whatever it was, and we were all focused and went after it then. And you just couldn't have a much better management team, as far as I was concerned."

In the 15 years that Milam was with CTI Molecular Imaging, the company was successful enough that it earned 70% of the market for PET scanners, outgrew its original headquarters and drew the attention of industry giants **General Electric** and **Siemens**. At that time, Siemens had a research and development group working on PET scanners, as that company could see the potential for the technology. When compared side-by-side, CTI's scanner technology was superior to Siemens', so Siemens made the decision to purchase CTI.

Milam retired in 2001 as CTI became a public company and the transition to Siemens was taking place. He and his wife have since had more free time to do medical missionary work with their church, traveling to places like Africa, Ukraine and Guatemala. Some of the clinics they visited have had old, second-hand medical equipment donated by hospitals. Milam was able to work on the equipment and get it up and running so it could be used. He has also volunteered in other ways, such as disinfecting medical instruments with an autoclave.

Milam's advice to students who are about to graduate into the working world is to "get a job that you enjoy, and that includes a company environment and everything else, too, and how the company runs the business, and how much freedom you've got to go out and solve problems your way. If you go into a business of your own, you've got to really commit yourself to it, because it's going to take a lot of extra time and effort. Go into it with people who have similar morals to what you have, and who are very capable in the areas where they are needed. A job should be something that you enjoy, and something you feel like it's helping mankind. And I've been fortunate enough to have access to things like that."

The elder Milam is understandably proud that his son has followed in his footsteps as an electrical engineer. "I was really glad to see him do it, if that's what he wanted to do. You can't overemphasize getting into a career that you enjoy going to work. And we've been very fortunate in that, I think. If you try and push somebody in a... a square peg in a round hole, it doesn't work very well. And that's kind of the way I look at careers. I'm really glad to see him be an engineer. We'll talk some, and he'll bring me up to date on what's going on, technology-wise."

Wes Milam's path to studying Electrical Engineering at the University of Tennessee was not necessarily predetermined; in fact, for a time he had considered becoming a teacher instead. "I had done well in math in high school, and many people recommended teaching and/or engineering to me. I picked electrical engineering because I knew a little more about it than the other disciplines, since my father was an electrical engineer. I think I qualified for admittance to other schools, but I had scholarship offers to UT, and its engineering school compared well with other schools. I was not driven to go to some far-off place, so UT was a great choice for me. My dad's experience at UT did not push me to attend, but let me know that UT offered a great education."

The younger Milam says of his father, "He was always willing to talk about how things worked. He wasn't afraid to talk about math, about how math played into life, and how you solve this problem and that problem. It gives you a much better understanding, to kind of prepare you to do the problem solving and analysis that engineering requires. So I think I was much more prepared to go into engineering, whether he pushed me that way or not.

"College was the most fun time of my life. Studying EE was a tough task, and there were strong bonds that developed between those of us who were going through that together. It seemed like there was always one big group project during the quarter (pre-semesters), where you had a group spending crazy hours trying to figure out how to get it to work. It turns out that was pretty good training for a career in electrical engineering. Dr. Vaughn Blalock and Dr. Bodenheimer were the masters of coming up with these challenging projects. Although I had picked EE without knowing

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too much about the different disciplines when I started at UT, once we got into circuits classes I really enjoyed the math and the problem-solving side of circuit design and analysis."

Wes feels like the approach taken with teaching while he was at UT helped to prepare him for the type of career he has had. "I thought the undergraduate classes at UT had labs that told you what the end product would look like and then turned you loose, while other schools may have labs that are more like following a specific recipe. UT's approach forced you to go understand the problem and allowed many different approaches to solving it. While you were working in the labs, you could see how different people approached the same problem. I thought that was the most obvious way UT's approach stood out compared with other schools."

Milam has noticed the EECS department's efforts to help UT join the ranks of the nation's Top 25 public research universities. "It seems like the department is competing to become one of the better departments in the country. They have recruited students and professors from a broader area than when I was in school. There has been a clear upgrade in facilities."

He now works as a design engineer for **Texas Instruments (TI)** here in Knoxville. "Our group designs battery charge management integrated circuits for portable electronics. They are chips that connect to your adapter and let you run your electronics and charge your battery without catching anything on fire. Our group is made up of about three-quarters Tennessee grads. This is my second stint at TI." He started his career at Texas Instruments after finishing school, designing products called "catalog op amps." He also worked at two other companies, **RFMD** and **TriQuint**, where he helped to design cell phone power amplifiers. Wes says that three-quarters of the employees in his TI office are UT Engineering graduates. He says that one of the reasons Texas Instruments wanted to open a design center in Knoxville is because the company has been impressed by UT's Engineering graduates.

Milam's career has taken him west to Dallas, Texas and east to Greensboro/Winston-Salem, North Carolina, but Knoxville is home for him and his family. "My wife, Chandra, and I are both from Tennessee – my family is in Knoxville, and hers is in Murfreesboro. We travel pretty regularly to visit our families, and when I worked at TI in Dallas that was a long trip. Moving to North Carolina helped, and when I found out TI had opened a design center in Knoxville, that was an ideal opportunity for me. I'll probably keep doing what I'm doing, but there are always opportunities to try new things. In the last year or two I have been able to try out verification, which is a little different than design. It gives me a chance to learn and try new things."

Thinking back to his own time as an electrical engineering student, Wes says that today's engineering students who are trying to make their way to graduation and into the working world beyond should take advantage of all the opportunities they have while they're in school. "There will never be another time when you have the chance and the time to explore so many things. Work hard, but have a life outside of work. Find something that you enjoy to do outside of work. When looking at a new job, pay attention to who you will be working for and with."

Faculty spotlight

Dr. J. Douglas Birdwell

Dr. J. Douglas Birdwell retired in May 2015 after 37 years on the faculty at the University of Tennessee. He has been a Professor of Electrical and Computer Engineering at UT since 1978, but he also attended UT as a student. Dr. Birdwell received his B.S. and M.S. degrees in Electrical Engineering at the University of Tennessee in 1974. He received his Ph.D. in Electrical Engineering from Massachusetts Institute of Technology in 1978, specializing in reliable control systems design. Having grown up in Knoxville, he then decided to come back to UT to work for his alma mater.

Dr. Birdwell's areas of interest during his career have been control systems, information processing, high-performance databases, data mining and bioinformatics. He was most recently the director of the Laboratory for Information Technologies, which develops secure distributed information systems and analysis tools for counter-narcotics and other law enforcement agencies.

Dr. Birdwell has over 100 publications in his areas of research, and has directed in excess of $4 million of externally sponsored research and development projects at the University. He is a Fellow of the IEEE and was formerly a member of the Board of Governors and President of the IEEE Control Systems Society.

He has served as an Associate Editor of the IEEE Transactions on Automatic Control, as Program Co-chair of the 1996 Control and Decision Conference held in Kobe, Japan, and as the General Chair of the 1998 CDC in Tampa, FL, USA. He is a member of the Tau Beta Pi, Eta Kappa Nu, and Sigma Xi honor societies.

Dr. Birdwell believes that the mission that really matters in higher education is to ensure that the next generation of college graduates is prepared and competent to run our civilization, in the United States and around the world. What matters is that "those people we'll be educating will excel and drive forward our quality of life and the protection of the earth for future generations. To me, nothing else matters. Talk about all the other metrics, but it's really continuity of our civilization that's the most important."

At his retirement dinner, he gave this advice and words of wisdom to his fellow faculty members: "All I ask, in leaving, and retiring, is please, do what is within your power to prepare our successors, because we won't always be here."

Dr. Catherine Schuman, one of Dr. Birdwell's former students, said "Dr. Birdwell has left a lasting impact on EECS at UT, and he has left a lasting impact on my life. His high expectations push students beyond what they think their limits are, and he shows us all what we are really capable of accomplishing. When I started my Ph.D. program five years ago, I never imagined that Dr. Birdwell and I would co-author six papers, submit six patent applications, and help form a research group that has produced three Master's theses and is currently being worked on by ten students. None of that would have been possible without Dr. Birdwell's relentless enthusiasm and willingness to always look ten steps ahead. I have and will continue to look to him for advice and support as I continue on with my career, and I have no doubt that he will continue to be there for me, as he has for so many of his previous students. His retirement is a tremendous loss for the department, but I know that the legacy he has left will last for years to come."

Dr. Mark Dean, the John Fisher Distinguished Professor in EECS, has great respect for and kind things to say about his colleague, Dr. Birdwell. Both of them attended UT, but their time as students did not overlap. Dr. Dean was completing his undergraduate degree when Dr. Birdwell joined the faculty. More recently, the two did work

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together for two years on a Neuromorphic Computing project. "He's obviously very intelligent, I'd almost say genius," Dr. Dean says about Dr. Birdwell. "There's not much he can't figure out. He almost talks over my head, he's got so much knowledge; both practical knowledge and technical knowledge. He loves UT, loves working with the students, and that's why he has been here so long. He wants them to be the best they can be. He'll push them to reach their limits- he expects a lot out of them and with his help, they deliver."

Dr. Dean says that post-retirement, Dr. Birdwell will probably still do some consulting work, and will still be one of the main contributors to the Neuromorphic Computing project, in addition to pursuing his passion for photography. Dr. Birdwell has always been passionate about diversity, too. He has wanted to see more women and minorities in the EECS department and in Engineering in general. Dr. Dean said that "he always did what he could do to support the groups who were underrepresented." Overall, says, Dr. Dean, "He has been a good representative of the College of Engineering and the rest of the university. He has enjoyed staying close to the work and close to the students, and will probably remain close to the students."

Dr. Doug Birdwell (far left) with students from one of his research groups, as well as Dr. Mark Dean, Spring 2014.

Notable Alumnus: Mike Dodd of Google

Michael D. Dodd (BS/EE '95) is a software engineer at **Google, Inc.** in Kirkland, Washington. Since earning his degree in Electrical and Computer Engineering at the University of Tennessee, he has worked for three of the biggest companies in the tech world- Apple, Microsoft and now Google. With that success has come the ability to give back to the university that helped him get his start. In 2010, Mike and his wife, Meredith, created the Michael D. Dodd Engineering Scholarship. The scholarship is available to any student enrolled in the College of Engineering with financial need who demonstrates successful academic performance. His gift to the College also includes an Engineering Honors endowment, as well as funding for the student organization Systers: Women in EECS @UTK.

