Electrical and Computer Engineering Annual Report 2018

Department of Electrical and Computer Engineering, Michigan Technological University
ECE

Michigan Technological University

Electrical and Computer Engineering
Annual Report 2018

SMART Grid Protection

Exploring Smart Grids and Power Systems Education
Hello again from Michigan Technological University and the Department of Electrical and Computer Engineering! I am happy and proud to present our 2018 Annual Report, which covers activity in the ECE Department for the 2018 fiscal year, running from July 1, 2017 to June 30, 2018. Last year was an interesting one of transition on campus, as we carried out searches for a new president and four academic deans. Those searches all ended successfully, and now we enter a new era under new leadership. We profile our new president, Richard J. Koubek, and the new dean of the College of Engineering, Janet Callahan.

Throughout the fall 2018 semester, the entire campus has participated in a series of conversations known as “Tech Forward.” Resulting from these discussions, I fully anticipate that Michigan Tech will chart new directions into the Fourth Industrial Revolution. It is an exciting time to be at the University, that’s for sure. As part of setting the stage for those conversations, last year under the direction of the provost, Jackie Huntoon, and with encouragement from the Board of Trustees, I led a Working Group on Computing and Information Sciences. We spent the year looking at the role that computing plays in the research and academic programs at Michigan Tech, and how we might increase our visibility and impact in this area which is critical for a university that calls itself “technological.” We examined internal issues, as well as how other universities nationwide are grappling with the same question. In our report, submitted to the provost in May 2018 and handed over to the incoming president, we recommended significant structural changes we believe will position the University as a leader in computing the same way it is a leader in engineering. There was a lot of debate on our recommendations, and that debate continues to this day in the Tech Forward conversations. I have my own opinions on the matter; if you’re interested, check out last year’s blog posts titled “Fridays with Fuhrmann” at blogs.mtu.edu/ece/category/fridays-with-fuhrmann.

The ECE Department continued to do what it does well: educating our students to create the future and carrying out cutting-edge research in a variety of ECE sub-fields. A number of our faculty members and their educational and research activity are profiled in this report. I especially want to draw attention to Professor Sumit Paudyal, who achieved the “trifecta” of an NSF CAREER award, HKN Professor of the Year, and promotion to associate professor with tenure! I also want to acknowledge Professor Jeremy Bos for his hard work with students in the Robotic Systems Enterprise and its flagship project, the GM/SAE AutoDrive Challenge. Another exciting development for the Department this year is signing an agreement with Keypath Education, Inc., to work in partnership to develop and deliver an online MSEE degree program with a focus in communications and signal processing. Professor Tim Schulz and I worked hard over the summer to develop the first two courses; the program has launched and we’re eager to get the word out about our fully online course options for working professionals.

As always, I remain grateful for the opportunity to serve Michigan Tech and the ECE Department. If you have any comments about anything you read here, or about any other news from our corner of the world, I would be delighted to hear them.

Daniel R. Fuhrmann
Dave House Professor and Chair
Department of Electrical and Computer Engineering
fuhrmann@mtu.edu
Welcome

New President of Michigan Technological University

On July 1, Michigan Tech witnessed an historical change of leadership by welcoming a new president and new deans in four of five of its colleges and schools. Dr. Richard J. Koubek has taken over as Michigan Tech’s 10th president, replacing Dr. Glenn Mroz, who retired after 14 years as president with the intent to return to his roots as a member of the faculty in the School of Forest Resources and Environmental Science (SFRES).

Koubek served previously as vice president and provost at Louisiana State University (LSU), with prior appointments as LSU’s dean of engineering, chair of industrial and manufacturing engineering at Penn State, former department chair and associate dean for research and graduate studies at Wright State, and was a faculty member in the school of industrial engineering at Purdue University.

Koubek holds bachelor’s degrees in biblical literature, with a minor in chemistry, from Oral Roberts University, and in psychology from Northeastern Illinois University. He received his master’s and PhD in Industrial Engineering from Purdue University.

Also retiring were Dr. Wayne Pennington (Dean of the College of Engineering), Dr. Bruce Seely (Dean of the College of Sciences and Arts), Dr. James Frendewey (Dean of the School of Technology), and Dr. Terry Sharik (Dean of the School of Forest Resources and Environmental Science). Michigan Tech welcomes its new deans Janet Callahan (College of Engineering, see below), Dr. David Hemmer (College of Sciences and Arts), Dr. Adrienne Minnerick (School of Technology), and Dr. Andrew Storer (SFRES).

New Dean of Engineering

Dr. Janet Callahan joined Michigan Tech as its Dean of the College of Engineering, effective July 1. Callahan joins us most recently from Boise State University, where she was Materials Science and Engineering (MSE) chair, professor, and co-founder of the Micron School of MSE. She also served as the associate dean of engineering for academics. Callahan received her PhD in Materials Science and Engineering, an MS in Metallurgy, and a BS in Chemical Engineering from the University of Connecticut. Before Boise State, she was an MSE faculty member at Georgia Tech. In addition to her administrative experience, she has established an international reputation as a researcher in the area of advanced materials processing—notably, chemical vapor deposition methodologies as applied to surface modification, creating engineered surface functionalities, and chemical synthesis.