Mike's interest in giving back stemmed from his own time at UT. After transferring to UT, Mike would not have been able to complete his degree without the financial assistance he received. Thanks to this support, Mike had the opportunity to learn as much as he could from his professors

Mike Dodd

in electrical engineering and his college experience surpassed his expectations. "Money was really tight for me in college; I couldn't have made it through without the financial help from family and family friends. So I liked the idea of being able to now turn around and help someone in school now get through it."

Dodd also had a good all-around college experience, beyond his studies. "My college experience involved a lot of time in Ferris Hall, then the seat of ECE, particularly in the electronics lab. I went to football games at Neyland when I could, but also still remember a few games that I heard while stuck inside the lab on a Saturday afternoon trying to finish a project. I loved watching them play, and got to see the start of Peyton Manning's career there. It was also a great time at UT for women's basketball. Pat Head Summitt's team taught me the joy of that sport. Those teams were amazing."

Some of his professors really made an impact on him. "A few professors stood out. Definitely Dr. Eldredge Kennedy and Dr. Vaughn Blalock. I had them for courses my junior and senior year. My senior year I mostly took analog electronics classes, for two reasons: it was the foundation of everything else, including digital, but really mostly, Kennedy and Blalock taught those courses and I just wanted to stick with them. Also C.D. Martin. He taught a computer programming class in ECE. I had taken a couple of computer courses, at another university, from professors who seemed annoyed that I already knew a fair amount about programming from my own work as a teenager and from my internship at Apple; Martin, on the other hand, delighted in it. Later he helped me out by giving me a paid TA job for his class which helped me pay for expenses in school."

At Google, Dodd is a Tech Lead Manager, which "means I have both technical and management responsibilities. My team works on text messaging for Android, which involves both system and application work."

Dodd's experience at UT has helped him throughout his career. "I think my experience at UT helped give me a foundation for how to think about engineering problems. How to take complex systems and break them down into simpler components, the math foundation for computer algorithms. And a better understanding of the building blocks of EE. That's been particularly helpful even just in terms of being able to have intelligent conversations when I've been working hand-in-hand with engineers on the hardware side when we've been bringing up software on brand-new devices."

"The Engineering Honors endowment just started with the money we gave last fall. The endowed scholarship has had some recipients already, just in the last couple of years."

"Systers is something I started giving to because I believe so strongly in getting more women into the industry. My hope is that Systers can help make this better at UT at least."

Electrical Engineering Senior Jessica Boles, President of Systers: Women in EECS @ UTK, says, "To us, Mr. Dodd's gift to our organization validates that what we're doing is important, for both our department and our field as a whole. Thanks to his generosity, we have been able to send several of our members to conferences such as the Grace Hopper Celebration of Women in Computing and the IEEE Women in Engineering International Leadership Conference. For minorities, these types of conference experiences are invaluable in terms of support and inspiration, for they provide an environment in which women from all over the world can gather to share experiences, advice, and future visions for our field. Mr. Dodd's contribution will continue to live on through the empowerment that these conference experiences have provided, both for our leaders and for our younger Systers members."

This is exactly what Dodd hoped for when he decided to give back to the university. "My hope is that this scholarship can help someone who is tight on money get through school without having to worry quite as much about paying for it," said Mike. "Then they can go change the world."

(Juliette McClure contributed to this story.)

Notable Alumnus: Tommy Nguyen of Neighborhood Nerds and Right Click Design

Tommy Nguyen is a 2014 graduate in Computer Science, and his career has already taken off. He is currently working for two companies, as Senior Regional Vice-President and co-owner of **Neighborhood Nerds**, and as President of software development company **Right Click Design**. His major, his career path and his life took quite a turn while he was going to UT.

He originally went to school for pre-med, and his goal since he was in middle school had been to become a doctor. However, by his senior year at UT, Nguyen realized that medicine was not his true passion. He abruptly switched his major to Computer Science and graduated in 2 years. "Making the switch was a scary thing to do at the time," recalls Nguyen. "My senior year! Here I go... should I start applying for medical schools? Should I continue with that or should I make this complete switch? And I'm glad I did."

Nguyen was born in Vietnam, but he and his family moved to Atlanta, Georgia in 1992. After four years there, they relocated to Knoxville, and Nguyen considers Knoxville to be home. "I just think it's the perfect city." He and his wife both attended the University of Tennessee. "Knoxville's home for both of our families; it's home for us, and I don't see us ever really wanting to move away." With the success he has had in Knoxville so far, he probably won't have to move anywhere.

Nguyen first walked into Neighborhood Nerds in July 2012 and met with company founders Leo Knight and Mark Armstrong. "I was really just looking for a part-time opportunity, like 20 hours a week while I was going to school. All through college I was pretty much working full-time, but I had never done anything in technology,"

Tommy Nguyen at the Neighborhood Nerds office.

says Nguyen, and he has been with the company ever since.

Neighborhood Nerds is a membership-based, concierge-style technology service. The company helps out its clients with all manner of tech solutions, beyond just fixing computers. Whether it's helping clients' computers run faster, upgrading computers to new operating systems, setting up home networks, resolving connectivity issues, or even negotiating with internet service providers on your behalf for the best rates, Neighborhood Nerds strives to do it all. Nguyen says that their goal is to help people use their technology better. "It's not about fixing people's broken stuff. That's boring; anybody can really do that. Our philosophy is we want people to have awesome things and learn how to use them better. And that includes businesses and residential clients. Obviously, we're in a great residential community. We want to be within walking or driving distance to our clients, and that's why were called the Neighborhood Nerds."

One popular service that Neighborhood Nerds offers its clients is "Tech Talks," a weekly series of mini-seminars held at the Nerds' headquarters in the Sequoyah Hills neighborhood. These talks cover tech topics of interest for their clients. "Our philosophy behind most of these Tech Talks is that technology should be about connections- you to your technology, you to your family, together. And that's really what technology, to us, is about. And a lot of times, what we find is it's the opposite. Technology is splitting people apart, making people frustrated, making people too focused on the technology side. And so the talks are about showing how you can use all these toys and all these gadgets, but also to connect you to your family, connect you to your loved ones, you and your friends.

"The long-term goal for our vision is to have eight, nine, ten of these stores in the Knoxville area, and then

we want to franchise it. We want to be able to take this, and have people who do what we like to do, and then buy into the company, and start their own Neighborhood Nerds. We want to expand to Nashville, to North Carolina, to Atlanta, and all over the U.S."

Nguyen believes that what sets Neighborhood Nerds apart from its competition is superior customer service. "No matter who you work with in my company, you're going to get the best and most brilliant customer support you've ever received, anywhere. That's a big part of my passion- making sure people are happy. To do so, you provide the most brilliant customer support. When you become a member, you have this relationship, you have this rapport. So when somebody does come to your home, you're comfortable with this person, you know who this person is. That's a really cool aspect of working with Neighborhood Nerds."

Nguyen had another vision, too, that he has seen come to fruition: to start an "awesome" software development company here in Knoxville. This has resulted in his other company, **Right Click Design**. A year into the existence of this venture, he considers it to be his "baby," and he is developing it slowly. After all, he is still working full-time with Neighborhood Nerds. Right Click Design is a small company, with two part-time and two full-time developers, all of whom are University of Tennessee graduates. As a small company just starting out, they have the freedom to pick the projects they work on, and they have a variety of clients. "They range from musicians, to medical providers, to entrepreneurs who want to get something done, to video game producers. We have such a diverse clientele. We get to write our own rules, so we get to work with who we want to work with," says Nguyen. His long-term goal is for Right Click Design to develop applications for productivity, geared towards businesses, that they can sell and support.

"When you're in startup mode, you wear all the hats," says Nguyen, "and there are 22 hats!" He is no longer working 80-hour weeks, as he was when he was in school and working for Neighborhood Nerds; he has cut that down to an apparently more manageable 60 hours a week. "I could have a desk job, Monday through Friday, nine to five, but I wouldn't be happy. I wouldn't feel the satisfaction that I'm creating something awesome, that I'm changing lives," he says.

Nguyen is even thinking beyond his two current companies and on to additional startup ideas. "There are a lot of opportunities to be successful. All you have to do is provide a solution to a problem. There definitely are some opportunities that I could spin off from Neighborhood Nerds. For example, Neighborhood Nerds doesn't have to just deal with tech issues or provide tech solutions. It could be 'Neighborhood Plumbers,' or 'Roofers,' or 'Gardeners,' or whatever! The same business model could be applied to all these industries, once you have the model down, and it's scalable, and you know how to find the right people to provide these services. I think there are so many opportunities; if only there were more time!

"Right now, I'm working a lot, but I'm fulfilled, and I'm happy, and I get to change lives. That's truly how I feel. Would I feel the same if I had just stayed with pre-med, and I'd be in my third or fourth year of medical school? Probably; I'd probably still feel fulfilled. But having this opportunity? I wouldn't have had it, if I hadn't switched to Computer Science. I would have never knocked on Neighborhood Nerds' door, I would have never started a software startup; I would have never met the hundreds and thousands of people that I've met through this industry, and learned the things I've learned. I'm glad I did it, there's no doubt."

Nguyen's advice to students who aspire to follow in his footsteps is, "don't be afraid to go meet people. The best thing that ever happened to me was walking into Neighborhood Nerds and saying, 'hey, my name's Tommy Nguyen, I'd love a part time job here.' And two weeks later, it becomes this incredible lifetime opportunity. Don't be afraid, don't be intimidated. No one's going to laugh at you for not knowing how to do something, because you're not supposed to know how to do anything yet. This is your opportunity to learn. This is the only time in your life that you can sit down and be brand new at something, and it's okay to do so. So yes, my advice to young people is to go out and talk to other people who have done it before, because you're going to be better for it."

Solar Panel and EV Charging Installation Benefits EECS Researchers and Instructors

A 20 kW photovoltaic solar panel array and four electric vehicle charging stations have been installed on the roof of the 11th Street garage, across the street from the Min Kao building. In addition to providing power to the UT campus grid (providing electricity to the parking garage lighting system), DC power generated by this garage-top installation is being routed to some of the teaching and research laboratories in the Min H. Kao Building for use in instruction (such as in the Eaton Laboratory) and research purposes (in the CURENT power electronics laboratory).

There are 36 electric lines running from the solar panels, across the Cumberland Avenue pedestrian bridge and into the Min Kao building. A power distribution system has been added to the building that will allow the department to move the solar power around the building, from the Power Electronics Lab in room 125, to the Hardware Testbed lab in room 101, and over to the High-Power Electronics Lab in room 117.