Cover: The ECE Department continues its tradition of excellence in power systems education and critical infrastructure protection.
Faculty Directory

Ashok Ambardar  
Associate Professor  
PhD, Electrical Engineering, University of Wyoming  
Signal processing, medical imaging

Glen Archer  
Principal Lecturer/Associate Chair  
PhD, Electrical Engineering, Michigan Technological University  
Image processing, security, information operations

Paul Bergstrom  
Professor  
PhD, Electrical Engineering, University of Michigan  
MEMS, nanotechnology

Leonard Bohmann  
Professor/Associate Dean, College of Engineering  
PhD, Electrical Engineering, University of Wisconsin  
Power systems, renewable energy

Jeremy Bos  
Assistant Professor  
PhD, Electrical Engineering, Michigan Technological University  
Atmosphere optics, image processing, machine intelligence

Jeffrey Burl  
Associate Professor  
PhD, Electrical Engineering, University of California—Irvine  
Adaptive control, robust control, image motion estimation

Bo Chen  
Dave House Associate Professor of Mechanical Engineering and Electrical Engineering  
PhD, Mechanical and Aeronautical Engineering, University of California—Davis  
Intelligent mechatronics, embedded systems

Christopher (Kit) Cischke  
Senior Lecturer  
Chair, Undergraduate Programs Committee  
MS, Computer Engineering, University of Minnesota  
Parallel computing and UPC

Zhuo Feng  
Associate Professor  
PhD, Computer Engineering, Texas A&M University  
VLSI computer-aided design, multiphysics modeling and simulation

Daniel Fuhrmann  
Dave House Professor and Chair  
PhD, Electrical Engineering and Computer Science, Princeton University  
Statistical signal and image processing

Lucia Gauchia  
Richard and Elizabeth Henes Assistant Professor of Energy Storage Systems  
PhD, Electrical, Electronic, and Automation Engineering, University of Carlos III of Madrid, Spain  
Energy storage systems, state estimation for batteries and supercapacitors

Durdu Guney  
Associate Professor  
PhD, Electrical and Computer Engineering, University of California–San Diego  
Metamaterials and plasmonics, quantum computing, communications and cryptography

Timothy Havens  
William and Gloria Jackson Associate Professor  
PhD, Electrical and Computer Engineering, University of Missouri  
Pattern recognition and machine learning, signal and image processing

Roger Kieckhafer  
Associate Professor  
PhD, Electrical Engineering, Cornell University  
Computer architecture, fault-tolerant computing

John Lukowski  
Associate Professor  
MS, Electrical Engineering, Michigan Technological University  
Power, energy, factory automation, robotics
Aref Majdara
Lecturer
PhD, Electrical Engineering, Michigan Technological University
PhD, Management Science & Technology, Tohoku University, Japan
High-dimensional data mining

Christopher Middlebrook
Associate Professor
PhD, Optics, University of Central Florida
Infrared detectors, optics, photonics, radiometry

Bruce Mork
Dennis Wiitanen Professor of Electric Power Systems
PhD, Electrical Engineering, North Dakota State University
Power system transients (ATP/EMTP), nonlinear dynamics and chaos theory, power system protection

Saeid Nooshabadi
Professor
PhD, Integrated Circuits (VLSI), Indian Institute of Technology Delhi
High-performance computer architecture, embedded systems

Aurenice Oliveira
Associate Professor
PhD, Electrical Engineering, University of Maryland, Baltimore County
Optical fiber communications, automation, wireless communication

Sumit Paudyal
Associate Professor
PhD, Electrical Engineering, University of Waterloo, Canada
Smart-grid technologies, optimization techniques in power systems

Joshua Pearce
Professor
PhD, Materials (Engineering option), The Pennsylvania State University
Photovoltaic materials and devices, energy system analysis and policy, 3-D printing and additive manufacturing

Warren Perger
Professor
PhD, Physics, Colorado State University
Theoretical atomic physics, electrophysics

Michael Roggemann
Professor
Chair, Graduate Programs Committee
PhD, Electro-Optics, Air Force Institute of Technology
Optics, image reconstruction and processing, pattern recognition

Timothy Schulz
Professor
DSc, Electrical Engineering, Washington University in St. Louis
Statistical signal processing, computational photography

Elena Semouchkina
Professor
PhD, Materials (Engineering option), The Pennsylvania State University
 Electromagnetic metamaterials, computational electromagnetic analysis

Chee-Wooi Ten
Associate Professor
PhD, Electrical Engineering, University College Dublin
Power infrastructure cybersecurity, future control center framework, SCADA/EMS/DMS applications

Zhaohui Wang
Assistant Professor
PhD, Electrical and Computer Engineering, University of Connecticut
Communications, signal processing, communication networks, and network security

Wayne Weaver
Dave House Associate Professor of Electrical Engineering
PhD, Electrical Engineering, University of Illinois at Urbana-Champaign
Power electronics systems, microgrids, hybrid and electric vehicles

Seyed (Reza) Zekavat
Professor
PhD, Electrical Engineering and Telecommunications, Colorado State University
Wireless localization systems, wireless power transfer, statistical signal processing

New Faculty

Aref Majdara became a lecturer in the Department of Electrical and Computer Engineering in fall 2018. He is currently teaching Electric Circuits II and Microcontroller Applications and advising two sections of ECE Senior Design. He is also serving as a member of the ECE Undergraduate Programs Committee. His teaching interests include circuits, microcontrollers, embedded systems, and Digital Signal Processing. His main research interests include analysis of high-dimensional data, machine learning, signal processing and parallel computing. Majdara received his BS in Electrical Engineering from Shahid Beheshti University, Iran, in 2002. He then received a MS in Nuclear Engineering from Shiraz University, Iran, in 2006, as well as a PhD in Management Science and Technology from Tohoku University, Japan, in 2009. He received his MS and PhD in Electrical Engineering from Michigan Tech in 2018. His PhD research was on developing computationally efficient algorithms for high-dimensional density estimation, with a focus on online density estimation. During his PhD studies, he also worked as a teaching assistant for more than three years in various undergraduate electrical engineering labs.
Promotion and Tenure

Sumit Paudyal was promoted from assistant professor to associate professor with tenure.