Eaton donated about $170,000 worth of equipment to the department, which includes the vehicle chargers and the inverters that convert DC power generated by the solar panels to AC power to put back into the UT ac grid. There are two "Level 1, 120 Vac chargers", one "Level 2, 240 Vac charger", and one "DC quick charger". As a whole, they can charge up to seven vehicles at the same time.

A video screen has been installed on the fifth level of the parking garage, near the bridge crossing over Cumberland Avenue. A graphic display will show information from the solar panel system for garage visitors to see: how much power is being generated by the panels, information about the power being provided to the grid, and the power going to the vehicle chargers.

Also, Nissan has donated two Nissan Leafs (electric vehicles) for EECS to use in research and information gathering. Drs. Charles Cao, Tolbert, and Asad Khattak of Civil and Environmental Engineering plan to install some driver and vehicle data collection and communication systems in the vehicles for research on intelligent and connected vehicle and transportation systems.

The majority of the installation cost was covered by income from the West Tennessee Solar Farm, a 5 MW installation located between Memphis and Jackson, TN. Data from that farm will be shared with CURENT for use in determining the impact that variability in power provided by large solar farms has on the grid.

Researchers will be able to communicate with the vehicle chargers by Ethernet cable. They will be able to

see things like: which chargers are in use and the charging level of the connected vehicle, what the charge amount is, and how quickly the car is being charged. One possible use for the data generated: students could study it to determine things like the effects of "DC quick chargers" on the batteries of electric vehicles.

The project is the result of a collaborative effort among Stacey Patterson, Vice President for Research and UT Research Foundation Vice President, Leon Tolbert, Min H. Kao Professor and EECS Department Head, Bob Martin, laboratory manager for CURENT, and Ron Thompson, Eaton's Director of Innovation at their Knoxville office. "The donation of equipment and vehicles made by Eaton and Nissan and the funding provided by UT has now put our department in a prime position to more fully integrate renewables and electric vehicle applications into our research and instruction in the department. We anticipate this installation will enable us to have long-term research funding in the areas of power electronics for renewable integration, intelligent and connected vehicles, and transportation system sensors and power electronics," explained Dr. Tolbert.

One professor who has used the Eaton Lab for classes is Dr. Daniel Costinett. He has taught ECE 482: Power Electronic Circuits as a hands-on design laboratory focused on power electronics circuits for transportation. In the course, Dr. Costinett's students build all of the power converters and control for an electric bicycle. Students work in groups, starting from a bicycle with a hub motor and lithium ion battery. Over the course of 7 labs, they gradually design, build, and test a DC-DC converter, motor drive, and central controller to complete the e-bike. In place of a final exam, there is a final exhibition where they take the e-bikes outside and ride around to see whose system works best.

In addition to the 11th Street Garage solar panel installation and EV chargers, there are two other solar panel/EV charger installations on campus. Located in the Music Building parking lot and on the Agriculture Campus near the UT Gardens, they provide the UT campus with 13 more solar-powered EV charging stations.

(Dr. Leon Tolbert contributed to this story.)

Systers Continues to Grow and Evolve, Doubles Its Program Offerings

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

At the core of Systers are programs designed specifically for executing this mission. As the student organization has grown and evolved, these programs have increased from three in 2014 (Mentorship, Professional Development and Outreach) to six for the 2015-16 school year:

Ongoing programs:

• Mentorship- Systers creates mentorship pairs according to career interest and sponsor monthly mentorship activities.

• Circles- Systers arranges groups of women who meet weekly for discussion about all things professional and personal.

• Tutoring- Systers sponsors free tutoring hours for those unable to find help in undergraduate classes.

Periodic programs:

• Skills Series- Systers hosts workshops on common skills necessary for success in industry and/or academia.

• Outreach Program- Systers sponsors engaging events with local K-12 students to spark female interest in engineering.

Occasional programs:

• Conference Travel Awards- Systers funds members to attend professional conferences for women in technology.

Systers' second year was even more successful than its first. Highlights from the past year included:

October, 2014:

• Thirteen Systers members attended the Grace Hopper Celebration of Women in Computing in Phoenix, AZ. One member spoke as part of "Lean In" Workshop and several other members took part in a poster session.

November, 2014:

• Systers became the first student organization campus-wide to have a project fully funded on VOLstarter. VOLstarter is an online fundraising tool created by the University of Tennessee that allows individuals and organizations to create and share fundraising campaigns with an engaged community. Systers' project was a "women in engineering" video commercial that they plan to complete during the coming school year.

• Google software engineer Mike Dodd made a large financial contribution to Systers, as part of an Electrical Engineering endowment. This will enable Systers members to attend conferences in their fields, such as the Grace Hopper Celebration of Women in Computing.

February, 2015:

• Served as a face of Lean in Circles' nationwide launch of Women in Computer Science and Engineering chapter

• Launched Tutoring Program

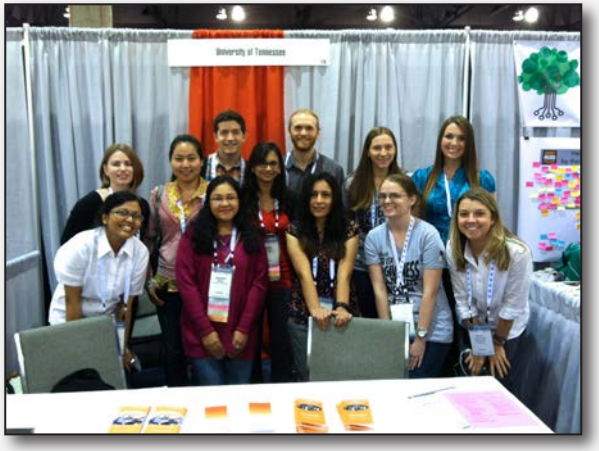
March, 2015:

• Hosted Dr. Ayanna Howard of Georgia Tech for mentorship workshops with both faculty and students. Dr. Howard has received national awards for her work with mentoring underrepresented groups in engineering.

April, 2015:

• WomEngineers Day. WomEngineers Day was a one-day conference, with approximately 350 attendees, for UT's College of Engineering. Sponsored by the UT COE's Board of Advisors, the conference sought to foster a higher degree of support for females in the

college and to educate students, both male and female, in professional and personal topics not covered in the typical engineering curriculum. Several Systers members led the organizational effort for this.
• Nine Systers members attended the IEEE Women in Engineering International Leadership Conference in San Jose, CA.



July 2015:
• Systers received a $10,000 Corporate Contribution from TVA to fund its Mentorship, Tutoring, and Skills Series Programs.

August, 2015:
• Systers hosted approximately 20 College of Engineering female freshmen at its inaugural Freshman Reception, which aims to provide a community for freshmen women entering engineering at UT.
• Third annual EECS Welcome Back Celebration hosted by Systers, IEEE, and ACM. Formerly called Bazinga!, this event featured a booth fair attended by twelve Employers and four Student Organizations, seven laboratory demonstrations, a pizza party, a scavenger hunt, and a social media raffle. The purpose of this event was to help grow the community in the EECS department and to provide students with resources before the school year began.
• Systers launched its new Circles Program to promote female camaraderie among its members. They will arrange groups of 10-12 women who meet weekly for informal discussion about everything professional and personal. A book study on Sheryl's "Lean In for Graduates" will be incorporated into this program.

With all of these achievements and activities in the last year, Systers has gained the attention of several news venues, being featured in Tennessee Today, USA Today, Mashable, The Oracle, The Torchbearer, The Daily Beacon, WATE-TV Knoxville, WKRN-TV Nashville and the Social Times.

The beginning of another school year finds Systers busy once again, with a full slate of activities. In September, Systers launched its new Skills Series, consisting of eight workshops per year on different skills necessary for success in industry, such as soldering, MATLAB and web development. IEEE East TN will assist with the first of these workshops. The following month, Systers will partner with IEEE's East TN chapter for a large-scale outreach event, while seven members will attend the Grace Hopper Celebration 2015 in Houston. In November, Systers will send eight members to the IEEE Women in Engineering Summit USA East in Philadelphia, while twelve members will attend the Southeastern Women in Computing Conference in Atlanta.

Systers President Jessica Boles says, "Watching the women we encounter through Systers grow into confident professionals and leaders

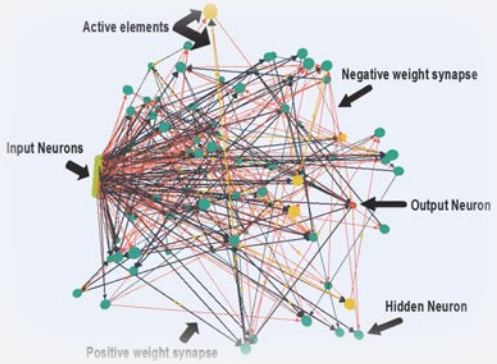
is truly energizing. Every day is an opportunity for growth, even for our executive board, and we strive to continue refining Systers so that it best addresses the needs in our department even as they change. We're absolutely thrilled about the progress we've made over the past year, and we look forward to continuing to advance our mission with the momentum we have as we enter our third year."

Neuromorphic Computing Set to Break Down Technological Barriers, Change the World

Many of us may not realize it, but the development of computers as we know them has hit a wall. The growth of computer processor performance has leveled off since about 2004, even as the amount of data has grown enormously. "We can't do all the processing on it. Our present von Neumann-based computing systems were not designed for processing large volumes of data," says Dr. Mark Dean, the John Fisher Distinguished Professor in the University of Tennessee's Electrical Engineering and Computer Science department. "Computers were designed to compute, not necessarily to move data around, so there are a lot of bottlenecks in the present design."

"We need something new, that's easy to program, eliminates data processing bottlenecks, and is able to be scaled up a million times from where we are today. And we don't have anything right now that does that."

However, one EECS project is working toward just that sort of computing breakthrough, by looking at how the brain works and using that as a guide. "We've coined the phrase **'Neuromorphic Computing,'** as representative of using neuroscience-based structures and understanding to construct a computing platform," says Dr. Dean. "The brain is a low-power device, has high-capacity, and does certain things well, like pattern recognition. If you want to process a lot of data, and that processing will consist largely of looking for patterns, anomalies, etc., maybe you should build computers based on what we know about how the brain works.



"Neuromorphic computing has interesting characteristics. It's all highly distributed. A diffuse set of elements, each doing a little bit, and then working together to create something bigger. You don't program it; you train it or teach it how to do something. You give it samples and run exercises. It learns what it needs to know to do a particular process or application. Then you put it to work."

Neuromorphic Computing is thought to have certain advantages over traditional computing; mainly flexibility, a lower processing time, and being able to detect things more quickly. Ideally, Dr. Dean says, a neuromorphic computer would be small and dense. "You can do it now, to some extent, with very large computers. What we would want to do is do it with a very tiny computer. You want to be able to do it in real time versus static. Low-power, runs off a battery. Dynamic, meaning it learns, versus you programming it. Improved security and application quality. Errors would be self-correcting; it could detect and resist attempts to alter or intrude on it and its applications. We're starting to see that yes, you can actually build these systems and make them work."

Other groups are currently working on similar projects, in both academia and industry. For example, the European Union is working on the Human Brain Project- they're actually trying to exactly duplicate the operation of the human brain.

Unlike the European Union's effort, the EECS's Neuromorphic Computing project is not attempting to create a human brain. "We don't think you need that much detail to build an effective computing system. We don't want to build a human, we want to build a computer." They are taking a simpler approach, only using those parameters or functioning elements in the brain that they think are important to solving a problem or running an application. Dr. Dean says, "It significantly simplifies our design point, compared to others."

The research team at EECS calls their approach to the problem "Evolutionary Optimization," or EO. Optimization is a way to create a neural network in a neuromorphic computer. Neural networks are essentially the program that is in a neuromorphic computer. That neural network does the processing of whatever it was trained to do; for example, recognizing a letter or a number. "The approach of using EO to create neural networks is based on our knowledge of how the brain works: neurons and synapses and how they communicate," says Dr. Dean.

The team has progressed as far as representing neuromorphic computing in the form of software simulations. Their next challenge is to represent it in

hardware form. They have been able to build a neuromorphic structure using digital circuits, structured in a form that look more like elements of the brain: neurons and synapses and the connections between them. They even plan to try to build brain-like structures using an analog circuit approach, versus the ones and zeroes of the digital circuit approach.

Neuromorphic Computing is going to require some completely new ways of creating computers. "Right now, we use silicon chips, and that has been okay for more than 50 years. But much like when we moved from vacuum tubes to silicon chips, maybe it's time to move to something else, something more suited to neuromorphic computing." One idea being explored is to store information based on intensity, instead of with ones and zeroes, or on and off, as current computers do. Dr. Dean envisions "a device that will store information based on the intensity of the information that it's exposed to."

Devices like these could potentially sidestep the limitations inherent in silicon chips: limitations that are discrete in time, as silicon operates on a period or clock, and limitations that are discrete in size, in zeros and ones- you normally only get those two choices. If that is possible, says Dr. Dean, "I think I've significantly increased capacity and performance by taking those two constraints away."

Neuromorphic computing has many potential applications, including security and anomaly detection; the Internet of things, which deals with the concept of connecting almost any type of powered device to the Internet; autonomous operation and controls of vehicles and other machines; and data analytics, such as those used in financial trading, medical and health care, that utilize both historic and real-time data.

The Neuromorphic Computing Group, Spring 2015

Neuromorphic computing is not likely to replace traditional computing, at least not in the near future. Neuromorphic Computing team member Dr. Catherine Schuman says, "My perspective is that neuromorphic hardware is not a replacement for traditional computing, but a complement. We are gathering data like video, images, and text at astounding rates. Much of this data is simply stored without being analyzed at all. My view of where neuromorphic hardware shines is in, essentially, a pre-processing step of data that can potentially be done in situ, or in the environment in which the data is gathered. In essence, neuromorphic hardware doesn't have to give the final answer or analysis about the data; it doesn't have to be 'exact', but it can pare down the data to an extent that it can be sent to and processed by more traditional architectures."

The team working on Neuromorphic Computing has some specific goals they want to achieve over the next few years. Dr. Dean says, "we have to prove that it is a viable approach. That it not only solves a problem or supports an application, but you can train it, and it's scalable. We have to show that we, at UT, have an approach that is competitive with the other approaches. So the new types of devices will have to be demonstrated and start to be integrated, I'd say, by the end of 2017, 2018. And in five years we're going to have to deploy."

There are some technical obstacles standing in the way of their goal. "However, the main obstacles to achieving that goal will not necessarily be technical ones, but are more likely to be cultural obstacles, the momentum of existing approaches and resistance to change," says Dr. Dean.

Previous advances in computing "were made not necessarily because we'd pick the best technology. We picked the technology that kind of fit the time and the needs of the people at that moment, right, and maybe somebody did better marketing. It wasn't necessarily because it was a better approach." Nearly all of the factors that determine which technology catches on with the public are out of the control of its creators. "All you control is the technical solution. The one thing we can do is adapt quickly, so we can catch the timing, and see where it's going.

"Something's going to happen in the next three to five years that will revolutionize the computing industry. We need to make something happen in that timeframe to capture the opportunity, because if we don't, something else will happen and it will solve the problem. Which is fine, but there's an opportunity now to steer people towards this approach. We've just got to demonstrate that it works. I think it will."

EECS Offers New Cybersecurity and Datacenter Technology Management Minors for Fall 2015

The Department of Electrical Engineering and Computer Science has introduced two new minor degree programs for the 2015-2016 academic year: **Cybersecurity** and **Datacenter Technology and Management**.

Cybersecurity

The world, its citizens, organizations, businesses and governments are heavily dependent on ubiquitous cyberspace infrastructure and services to function efficiently and effectively. This cyber-infrastructure enables collaboration, business operations, information sharing/services, sales, entertainment, advertising, and support of our national defense. The flip side of this increased reliance, however, is that we are vulnerable to threats to our cyber-infrastructure. Network outages, data/system compromise, denial of service attacks, malicious software and hardware, and other intrusions in the cyber-infrastructure affect our lives in ways that range from inconvenience to information theft to loss of business to life-threatening. The minor in Cybersecurity provides students with the insights and knowledge of technology, systems, environments and best practices to protect cyber-assets and to prevent, detect, and defend against cyber-attacks. The program focuses on theory, design, tools, operational procedures, policies, techniques, and best practices for assessment, prevention, detection, defense, and recovery from cyber incidents.

According to the National Institute for Cybersecurity Education (NICE), Computer Security or Cybersecurity, also known as IT security, is information security as applied to computing devices – hardware and software systems – such as computers and smartphones, as well as computer networks (private and public), applications, data, and transaction services. The field covers all the processes and mechanisms by which computer-based equipment, information and services are protected from unintended or unauthorized access, change or destruction, and is of growing importance in line with the increasing reliance on computer systems of societies worldwide.

The job market is promising. Numerous companies, agencies, and organizations have expressed interest in this skill. For example, the Department of Homeland Security has posted jobs requiring skills in areas such as Cyber Incident Response, Cyber Risk and Strategic Analysis, Vulnerability Detection and Assessment, Intelligence and Investigation, Networks and Systems Engineering, Digital Forensics. The World Economic Forum placed cybersecurity as one of the top five global risks in 2012, and it has been ranked as a top concern in federal chief information officer surveys. A 2012 Abell Foundation report found 340,000 cybersecurity job postings by 18,000 companies operating in the US. Cisco's cybersecurity team in Knoxville (led by Joe Gipson) is expecting to grow at a 10% yearly rate over the next five years.

Example job roles for graduates would include:

- Protect an organization's critical information and assets by ethically integrating cybersecurity risk management and business continuity best practices throughout an enterprise.
- Implement continuous network monitoring and provide real-time security solutions.
- Analyze advanced persistent threats and deploy countermeasures.
- Conduct risk and vulnerabili-

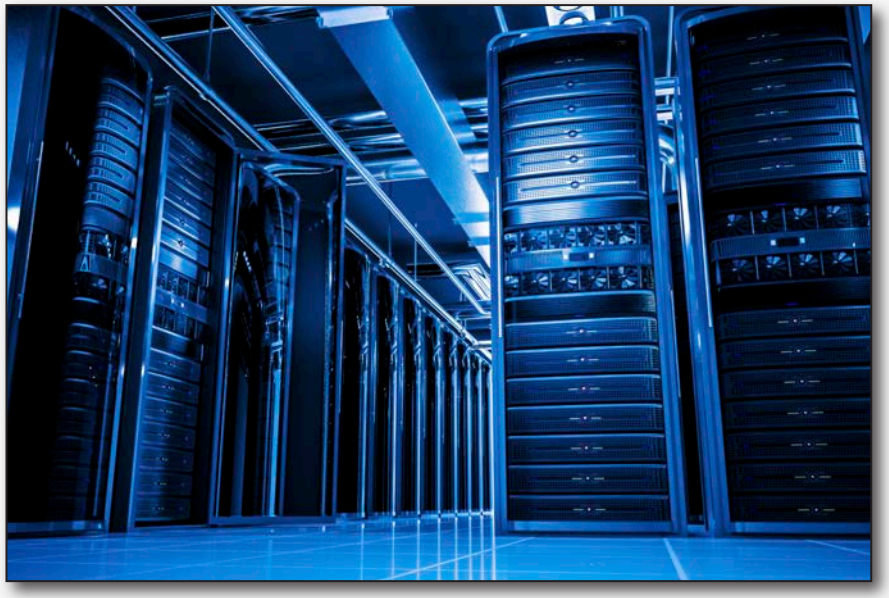
ty assessments of planned and installed information systems.
• Participate in forensic analysis of cyber incidents and assist in recovery of operations.
• Formulate, update, and communicate short- and long-term organizational cybersecurity strategies and policies.

Curriculum Objectives

The minor in Cybersecurity prepares graduates to be leaders in the protection of data assets and critical cyber infrastructure. The curriculum focuses on the techniques, policies, operational procedures, and technologies that ensure the availability, integrity, authentication, confidentiality, and nonrepudiation of information and information systems, in local as well as more broadly based domains. The curriculum allows students to explore security of a variety of computing environments: embedded, mobile, server, datacenter, cloud, distributed, network, web, and special purpose (e.g. HPC). The minor helps prepare students for careers that address security in the design and implementation of applications, networks, services, and systems, infrastructure, system management, and policy.

Curriculum Design

The cybersecurity minor program is intended to be a college-wide program from which students from different disciplines can all benefit. Due to the different programming and math backgrounds of students across the college, we have differentiated the minor into two programs, one for non-majors and one for majors, although the general framework remains the same.



Datacenter Technology and Management

Datacenters have become a major component in a company's and country's operational infrastructure (R&D, administrative, financial, employee services, etc.). Being able to deliver reliable and responsive computing services to employees, clients, customers and citizens has become a major driver of corporate revenues and profits. The complexity and diversity of the computing services needed has made datacenter design, operation and management challenging. In support of the demand for skills in the area of datacenter technology and management, the College of Engineering has established a minor degree program called "Datacenter Technology and Management." The primary objective of this minor degree program is to deliver broad awareness of datacenter requirements, design and management technologies and methodologies. The program is not expected to deliver deep knowledge in a specific area, but give a student sufficient basic insight on datacenter operational characteristics and requirements.