Elena Semouchkina was promoted from associate professor with tenure to professor with tenure.

The ECE Department congratulates professors Paudyal and Semouchkina on these accomplishments, and on all their achievements in research and teaching.

Awards

Glen Archer received the Michigan Tech CTL Teaching Award for Excellence for Large Class Teaching for his work in EE3010, Circuits and Instrumentation, our course in electrical engineering for non-departmental majors.

Sumit Paudyal was honored as Professor of the Year by the Michigan Tech chapter of Eta Kappa Nu (HKN), the student honor society of IEEE.

Zhaohui Wang received the 2018 Achievement Award from the Institute of Computing and Cybersystems (ICC) at Michigan Tech for her contributions in underwater wireless communications and networking.

Joshua Pearce is the editor-in-chief of HardwareX, the associate editor of 3D Printing and Additive Manufacturing, and serves on the editorial board of Sustainable Energy Technologies and Assessments; Materials; Energies; Journal of Open Hardware; Journal of Manufacturing and Materials Processing; and Sustainability.

Sabbatical Activity

John Lukowski spent the spring 2018 semester on sabbatical in Houghton, working on his PhD dissertation research in power systems.

Saeid Nooshabadi spent the 2017-18 academic year with Ford Research and Innovation Laboratory in Palo Alto, California. As part of the autonomous vehicle team, Nooshabadi worked on computer vision and data analytics on a project that led to two patents pending.

Joshua Pearce spent the 2017-18 academic year in Helsinki, Finland, as the Fulbright-Aalto University Distinguished Chair.

Professional Service

Glen Archer serves as an Accreditation Board for Engineering and Technology (ABET) Engineering Accreditation Commission (EAC) evaluator.

Leonard Bohmann is the treasurer of the IEEE Education Society and serves on the board of governors. He is a member of ABET EAC and serves as a team chair on accreditation visits. He serves on the Finance Committee of the Women in Engineering ProActive Network (WEPAN).

Jeremy Bos was reappointed SPIE Scholarship Committee Chair for 2018 and serves as a conference chair for Laser Propagation through Atmospheres and Oceans. Bos serves as an associate editor for Applied Optics.

Bo Chen serves as associate editor of the IEEE Transactions on Intelligent Transportation Systems.

Lucia Gauchia serves as associate editor of the IEEE Transactions on Transportation Electrification, and is part of the IEEE Working Group on Management of Distributed Battery Storage Systems.

Durdun Gunev serves on the editorial board of Nanomaterials and Nanotechnology as associate editor for Nanodevices, and serves on the Program Committee for the SPIE Conference on Defense + Commercial Sensing.

Tim Havens serves as associate editor of IEEE Transactions on Fuzzy Systems, is the co-chair of the IEEE Computational Intelligence Society (CIS) Task Force on Cybersecurity for Smart World, and serves on the IEEE CIS Fuzzy Systems Technical Committee.

Bruce Mork serves as the IEEE Working Group (WG) chair on Ferroresonance, the IEEE WG chair for Power Globe, and is a member of the Scientific Advisory Board for the Norwegian Smart Grid Center.

Aurenice Oliveira serves as an ABET EAC evaluator. She serves on the editorial board of the International Journal of Engineering Research and Innovations (IJERI).


Joshua Pearce is the editor-in-chief of HardwareX, the associate editor of 3D Printing and Additive Manufacturing, and serves on the editorial board of Sustainable Energy Technologies and Assessments; Materials; Energies; Journal of Open Hardware; Journal of Manufacturing and Materials Processing; and Sustainability.

Chee-Wooi Ten is a member of the editorial boards for the IEEE Transactions on Smart Grids and Sustainable Energy, Grids, and Networks (SEGAN).

Reza Zekavat regularly serves as chair or co-chair of the Workshop on Space Solar Power for the IEEE Wireless for Space and Extreme Environments (WiSEE) Conference. He also serves on the editorial board of the Springer International Journal on Wireless Information Networks and GSTF Journal on Mobile Communications, Networking and Applications.
In September 2018, the ECE Department, in partnership with the online education support company Keypath Education, began delivering a new set of online courses leading to the MSEE degree, with an emphasis in communications and signal processing. Tim Schulz, professor of electrical and computer engineering, will develop four courses for the new degree program, which consists of seven pre-requisites and three electives for 10 total courses. Over the summer, Schulz prepared a course never offered in the department: EE5300 Mathematical and Computational Methods in Engineering. Simultaneously, he is developing a course for spring 2019 that he’ll deliver as he begins creating content for a third course, and so on.

EE5300 Mathematical and Computational Methods in Engineering is the entry point for all new students. The course provides many of the tools in the toolkit for engineers that work in communications and signal processing. More importantly, it ensures that all students are on a level playing field as they enter the heart of the program.

Schulz says creating the EE5300 course demanded him to reimagine how he teaches—reinvigorating his instructional approach; as a result, he says his instructional materials are improved and that his on-campus students benefit just as much from his instructional redesigning as his online students do. Instead of using a textbook, Schulz creates interactive videos and materials practice problems to engage students.