In support of this new minor degree program, a new core class, ECE463, was established called "Introduction to Datacenter Technology." The class is an overview of all aspects of datacenter technology and management, including: reliability, security, network systems, physical infrastructure, storage systems, industrial design, systems management, operating environments, application environments/management, operations, logistics and energy efficiencies. As with the intent of the minor degree program, this core class is not expected to deliver deep knowledge in a specific area, but provide a broad overview of datacenter characteristics and requirements.

Disciplines appropriate for entry into this program include Computer Science, Computer Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering.

There will be opportunities for students to complete the program and intern (strongly recommended) at commercial companies and government agencies interested in this skill set.

(Dr. Mark Dean and Dr. Jinyuan "Stella" Sun contributed to this story.)

Focus On: CURENT

A collaboration between academia, industry, and national laboratories, **CURENT, the Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks**, is a National Science Foundation (NSF) Engineering Research Center. Jointly supported by NSF and the Department of Energy, the center is led by Dr. Kevin Tomsovic, CTI Professor at the University of Tennessee, Knoxville.

CURENT's vision is for a nation-wide or continent-wide transmission grid that is fully monitored and dynamically controlled in real-time for high efficiency, high reliability, low cost, better accommodation of renewable energy sources, full utilization of energy storage, and accommodation of responsive load; and for a new generation of electric power and energy systems engineering leaders with global perspectives and diverse backgrounds.

Perhaps the most important technical challenge facing the electric utility industry over the next several decades is how to address societal energy needs without heavy reliance on fossil fuels.

Less appreciated in this discussion is the critical role that the electric power system transmission infrastructure must play in any viable solution. Most economic renewable resources are located far from population centers or have characteristics that make operation on a local basis difficult, e.g., daily cycles that correlate poorly with local demand. Moreover, one of the potentially most effective ways to reduce our societal carbon footprint is to shift transportation load to the power grid through plug-in hybrid or all-electric vehicles. This, along with the retirement of coal-fired generation plants, requires development of new large-scale generation capacity.

While recently there has been a focus at the consumer level for greater control of demand with approaches such as smart metering, the core challenge facing operation of an extremely large, complex electric network with tens of thousands of transmission lines, buses, and potentially millions of control points remains unaddressed.

Fundamental breakthroughs are needed to control interconnection-wide dynamics and manage resources across vast geographical distances, widely varying timescales, and diverse production sizes.

This is the challenge addressed by CURENT. Going into its fifth year, CURENT is maintaining its focus on the core areas of **research, industry and education**.

Research at CURENT focuses on:

- Developing new technologies to utilize advancements in power grid wide-area measurement and communication to allow coordinated action on a continental ultra-wide scale.
- Redesigning the control and information structure so it is less hierarchical and can replace, at all levels of the power grid, traditional inflexible operations strategies and facilitate the integration of intermittent renewables.
- Drawing on today's high performance computing capability to realize large-scale and faster than real-time dynamic simulation for predictive control (and fast response) to ensure secure and reliable operation.
- Allowing full use of generation and transmission assets across the interconnected system by incorporating high-speed power electronics based controllers.
- Developing advanced power electronic interfaces with wind and solar farms and bulk energy storage and associated controls for high penetration of renewable resources.

Industry

Industrial Partners are integral to CURENT's research program. The Center links engineering research to technological innovation through sustained partnerships with industry. This close collaboration helps stimulate technology transfer into commercial products and start-

up companies.

Membership in CURENT provides Industrial Partners with opportunities for collaboration in research, education programs, and product development. Industrial Partners are intimately involved in research plans through posing engineering problems to faculty and students. Membership benefits include, but are not limited to, the following:

- Ability to leverage NSF/DOE funding and influence the Center research and education directions.
- Interaction with a cross-disciplinary pool of experts.
- Annual Center conferences and periodic web-based seminars for early dissemination of research outcomes.
- Opportunity to network and exchange ideas with other industry members.
- Preferential intellectual property rights.

A total of 29 industry members have signed Industrial Partnership Agreements with CURENT, up from 18 just two years ago.

Selected Industrial Partnership representatives serve as members of the Industrial Advisory Board (IAB) that advises the Center on strategic plans, research projects, research implementation, annual funding, and other resource allocations for CURENT and its research thrusts.

Education and Outreach

The education program supports the center's strategic plan by cultivating students' creativity and innovation. Programs are designed to enhance students' adaptability and to enable them to thrive in a global environment.

The CURENT education team has established the following objectives to enhance students' academic experience:

- Create programs that increase the participation of domestic, women, and underrepresented minority students;
- Design a multi-disciplinary curriculum focused on electrical energy transmission system analysis and problem-solving skills;
- Develop connectivity with industry, partner institutions, and the larger power and energy system community; and
- Introduce pre-college and undergraduate students to the possibility of pursuing careers in engineering.

CURENT offers several programs for both pre-college and university students:

Pre-college Program

- Research Experience for Teachers (RET)
- Young Scholars Program (for high school students)
- Middle and high school summer programs
- Parents' Night
- Lab tours and field trips

University Program

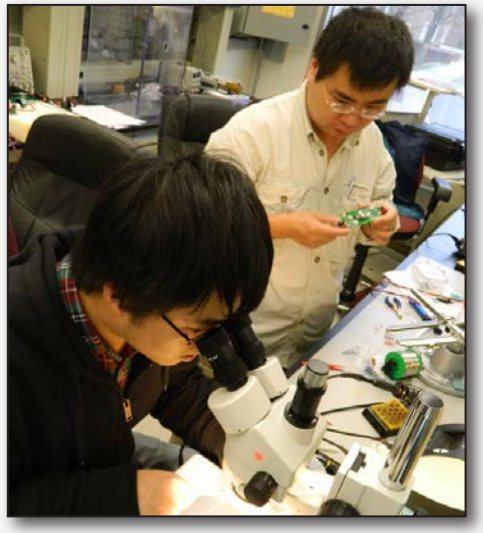
- Research Experience for Undergraduates (REU)
  - -8-week summer program, or
  - -Academic year program
- Undergraduate concentration
- Senior research projects
- Graduate certificate and fellowships
- Student Leadership Council

Participating faculty in CURENT include **Drs. Yilu Liu, Fred Wang, Leon Tolbert, Fran Li, Kai Sun, Daniel Costinett, Hector Pulgar, Hairong Qi, Stella Sun, and Jian Huang**.

CURENT's domestic partner institutions include:

- Northeastern University
- Rensselaer Polytechnic Institute
- Tuskegee University

curent.utk.edu



Department profile

Our Mission:

- To prepare students for entry into the profession;
- To instill in students the capabilities required by the discipline, the recognition of the need to enhance the discipline, and the desire for lifelong learning; and
- To equip students with a general knowledge and/or research capabilities in technical and non-technical disciplines so that they are prepared for further study and contribution in other fields, including professional and graduate education.

Our Vision:

We are resolved to become one of the country's top public EECS departments. To bring this vision to reality, the department is committed to these six 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 education in EE, CE, and CS.
- 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 and research world.
- Maintaining technical relevance in response to scientific and engineering advances, and the evolving student body.
- Investing strategically in the college's most important resources — students, faculty, and programs — through the vigorous acquisition of grant and contract funding from agencies, corporations, and foundations.
- Partnering with academic, industrial, and government entities that share and enhance the mission of the department so that our educational, research, and collaborative efforts result in the maximum positive economic impact locally, regionally, nationally, and globally.

Industrial Advisory Board 2015-2016

Chairperson

Mr. C. Chris Meystrik
Chief Technology Officer
Jewelry Television
Knoxville, TN

Members

Dr. Thomas (Tom) Ball
Principal Researcher/Research Manager
Microsoft Research
Redmond, WA

Dr. Thomas Chapin
Vice President of Corporate Research
Underwriters Laboratories, Inc.
Northbrook, IL

Dr. Rebecca Collins
Software Engineer
Google
New York, NY

Mr. Michael Evans
Managing Vice-President- Dallas Office
Pariveda Solutions, Inc.
Dallas, TX

Dr. John Garrison
Engineer
Huntsville, AL

Mr. Joe Gipson
Operations Manager
Cisco Systems
Knoxville, TN

Dr. Brad Grinstead
Senior Vice President
IAVO Research and Scientific
Durham, NC

Mr. Jeffrey D. Lamoree
President and CEO
EnerNex Corporation
Knoxville, TN

Mr. Brian LaRose
Global Technical Architect Specialist
VMWare
Knoxville, TN

Mr. Ken Lowery
Senior Partner
Cadre5, LLC
Knoxville, TN

Mr. John McNeely
President and CEO
Sword & Shield Enterprise Security, Inc.
Knoxville, TN

Dr. Mohammad M. Mojarradi
Principal Engineer and Group Supervisor
Jet Propulsion Laboratory
Pasadena, CA

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

Dr. Jelena Pjesivac-Grbovic
Senior Software Engineer
Google Inc.
Mountain View, CA

Mr. Dan Roberts
President & CEO
InterFET Corporation
Richardson, TX

Mr. Richard Stair
Design Engineering Manager
High Power Chargers Product Line
Texas Instruments
Knoxville, TN

Mr. Ron Thompson
Director, Business Development
Emerging Technologies & Markets
Electrical Sector- Global Marketing
Eaton Corporation
Louisville, TN

Dr. Ken Tobin
Director and Corporate Research Fellow
Measurement Science and Systems
Engineering Division
Oak Ridge National Laboratory
Oak Ridge, TN

Dr. Richard (Dick) Todd
President
RIS Corp.
Knoxville, TN

Mr. Dave Tolman
Electrical/I&C Engineering Manager
Enercon Services
Kennesaw, GA

Mr. Tim Wheelock
Director of Knoxville Operations
Siemens Medical Solutions USA, Inc.
Knoxville, TN

Mr. J. D. Wilson
Distribution Engineer
Georgia Power Company
Woodstock, GA

Dr. Brian Worley
President and Chief Executive Officer
PYA Analytics, LLC
Knoxville, TN

Ms. Angela Yochem
Global Chief Information Officer
BDP International
Philadelphia, PA

Departmental Scholarships 2015-2016

James W. McConnell
Maeve Elise Lawniczak

Carol and Malcolm Bayless
Benjamin Acker Brock
Sharvari Sanjiv Desai
Joseph Townley Teague

Electrical Engineering and Computer Science Departmental
Simon Alexander Finney

S. T. Harris
Daniel Alexander Graves
Adam Michael Seal
Christopher Brian Tester

Dr. Eldredge Johnson and Mrs. Lynda Herndon Kennedy
Ryan John Weiss

W. O. Leffell
Kevin A. Dunn
Mills Sharvari Sanjiv Desai
Moore Joseph Daniel Marshall

Erby Roy and Jean Bush Nankivell Electrical Engineering
Sunay Bhat
Spencer Pierce Cochran
Garrett M. Sexton
Christopher Heath Skelton

Leonard and Betty Shealy
Gabriel Joseph Hanas
Andrew Kenneth Messing
Nicklaus K. Penley
Tyler Brooks Stuessi
Cory M. Walker

Charles and Martha Sprankle
Hollis X Hop Bui
John Andrew Burnum
John Peter Dorris
Jordan Alexander Holland
Jonathan Troy Jackson
Aleksander Klibisz
Zachery I. Miller
Cody Nathan Orick
James Scott Tucker
William Tyler "Ty" Vaughan
Jackson Taylor Wood

Dr. David W. Straight
Aleksander Klibisz

Arthur F. Woods
Jared Willis Bolin
Jeffrey Coburn Brandon
Michael John Breuhl
Kenton Walker Culbertson
Edgardo William Diez
Kyle Jackson Goodrick
Montie Edwin Smith
Albert Joseph Toth
Haley Elizabeth Whitaker
Paxton Elliot Wills

Breakfast of Champions
Isaiah Beaty
Micheal Boyd
Diane Garcia
Darren Jones
Christopher Logan
Justin Martinez

Min H. Kao Electrical Engineering and Computer Science
Jared Alexander Baxter
Natalie Rene Beitel
Quillen Vaughn Blalock
Jessica Danielle Boles
Grant Richard Bruer
William Andrew Brummette
Isaiah Christian Cash
Summer Francesca Church
Richard Joseph Connor
Jacob Lloyd Davis
Richard Hilker Fagan
Victoria Nicole Florence
Austin Curtis Fullbright
Elliot Davis Greenlee
Saajid Al Haque
Harry Norman Hughes
James Thomas Hunter
Garrett Reid Massman
Richard Austin McEver
Anthony Paul Meyer
Connor Christian Minton
John Parker Mitchell
William Edward Norton
Benjamin David Parrott
Samuel Browder Rose
Dev Sharma
Taylor Allen Thomas
Ryan D. Wagner
Sophie Elizabeth Wardick
Andrew R. Wintenberg
Aaron Reed Young

Departmental Fellowships 2015-2016

Min H. Kao Graduate Fellows
David Andrew Basford
Yutian Cui
Ali Mohsin
Xiaojie Shi
Ali Taalimi

Chancellor's Award Fellows
Gangotree Chakma
Shawn Michael Cox
Jeffery Michael Dix
Md. Munir Hasan
Ling Jiang
Edward Andrew Jones
Ifana Mahbub
Farhan Quaiyum
Christopher Michael Reardon
Firoozeh Sepehr
Aysha Siddique Shanta
Mst. Shamim Ara Shawkat
Kai Zhang

ESPN Fellows
Hantao Cui
Alok Hota
Chongwen Zhao

Ron Nutt Fellow
Joshua Clinton Dunn

Bodenheimer Awards
Jessica Danielle Boles
John Willis Duggan
Charles Kenneth Roberts
Jeremy Joseph Langford
Adam Wayne Disney
Richard Kyle Harris

Department Excellence Award
Kelley Ann Deuso
Farnaz Foroughian
Chengcheng Li
Lakshmi Sundaresh
Jingyi Tang
Xuemeng Zhang
Andrew August
Jonathan Devadason
Tapajit Dey
Sina Jahandari
Mojtaba Jalalpour
Jie Li
Mingshuo Li
Yuxing Ma
Md. Badruddoja Majumder
Mohamad Ramin Nabati
Taher Naderi
Maxwell Hunter Robinson
Qingxin Shi
Yu Su
Farshid Tamjid
Mesbah Uddin
Zi Wang
Chi Xu
Wen Zhang
Dong Zhong
Tianli Zhou
Tong Zhou

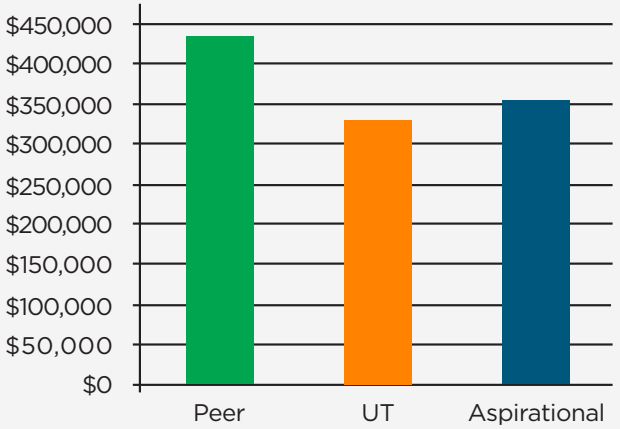
By the numbers

How EECS at UT compares to peer and aspirational institutions

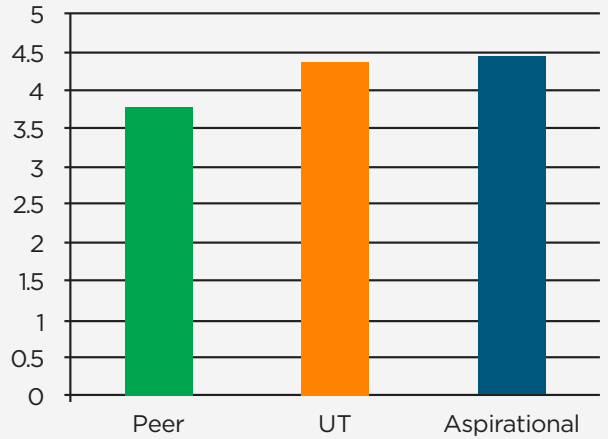
We've collected data from universities we consider peers and aspirational peers over the past year to see how our EECS program compares. The data from our peers and aspirational universities has been averaged and displayed in the following charts.

Our peers include: Auburn, Central Florida, Michigan State, Mississippi State and Vanderbilt. Our aspirational peers are: Maryland, Wisconsin, Penn State, Florida, North Carolina State, Colorado, California-Davis and Utah.

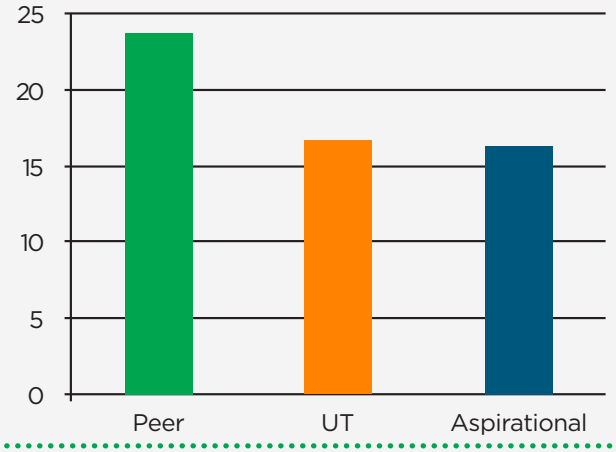
Research expenditures per T/TT faculty



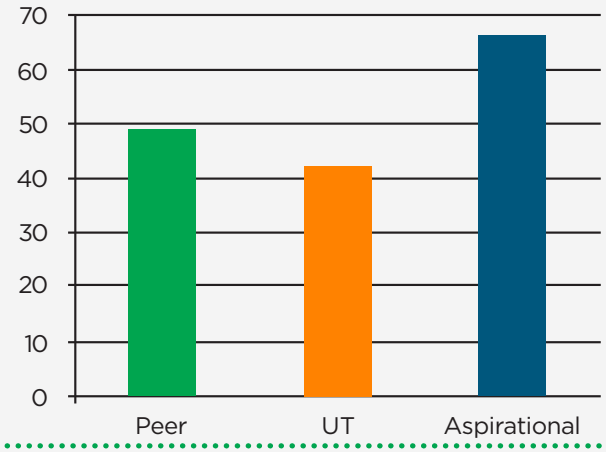
PhD enrollment per T/TT faculty



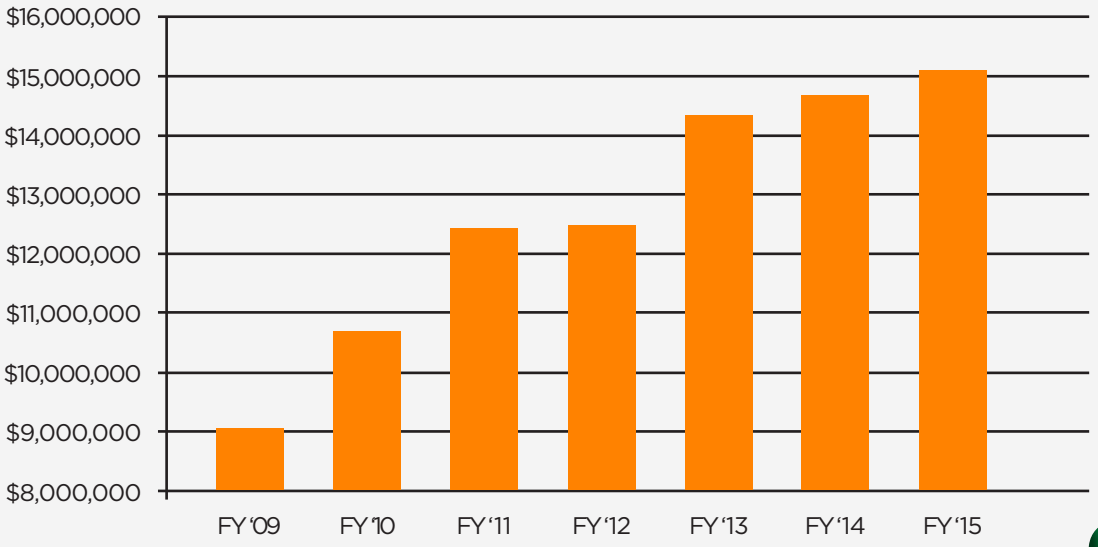
Undergraduate enrollment per T/TT faculty