“A 50-minute lecture is a 10-minute video. You can make it really clear what students need to do. Clear directives of what they need to do and what they will receive as a result of their efforts. Transparency? Directness? Everything in the course that’s important is shared, nothing more, nothing less. I really believe that in teaching there are three dimensions to a course: time, material, and mastery. We fix two of them and measure people on the third. I think students should get a perfect score on everything. I’m not a perfectionist, I just believe as a teacher I should break teaching and homework down into little chunks that students can master,” Schulz says.

Distance education is not new to the ECE Department. More than 15 years ago, ECE faculty members Bruce Mork and Leonard Bohmann recognized a workforce need in the utility power industry for advanced education in power and energy, and proceeded to create online versions of all our senior and graduate-level courses in that area. The online courses were offered in tandem with our on-campus courses through lecture capture, at first in dedicated studios and more recently in self-service classrooms.

But Schulz and Dan Fuhrmann say the new program is different because of the way they are delivering course content. Fuhrmann says, “Given my musical inclinations I make the analogy that putting together an online course in today’s market is more akin to going into the recording studio and cutting an album. We need to have a vision for the complete course, from soup to nuts, and the full package needs to be ready to go on day one of the semester. When you go into the studio, you bring the producer and the recording professionals in with you, and it becomes a team effort. The Keypath team will be our producers.”

The Department selected communications and signal processing as a technical sub-area within EE for this new venture, for several reasons. First, this is an area where we anticipate high workforce demand. As we move further and faster into the Fourth Industrial Revolution and the era of the Internet of Things, electrical engineers need to know how to acquire digital data, process it, merge it with other data, and design systems that allow for the communication of that data over complex global networks. This need cuts across all industry sectors and all applications of electrical engineering, and is very closely related to robotics, automation, and control. Second, we think the material will lend itself well to online learning, as it is mostly theoretical with the applications either implemented or simulated with computer models. Finally, it turns out just by coincidence that the faculty members in the ECE Department with the most enthusiasm about trying these new methods of course delivery, including Schulz, Fuhrmann, Mike Roggemann, and Glen Archer, are all in signal processing.
Sumit Paudyal Recognized for Excellence in Teaching and Research

2018 was a good year for Sumit Paudyal: He received accolades in teaching and research and earned a promotion to associate professor with tenure. At the Department’s senior banquet in May, Eta Kappa Nu (HKN) undergraduate student organization awarded Paudyal Professor of the Year. Paudyal teaches the senior-level undergraduate power systems course and advises Senior Design. In fact, he advised students on the project that took the top prize at the 2018 Design Expo. In addition to working with undergraduates, he teaches several graduate courses in power and energy. The HKN Professor of the Year Award indicates how valuable undergraduates students find Paudyal.

But our students are not the only ones who recognized Paudyal with accolades in 2018. In February, the National Science Foundation (NSF) awarded Paudyal with a five-year, $500,000 Early Career Development Program Award (CAREER) for his project “Operation of Distribution Grids in the Context of High-Penetration Distributed Energy Resources and Flexible Loads.” The award is the NSF’s most prestigious and is intended to support faculty early in their careers who exhibit strong potential to lead and advance research and education in their departments or universities.

The NSF’s generous award will aid Paudyal in his development of a computational method for small distributor energy sources. Additionally, he will use the funds to facilitate several educational outreach activities, which include:

- Training online and traditional undergraduate and graduate students of power engineering;
- Motivating K-12 students to pursue STEM fields through activities connected to Michigan Tech’s Smart Grid Operations Center (SGOC);
- Bringing Michigan Tech’s Mobile Microgrid Laboratory to Texas and South Dakota to engage minority student populations in the study of power engineering.

A well-deserved congratulations to Sumit Paudyal in being recognized for his excellence in teaching and research!
Pivoting into Future Research: Chee-Wooi Ten Spending Sabbatical at Carnegie Mellon

By Kelley Christensen

Since arriving at Michigan Tech eight years ago, Chee-Wooi Ten, associate professor of electrical and computer engineering, has focused on understanding electrical grid cybersecurity.

Electrical grids include generation plants, transmission lines, central control centers, substations (more than 100,000 of them), homes and businesses, and increasingly, distributed energy production like solar panels and wind turbines. Each of these nodes is susceptible to failure from accidents, disasters, or attacks, and replacing them is expensive and time-consuming.

“Traditional terms of security used in the power industry means reliability and adequate power supply to meet demands,” says Ten. “It’s N minus one contingency of a hypothesized component outage: Take one line out and see if the system can withstand a disturbance.”

Ten says this contingency has been the norm for decades in planning and operation, but the complexities of cybersecurity complicate the equation. A physical attack could damage parts of the grid, but a cyberattack to interconnected substations could cripple the entire system simultaneously.

Comparing cybersecurity to protecting one’s home from a break-in is one way Ten explains the importance of his research.

“Let’s say you check your front door once a day to make sure it is locked,” he says. “Does that mean your house is secure? Probably not. Just because your door is locked doesn’t mean someone can’t get in. But if you put a camera in front of your house with incoming motion data to determine if there is movement around your house, you have more data so security can be better assessed.”

Ten wants to incentivize investments in electrical grid cybersecurity before it’s too late. Together with Yeonwoo Rho, assistant professor of mathematical sciences, and colleagues at the University of Wisconsin-Milwaukee, Ten proposes an actuarial framework of cyber risk management for power grids.

Such a framework would establish what Ten calls a “sustainable ecosystem” of improved security protection with technologies for utilities. He says the key impacts include increased social welfare because the risk of grid failure would decrease. It would stimulate actuarial research on challenging models such as insurance for high-impact, low-probability events. It would also provide educational activities and workforce development.

Future Directions

During his sabbatical, Ten has a busy agenda that includes traveling around the country to share his work at other institutions and create a wider network of research colleagues to increase the impact of his research. He also recently visited a power authority to discuss a long-term collaboration plan.

“We have mutual interest in what we want to pursue: A high-performance computing platform, specifically geared toward power systems dynamic simulators,” Ten says. “It’s a platform that allows a person to simulate the entire power grid with very fast processing to capture the trends and behavior of a bulk power system.”

One challenge Ten and other electrical grid researchers face is that utility providers protect aspects of their networks as proprietary information, creating a research hurdle. But Ten argues that electricity is critical to the economic stability of the nation, and allowing researchers to understand all components of electrical grids—under nondisclosure agreements—is vital to protect against cyberattack. Researchers like Ten can simulate data based on network security models and network control architecture, from step one to step 1,000 of a potential cyberattack. Running simulations saves utility companies time and money, and helps them prepare for the cascading effects of such an event. Though researchers may not have access to real cyberattack events, they can extract anomalies of the cyber system to simulate events.

“Cyberattack insurance will happen, but you have to have incentives,” Ten says. “It’s a vision that I dreamed many years ago, but it is becoming true. This work will take decades. My biggest struggle is changing minds, from not believing this is a problem, to believing, and from becoming low priority to high priority, and incentivized.”
Protecting electrical power systems against short circuits and blackouts is critical to both the people using the energy and the people supplying the energy. As technologies advance, power systems protection and monitoring has expanded to cover hundreds of miles, to be proactive rather than reactionary.

“Power system protection has been a staple of electrical power engineering for the past 80 years. What’s changing over time is the enabling technologies,” says Bruce Mork, Dennis Wiitanen Professor of Electric Power Systems. “It’s about working with the power grid to detect short circuits or other abnormalities, to detect and deenergize the part of the system that’s having trouble. Time is money, and the longer an outage persists, the more damage there can be.”

Smart grids use sensors and embedded processors incorporated into individual pieces of equipment that can access the internet. Mork and students working in the Smart Grid Operations Center are improving performance and reliability of the power grid by prototyping and testing technologies.

“We’ve built up an extensive laboratory capability in support of smart grid technologies in a power systems protection context,” Mork says, noting the importance of partnerships with alumni and industry for more than $1 million in improvements to student laboratory experiences and faculty research. “We’ve leveraged lab fee money from the department coupled with a gift from a power company, have negotiated discounts with suppliers, and have been generously gifted equipment.”

But these constantly advancing technologies aren’t limited to the sole purview of utility companies.

“Smart grid technologies can be applied to miniature systems—the homebrew system in your basement—or the entire North American power grid,” Mork says.

Equally important are time scales. Smart grid tech has long been able to implement slower-changing, minute-by-minute and hour-by-hour price adjustments, which is meaningful in large cities to encourage less electrical consumption during peak demand hours—crucial in the fight against overloaded grids.

“Real-time protection and emergency control applications need to be much faster. We’re taking measurements and updating in the millisecond range,” Mork says. “We need huge speeds and data throughput on these internet connections. That’s the most challenging boundary we’re pushing now.”

Mork’s current research projects include a partnership with Norwegian University of Science (NTNU), utility partners, and Swedish-Swiss technology company ABB Group. A longstanding collaboration with Xcel Energy in Minneapolis, includes PhD student internship placement with the company annually in the field of transient simulation—detailed computer simulations of system disturbances to understand how over-voltages stress equipment and lead to equipment failures. Also in Minnesota, Mork and his graduate students have...
worked with 60- and 100-megawatt solar installation projects using computer simulations to preemptively identify possible operating problems.

Another problem Mork hopes to prevent is a shortage of power systems engineers. Mork gave an invited presentation to the North American Electric Reliability Corporation (NERC) Summit in Washington, D.C., briefing dozens of utility company executives about the status of power systems programs and the capacity of the workforce pipeline. He said Michigan Tech’s power system protection course and laboratory is a unique offering that few other universities provide, positioning electrical and computer engineering graduates to begin high quality careers upon graduation. Partnering with Sumit Paudyal, associate professor of electrical and computer engineering, Mork has developed a “Smart Grid Boot Camp” and an advanced power system automation and protection course tailored to meet the needs of employers.

Additionally, the online master’s degree program in electrical engineering, established in 1999, offers power system courses to those who would like to advance in their careers without leaving their jobs to further their educations. The online courses are the same as those taught on campus, and students in both online and on-campus programs are required to collaborate on projects.

“We’re very proud of the online program,” Mork says. “It’s a cost-effective use of resources to simultaneously teach on campus and online. And with term projects, we require technical writing and presentations. Doing great work and communicating it, that will get you raises and promotions.”

ProSmart project

L-R: Zhou Liu, NTNU postdoc; Konstantin Pandakov, NTNU PhD student; Charles Adrah, NTNU PhD student; Hans Kristian Høidalen, NTNU faculty; Tin Rabuzin, NTNU PhD student; Bruce Mork, Michigan Tech faculty; Murari Saha, ABB; Jaya Yellajosula, Michigan Tech PhD student.

Not pictured: Sumit Paudyal, Michigan Tech faculty; Zagros Shahooei, Michigan Tech PhD student; Maciej Grebla, NTNU PhD student; Øivind Kure, NTNU
Timothy Havens Appointed Director of the Institute of Computing and Cybersystems

By Sue Hill and Kelley Christensen

Timothy C. Havens (ECE), the William and Gloria Jackson Associate Professor of Computer Systems, has been named director of the Institute of Computing and Cybersystems (ICC).