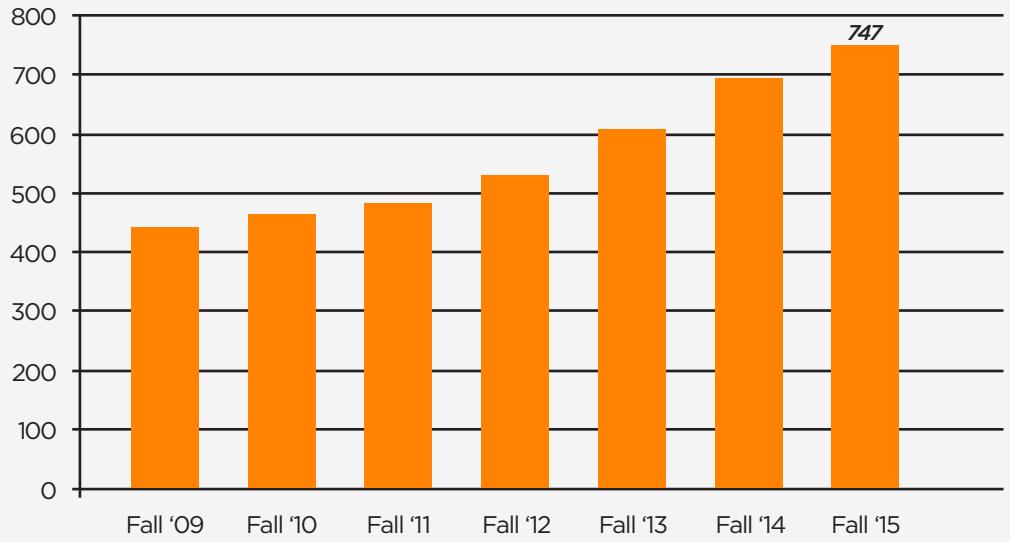
Number of T/TT faculty



EECS Research Expenditures



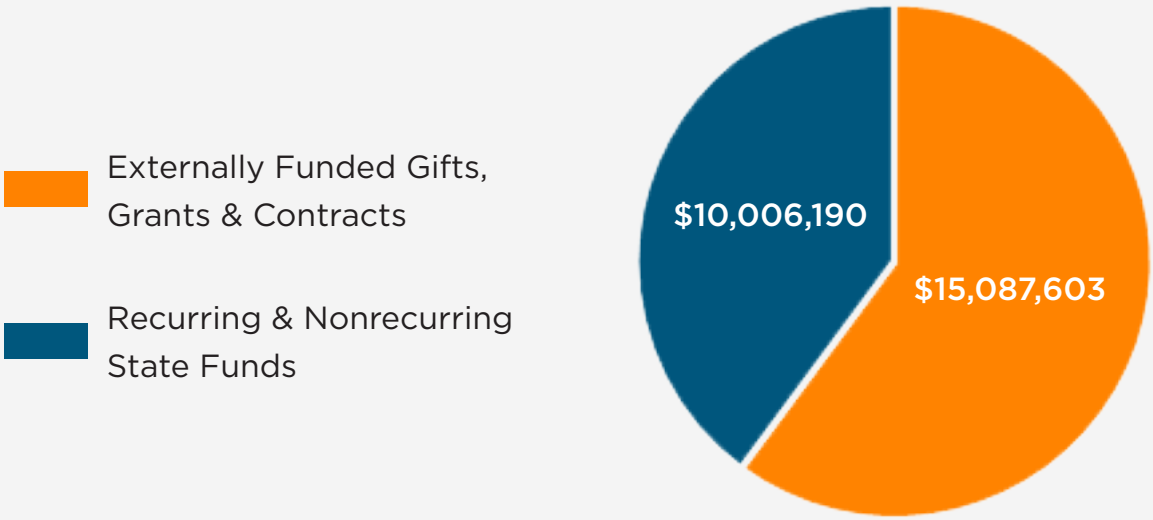
EECS Undergraduate Enrollment



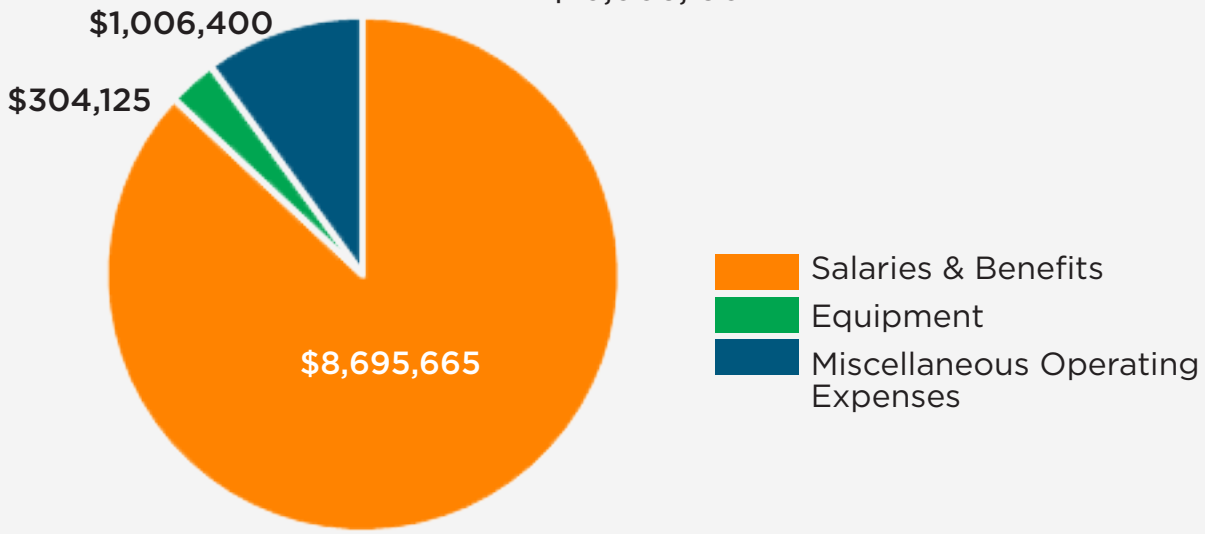
Financial Information

Numbers reflect the department's financial information for FY15.

Total Resources
$25,093,793

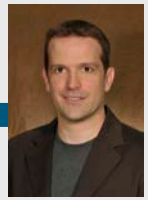


Expenditure Breakdown of State Funds
$10,006,190

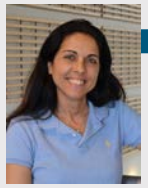


EECS Faculty 2015-2016

Mongi Abidi
Ph.D. The University of Tennessee
Cook-Eversole Professor
Pattern recognition, image processing, robotics

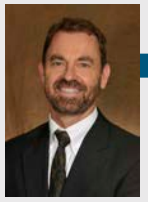


Itamar Arel
Ph.D. Ben Gurion University (Israel)
Associate Professor
Deep machine learning, artificial intelligence

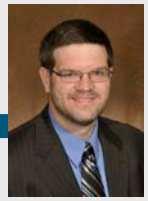


Ortal Arel
Ph.D. The University of Tennessee
Senior Lecturer
Cryptography, signal processing

Micah Beck
Ph.D. Cornell University
Associate Professor
Networks, distributed computing

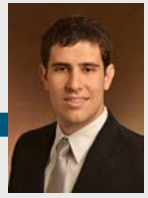


Michael W. Berry
Ph.D. University of Illinois
Professor
Bioinformatics, information retrieval



Benjamin J. Blalock
Ph.D. Georgia Institute of Technology
Kennedy-Blalock-Pierce Professor
Analog and mixed-signal circuits

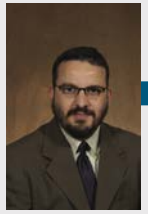
Qing (Charles) Cao
Ph.D. University of Illinois
Associate Professor
Wireless and distributed sensor networks



Daniel J. Costinett
Ph.D. University of Colorado
Assistant Professor
Power electronics, electric vehicles

Judy Day
Ph.D. University of Pittsburgh
Assistant Professor
Model predictive control, translational medicine

Mark Edward Dean
Ph.D. Stanford University
Fisher Distinguished Professor
Neuromorphic computing, data center reliability



Seddik M. Djouadi
Ph.D. McGill University (Canada)
Professor
Automatic control, smart grid applications

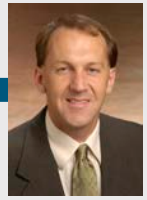
Jack Dongarra
Ph.D. University of New Mexico
University Distinguished Professor
High performance and scientific computing

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

Wei Gao
Ph.D. Pennsylvania State University
Assistant Professor
Embedded systems, sensor networks

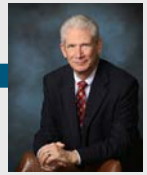
Jens Gregor
Ph.D. University of Aalborg (Denmark)
Professor
Image processing, biomedical data visualization

Gong Gu
Ph.D. Princeton University
Associate Professor
Graphene, electronic materials



Jeremy H. Holleman
Ph.D. University of Washington
Associate Professor
Bio-electronics, integrated circuits

Jian Huang
Ph.D. The Ohio State University
Professor
Data analytics and visualization

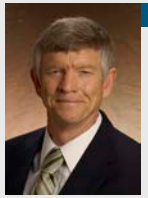


David Icove
Ph.D. The University of Tennessee
UL Professor of Practice
Fire protection and forensics

Syed Kamrul Islam
Ph.D. University of Connecticut
James W. McConnell Professor
Bio-electronics and sensors

Michael Jantz
Ph.D. University of Kansas
Assistant Professor
Software systems, compilers

Andreas Koschan
Ph.D. Technical University Berlin
Professor of Practice
Computer engineering, image processing

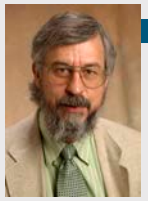


Michael A. Langston
Ph.D. Texas A&M University
Professor
Bioinformatics, data analytics, graph theory

Fangxing (Fran) Li, P.E.
Ph.D. Virginia Tech
Associate 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

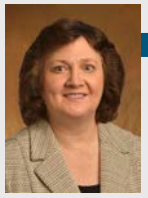


Bruce J. MacLennan
Ph.D. Purdue University
Associate Professor
Bio-inspired computation, artificial morphogenesis

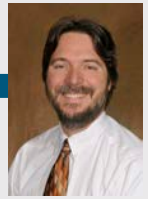
Donatello Materassi
Ph. D. Università degli Studi di Firenze (Florence)
Assistant Professor
Stochastic systems, control and system identification

Nicole McFarlane
Ph.D. Maryland University
Assistant Professor
Bio-electronics, mixed signal circuits

Audris Mockus
Ph.D. Carnegie Mellon University
Ericsson Harlan Mills Chair Professor
Data analytics, software engineering

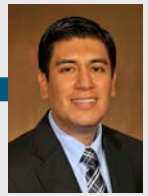


Lynne E. Parker
Ph.D. Massachusetts Institute of Technology
Professor
Robotics, distributed intelligence



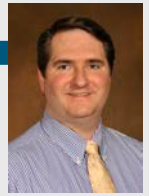
Gregory D. Peterson
Ph.D. University of Washington (St. Louis)
Professor
High performance computer architectures

James S. Plank
Ph.D. Princeton University
Professor
Neuromorphic computing, data storage



Hector Pulgar-Painemal
Ph.D. University of Illinois at Urbana-Champaign
Assistant Professor
Power system dynamics and control

Hairong Qi
Ph.D. North Carolina State University
Gonzalez Family Professor
Collaborative sensor signal and image processing



Garrett Rose
Ph.D. University of Virginia
Associate Professor
Memristors, Nanoelectronics, hardware security

Jinyuan (Stella) Sun
Ph.D. University of Florida
Assistant Professor
Cybersecurity, network privacy

Kai Sun
Ph.D. Tsinghua University (China)
Assistant Professor
Power system dynamics, stability, control

Chao Tian
Ph.D. Cornell University
Associate Professor
Data communication, information theory

Leon M. Tolbert, P.E.
Ph.D. Georgia Institute of Technology
Min H. Kao Professor
Power electronics, renewable energy

Kevin Tomsovic
Ph.D. Washington University
CTI Professor
Power system modeling and control

Bradley T. Vander Zanden
Ph.D. Cornell University
Professor
Graphic programming, instructional technology

Michael D. Vose
Ph.D. University of Texas
Associate Professor
Mathematical software

Fei (Fred) Wang
Ph.D. University of Southern California
Professor and Condra Chair of Excellence in Power Electronics
Power electronics, aerospace applications

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

Yan Xu
Ph.D. The University of Tennessee
Eastman Professor of Practice
Power systems, power electronics

Faculty Profile

EECS has 43 (for 2015-2016) full-time 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*
Biological applications	Berry, Day, Holleman, Islam, Langston, McFarlane, Peterson, Vose, Wu
Computer systems and architecture	Beck, Dean, Jantz, Mockus, Peterson, Plank, Rose, Vander Zanden
High performance and scientific computing	Berry, Dean, Dongarra, Gregor, Huang, Langston, Peterson, Vose
Intelligent systems, data mining, and machine learning	Arel, Berry, Gregor, MacLennan, Mockus, Parker, Qi, Vose
Microelectronics, microwave, and MEMS	Blalock, Fathy, Gu, Holleman, Islam, McFarlane, Wu
Networked and embedded systems	Beck, Cao, Djouadi, W. Gao, H. Li, Parker, Qi, J. Sun, Tian
Power systems, power electronics, and renewable energy	Costinett, F. Li, Liu, Pulgar, K. Sun, Tolbert, Tomsovic, F. Wang
Signal processing, systems, and controls	Djouadi, H. Li, Materassi, Qi
Visual computing and image processing	Abidi, Arel, Gregor, Huang, Qi, Vander Zanden, Vose

Masters Graduates 2014-2015

Ammar Dhafer Alkhuwaiter
Non-thesis MS
Advisor: M. Abidi

Dounia Baiya
On the Development of Conductive Textile Antennas.
Advisor: A. Fathy

Ronald James Cortese
Non-thesis MS
Advisor: M. Vose

Christopher Edward Crowder
A Low-Power, Laser-Based Delta-Sigma Modulator for the Measurement of Atmospheric Gas Composition.
Advisor: S. Islam

Christopher Paul Daffron
DANNA A Neuromorphic Computing VLSI Chip.
Advisor: M. Dean

Thomas Warren de Wit
Non-thesis MS
Advisor: J. Gregor

Jeffery Michael Dix
CMOS Gate Drive IC With Embedded Cross Talk Suppression Circuitry For Power Electronic Applications.
Advisor: B. Blalock

Margaret Grace (White) Drouhard
Visualization Techniques for Neuroscience-Inspired Dynamic Architectures.
Advisor: D. Birdwell

James Kelly Griffin
Ultra-Low-Power Configurable Analog Signal Processor for Wireless Sensors.
Advisor: J. Holleman

Tasneem Halim
Non-thesis MS
Advisor: J. Sun

Weihong Huang
A New Approach to Optimization of Dynamic Reactive Power Sources Addressing FIDVR Issues.
Advisor: K. Sun

Hesen Liu
Non-thesis MS
Advisor: Y. Liu

Yidan Lu
Non-thesis MS
Advisor: K. Tomsovic

Farshad Rabib
Non-thesis MS
Advisor: D. Birdwell

Cameron William Riley
An Autonomous Online I-V Tracer for PV Monitoring Applications.
Advisor: L. Tolbert

Mohamed Saleh
Non-thesis MS
Advisor: A. Fathy

Jacob Hunter Shelton
Radiation-Hardened Data Acquisition System Based on a Mask-programmable Analog Array.
Advisor: B. Blalock

Ye Sun
Non-thesis MS
Advisor: M. Berry

Chunyan Tang
From MPI to OpenSHMEM: Porting LAMMPS.
Advisor: J. Dongarra

Logan Smith Taylor
A Low-Power Approach for Front End Biological Signal Conditioning.
Advisor: S. Islam

Madeline Nicole Threatt
CMOS Current-Frequency Signal Processing Unit for Bioimplantable Sensors.
Advisor: S. Islam

Micah Joel Till
Non-thesis MS
Advisor: Y. Liu

Joshua Caleb Willis
Middleware and Services for Dynamic Adaptive Neural Network Arrays.
Advisor: D. Birdwell

Yongchao Yu
Cell Impedance Sensing System Based on Vertically Aligned Carbon Nanofibers.
Advisor: N. McFarlane

Doctoral Graduates 2014-2015

Madhu Sudhan Chinthavali
Isolated Wired and Wireless Battery Charger with Integrated Boost Converter for PHEV and EV Applications.
Advisor: L. Tolbert

Haochen Cui
Alternating Current Electrokinetics Based Capacitive Affinity Biosensor: A Point-of-Care Diagnostic Platform.
Advisor: J. Wu

Jerel Alan Culliss
A 3rd Generation Frequency Disturbance Recorder: A Secure, Low Cost Synchophasor Measurement Device.
Advisor: Y. Liu

Essam Abdel Kadir Ibrahim Salim Elkhouly
UWB Precise Indoor Localization System Performance, Limitations, and Its Integration.
Advisor: A. Fathy

Shuang Gao
Improving GPU Shared Memory Access Efficiency.
Advisor: G. Peterson

Lakshmi Reddy Gopi Reddy
Lifetime Estimation of IGBTs in a Grid-Connected STATCOM.
Advisor: L. Tolbert

Denise Renee (Koessler) Gosnell
Social Fingerprinting: Identifying Users of Social Networks by their Data Footprint.
Advisor: M. Berry

Ben Guo
High-Efficiency Three-Phase Current Source Rectifier Using SiC Devices and Delta-Type Topology.
Advisor: F. Wang

Maryam Hassani Variani
Flatness-Based Control Methodologies to Improve Frequency Regulation in Power Systems with High Penetration of Wind.
Advisor: K. Tomsovic

Mohammed Shahriar Jahan
A Low-Power BFSK/OOK Transmitter for Wireless Sensors.
Advisor: J. Holleman

Bruce Andrew Johnson
Computing Approximate Solutions to the Art Gallery Problem and Watchman Route Problem by Means of Photon Mapping.
Advisor: H. Qi

Yun Seo Koo
Wide Band Embedded Slot Antennas for Biomedical, Harsh Environment, and Rescue Applications.
Advisor: A. Fathy

Sang Hyeb Lee
Computational Framework for Small Animal SPECT Imaging: Simulation and Reconstruction.
Advisor: J. Gregor

Shuangjiang Li
Compressed Sensing in Resource-Constrained Environments: From Sensing Mechanism Design to Recovery Algorithms.
Advisor: H. Qi

Benjamin Walter Martin
Computational Analysis of Neutron Scattering Data.
Advisor: M. Berry

Benjamin Matthew McCue
A GHz-range, High-resolution Multi-modulus Prescaler for Extreme Environment Applications.
Advisor: B. Blalock

Terence Cordell Randall
A Low-Power, Reconfigurable, Pipelined ADC with Automatic Adaptation for Implantable Bioimpedance Applications.
Advisor: S. Islam

Catherine Dorothy Schuman
Neuroscience-Inspired Dynamic Architectures.
Advisor: J. Birdwell

Ki Ryung Shin
Development of RF accelerating structures in the front-end system of light ion particle accelerators.
Advisor: A. Fathy

Yue Tong
Data Security and Privacy in Smart Grid.
Advisor: J. Sun

Fahmida Shaheen Tulip
Development and Modeling of a Biosensor Platform using AlGaN/GaN HEMT Devices.
Advisor: S. Islam

Jingyuan Wang
Interactive Feature Selection and Visualization for Large Observational Data.
Advisor: J. Huang

Kai Wang
Analytical, Theoretical and Empirical Advances in Genome-Scale Algorithmics.
Advisor: M. Langston

Jing Wang
Versatile Three-Phase Power Electronics Converter based Real-time Load Emulators.
Advisor: L. Tolbert

Zhiqiang Wang
Driving and Protection of High Density High Temperature Power Module for Electric Vehicle Application.
Advisor: L. Tolbert

Yao Xu
Adaptive Control for Power System Voltage and Frequency Regulation.
Advisor: F. Li

Steven Robert Young
Scalable Hardware Efficient Deep Spatio-Temporal Inference Networks.
Advisor: I. Arel

Marcus Aaron Young
Saturable Reactor for Power Flow Control in Electric Transmission Systems: Modeling and System Impact Study.
Advisor: Y. Liu

Lingwei Zhan
Accuracy and Reliability Improvement of Wide-Area Power Grid Monitoring.
Advisor: Y. Liu

Ye Zhang
Frequency Monitoring Network (FNET) Data Center Development and Data Analysis.
Advisor: Y. Liu

Zheyu Zhang
Characterization and Realization of High Switching-speed Capability of SiC Power Devices in Voltage Source Converter
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