The ICC is the research arm of the Alliance for Computing, Information and Automation, and one of several research centers at Michigan Tech organized under the authority of the Office of the Vice President for Research. It brings together some 50 Michigan Tech faculty members from 12 different academic units on campus, collaborating in the areas of cyber-physical systems, cybersecurity, data sciences, human-centered computing, and scalable architectures and systems. Since its inception in 2015, it has hosted 28 funded projects.

“It’s the ICC’s goal to bring together and enable collaborations across organizational barriers,” Havens says. “We’re enabling faculty to build teams to solve big problems.”

Havens says his personal goal for the center is to grow its research expenditures, which will in turn lead to greater infrastructural and staff support to aid research faculty with seeking funding sources, writing grant proposals, aid in pre- and post-award reporting, and budget management.

“We’re building an infrastructure that everybody can use that will amplify everyone’s research capabilities,” Havens says. “We’re getting there. We have had some exceptional growth in research expenditures. In fiscal year 2018, our expenditures were nearly $1.9 million.”

Havens points to the recent successes of several ICC members:

• Ye Sun, assistant professor in mechanical engineering-engineering mechanics, received a National Science Foundation CAREER award for “System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics.” The project hinges on the innovative idea to replace wearable health monitoring devices with embroidered electronics, but is underpinned by the creation of a manufacturing network and a cloud-based website where stitch generation orders can be made.

• Soner Onder, professor of computer science and affiliated professor of electrical and computer engineering, was recently awarded an NSF/Intel Partnership award for “Foundational Micro-architecture Research (FoMR): Dependent ILP: Dynamic Hoisting and Eager Scheduling of Dependent Instructions.” Instruction-level parallelism (ILP) in computing allows different machine-level instructions within an application to execute in parallel within a micro-processor.

As the William and Gloria Jackson Associate Professor, Havens holds a joint appointment in the Department of Electrical and Computer Engineering and the Department of Computer Science. His technical areas of expertise are machine learning, computational intelligence, data science, and signal and image processing.

Havens is currently on sabbatical, and his sabbatical projects include:

• Working with Signature Research, Inc., in Calumet, exploring ideas on the confluence of synthetic data and machine learning. The research focuses on training artificial intelligence and machine learning algorithms to respond to situations in the real world using synthetic data.

• Through the National Geospatial-Intelligence Agency, a project to train deep-learning algorithms with infrared (thermal) imagery.

• With MIT Lincoln Laboratory, developing processing for simultaneous transmit-and-receive phased arrays. This research seeks to enable systems to operate in full duplex mode, which can transmit messages and listen for received messages at the same time.

• Working with the US Army developing uninhabited aerial vehicles to find buried explosive hazards.
Ashok Ambardar, associate professor of electrical and computer engineering, has been at Michigan Tech for 42 years. He began his career at Michigan Tech in 1976, the same year the EERC—the building which houses his office and the ECE Department—was inaugurated. Ambardar humbly says that after four decades his teaching, “Isn't any better, it's just more fun.” Going further he says, “What keeps me in the classroom is trying to get better at it. There's never a point where I can say 'I had a perfect class.' If it came to that, then that's when it would be time to call it quits.”

But Ambardar doesn’t plan to retire anytime soon. He says, “I'm happy to be here” and enjoys the opportunity to teach a number of core undergraduate courses. He observes that students today are different: “In terms of what they come in with. Their awareness is different. They're aware of what's happening around them, who they are, and what they want to be because they are technologically aware and access to information is in the palm of their hand,” he says.

Students’ awareness makes for interesting conversations he enjoys. “Students are always curious—they may not be curious about what we're talking about in class, but outside the classroom, students keep asking questions,” Ambardar says. “That interaction is great for me because they are always looking for a different perspective to bring to what they are learning and doing in the classroom.” Conversations with students in and outside the classroom allow Ambardar to keep learning—students’ curiosity feeds his curiosity and vice versa—inspiring him to keep teaching into the next decade.
Faculty Publications

Book Chapters


Journal Articles and Selected Conference Publications


John Pakkala
Graduate Academic Advisor and Adjunct Assistant Professor, John Pakkala ’99, ’01 finds his dual position, which he began July 2017, a perfect fit. Pakkala explains and shares aspects of his work in the Department.

Your title is Graduate Academic Advisor/Adjunct Assistant Professor, Electrical and Computer Engineering. What does that entail?

I make sure students have the classes they need for graduation. I also like to talk to them about their goals. Most students have definite short-term goals: to get a degree and a job. Students are very much focused on having a technical expertise in some specific area. We have several foci in our department. Most students come in with an idea of what they want to specialize in that they believe, and rightly so, that if they have a specialty they’ll be marketable; so I talk to them about what classes they need to be a specialist in the area. I also like to be the experienced person in the room, informing them that some broad skills will also pay off in whatever job they get. I spend a lot of time talking to students about their immediate and long-term goals, to think about their classes in the long-term sense, about what it may mean to their future careers—helping them on a path to promotion. The other half of my job is teaching. I teach some graduate courses and undergraduate courses, so sometimes I end up talking to undergraduates about what it means to go to graduate school or get a job and come back to graduate school later, or stay and get a degree and then get a job; these are tough decisions and they need someone to talk to and that’s my job. I also work in a department with faculty who are doing amazing work. It is my hope that the support role I play offers them some small measure of additional freedom to pursue their professional goals.

How many students do you advise?
This year our department has around 150 graduate students and I see almost all of them at one point. I have contact with most every student; most in-person but some just by email. Some graduate without ever having to ask me for help but most come to talk to me. If students are taking a co-op they talk to me about the suitability of the job offer to their degree path—if it makes sense to them for their career path versus their degree program. Eventually, they all come to see me for some kind of advice. I don’t keep track of who shows up or how many times, but I do get to know some of them personally. They show up, we talk, and then I am happy to see them go off on their adventures.

You’re no stranger to Michigan Tech as an electrical engineering alumnus ’99 (MS) ’01 (PhD). Why come back after 17 years?
I came back for a lot of reasons: I have family here; I really liked being at Michigan Tech as a grad student; some of the professors I had are still here; while teaching mechanical engineering in Milwaukee for 17 years, I always had in the back of my mind if some availability opened up at Michigan Tech I would take it. The dual appointment in advising and teaching is a perfect fit. I’ve reached a point of my career—I have 20 years of industry experience and 20 years in academia—that I can give students advice about both areas. I have the experience to advise and I get to teach. That’s why the dual posting suits me so well.
Graduate Student Awards

ECE Fellowships 2017-18

Wyatt Adams  
John Miles Endowed Fellowship

Ian Cummings  
NSF Graduate Research Fellowship

Muhammad Fahad  
Funds derived from the Dave House Endowed Professorship

Brian Flanagan  
Funds derived from the William and Gloria Jackson Endowed Professorship

Eassa Hedayati  
John Miles Endowed Fellowship

Kunle Titus Olutomilayo  
Funds derived from the Dave House Endowed Professorship

Joseph Rice  
James and Marlene Fugere Fellowship

Brandon Swatowski  
Earl R. and Ellanette F. Lind Memorial Endowed Fellowship

2017 Jonathan Bara Award for Outstanding Graduate Teaching Assistant in Electrical and Computer Engineering
Aref Majdara

2017 Matt Wolfe Award for Outstanding Graduate Research Assistant in Electrical and Computer Engineering
Navid Gandji

ECE Doctoral Degrees: Summer 2017 to Spring 2018

<table>
<thead>
<tr>
<th>PhD Graduate</th>
<th>Advisor</th>
<th>Major</th>
<th>Dissertation Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guna Bharati</td>
<td>Sumit Paudyal</td>
<td>Electrical Engineering</td>
<td>Hierarchical Optimization Framework for Vehicle-to-Grid (V2G) and Building-to-Grid (B2G) Integration</td>
</tr>
<tr>
<td>Hanieh Deilamsalehy</td>
<td>Tim Havens</td>
<td>Electrical Engineering</td>
<td>Heterogeneous Multi-Sensor Fusion for 2D and 3D Pose Estimation</td>
</tr>
<tr>
<td>Solmaz Hajmohammadi</td>
<td>Saeid Nooshabadi</td>
<td>Electrical Engineering</td>
<td>Parallel Implementation of Bispectrum Multi-Frame Deconvolution for Image Reconstruction</td>
</tr>
<tr>
<td>Mehdi Jafari</td>
<td>Lucia Gauchia</td>
<td>Electrical Engineering</td>
<td>A Bayesian Network Approach to Battery Aging in Electric Vehicle Transportation and Grid Integration</td>
</tr>
<tr>
<td>Siranee Nuchitprasitchai</td>
<td>Mike Roggemann</td>
<td>Computer Engineering</td>
<td>An Algorithm for Reconstructing Three-Dimensional Images from Overlapping Two-Dimensional Intensity Measurements with Relaxed Camera Positioning Requirements, with Application to Additive Manufacturing</td>
</tr>
<tr>
<td>Zagros Shahooei</td>
<td>Bruce Mork</td>
<td>Electrical Engineering</td>
<td>Time-Domain Voltage Stability Assessment and Wide-Area Control</td>
</tr>
<tr>
<td>Husam Sweidan</td>
<td>Tim Havens</td>
<td>Electrical Engineering</td>
<td>Resource Optimization in Wireless Sensor Networks for an Improved Field Coverage and Cooperative Target Tracking</td>
</tr>
<tr>
<td>Xuegian Zhao</td>
<td>Zhuo Feng</td>
<td>Electrical Engineering</td>
<td>Fast Very-Large-Scale Integrated (VLSI) Circuits Simulations</td>
</tr>
<tr>
<td>Yuchen Zhou</td>
<td>Shiyan Hu</td>
<td>Computer Engineering</td>
<td>Strategic Energy Theft Detection in Smart Energy Cyber-Physical Systems and Data Centers</td>
</tr>
</tbody>
</table>
Early last summer, five undergraduate engineering students from the Michigan Tech chapter of Engineering World Health (EWH) took a trip to Les Cayes, Haiti. They were led by fellow electrical engineering undergraduate, Megan Byrne, who organized the trip. The students describe the experience as nothing short of life-changing. EWH inspires, educates, and empowers young engineers, scientists, and medical professionals to use their engineering skills to improve global health in the developing world. The Michigan Tech chapter of EWH is now in its second year.

To get to Haiti, students bagged groceries and each spent $1,500 to cover travel costs. Another non-profit organization operating in Haiti, Hut Outreach, provided lodging for the Michigan Tech team during their stay, and invited them to help teach STEM subjects to a class of seventh graders in their secondary school.

Byrne is a peer mentor at Michigan Tech for Learning with Academic Partners (LEAP), a program for first-year engineering students in the Department of Engineering Fundamentals, which also provided support for the Haiti trip. Byrne put her experience as a LEAP leader and mentor to good use in Haiti. “Our EWH team wanted the students to learn the theory of series and parallel circuits, forces to build bridges, first aid, and how to build water filters,” says Byrne. “This was a challenge, because the students had not been exposed to any of these topics or hands-on learning, and they also spoke a different language. Thanks to our Haitian translator, Wesley, along with the experience I gained through the LEAP program at Michigan Tech, I was able to use a creative twist to help the students gain understanding of the difficult lessons in a way that would be impactful for them. As a matter of fact, the lessons we taught in Haiti were very similar to LEAP
Meet Hailey Trossen, May 2018 graduate of the accelerated master’s degree in computer engineering. Now a software engineer, Hailey works for Target in the Twin Cities. Originally from Ann Arbor, Hailey says she, “decided during the spring of my first-year to do the master’s program when I realized I could complete my undergraduate degree in three years.”

The crux of the accelerated master’s degree program is this: While the BS degree requires a minimum of 128 credits, and the MS degree 30 credits, students in the accelerated MS program may double-count six credits to apply toward both degrees simultaneously. This brings the total number of credits for the combined BS/MS package down to 152. It’s not a bad deal, and one the department hopes other undergraduates seriously consider. Trossen says she enrolled in the program “to get more in-depth knowledge and another internship opportunity to inform my career plans.”

“I really enjoyed the courses I was able to take during my master’s. I gained more knowledge about machine learning, artificial intelligence, and security. I spent the summer traveling and am about a month into my job as a software engineer in Target’s Technology Leadership Program at their headquarters in Minneapolis,” Trossen says.
This Senior Design team was selected by the ECE External Advisory Committee to receive the 2018 Larry Kennedy Industry Innovation Award at the ECE senior banquet in April for their project titled “One-Wire Communication Emulator.”

L-R: Trever Hassell (advisor), Kyle Ludwig, Benjamin Schaedig, Morgan English, Justin Evankovich, and Charles Lubitz.

### 2017-18 Senior Design Teams

<table>
<thead>
<tr>
<th>Project</th>
<th>Sponsor</th>
<th>Advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMI Annunciator Replacement</td>
<td>ITC Holdings</td>
<td>Chee-Wooi Ten</td>
</tr>
<tr>
<td>Instrument Transformer Signal Conditioner</td>
<td>S&amp;C Electric</td>
<td>Trever Hassell</td>
</tr>
<tr>
<td>Radar Integration</td>
<td>ECE Department/Supporting RSE Autodrive (Jeremy Bos)</td>
<td>Dan Fuhrmann</td>
</tr>
<tr>
<td>Medical Device Tool One-Wire Communication Emulator</td>
<td>Stryker</td>
<td>Trever Hassell</td>
</tr>
<tr>
<td>Optical Design Camera System</td>
<td>ECE Department/Supporting RSE Autodrive (Jeremy Bos)</td>
<td>Durdu Guney</td>
</tr>
<tr>
<td>Functional Safety Controller for Autonomous Vehicle Prototype</td>
<td>ECE Department/Supporting RSE Autodrive (Jeremy Bos)</td>
<td>Chris Middlebrook</td>
</tr>
</tbody>
</table>
Enterprise

Blue Marble Security Enterprise
Blue Marble is comprised of several sub-teams, each working on projects related to security. The goal of Blue Marble is to create sustainable, secure systems for our sponsors—corporate or within the University. Though hosted in the Department of Electrical and Computer Engineering, Blue Marble team members come from a variety of disciplines including mechanical engineering, computer science, and business.
Advisor: Glen Archer

<table>
<thead>
<tr>
<th>Project</th>
<th>Sponsor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outreach: Promoting STEM Careers to Youth</td>
<td>ECE Department</td>
</tr>
<tr>
<td>Jetson: Improving the Nvidia TX1 Kit</td>
<td>ECE Department</td>
</tr>
<tr>
<td>Autobot: Testing an Autonomous Ground Vehicle</td>
<td>ECE Department</td>
</tr>
<tr>
<td>Vision System Measurement Verification of Slab Dimensions</td>
<td>ArcelorMittal</td>
</tr>
<tr>
<td>Blue Marble Security Website</td>
<td>ECE Department</td>
</tr>
<tr>
<td>CRT Adapter</td>
<td>ECE Department</td>
</tr>
</tbody>
</table>

Robotic Systems Enterprise
The Robotic Systems Enterprise is an innovation-driven student team that focuses on integrating knowledge in electronics, robotics, programming, and mechanical principles to solve real-world engineering problems.
Advisor: Jeremy Bos

<table>
<thead>
<tr>
<th>Project</th>
<th>Sponsor</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoDrive Collegiate Design Competition</td>
<td>ECE Department</td>
</tr>
<tr>
<td>Buoy-cam</td>
<td>Great Lakes Research Center</td>
</tr>
<tr>
<td>Tow-behind underwater sensor pod</td>
<td>Great Lakes Research Center</td>
</tr>
<tr>
<td>Aurora-Minor</td>
<td>General Motors Foundation</td>
</tr>
<tr>
<td>AutoDrive Sound and Lighting Controller</td>
<td>ECE Department</td>
</tr>
</tbody>
</table>
**Wireless Communication Enterprise**

The Bird-Window Sensor team tested their sensors at the U. J. Noblet Building with help from a tennis ball launcher borrowed from the tennis team to determine sensor sensitivity and impact detection.

Advisor: **Kit Cischke**

<table>
<thead>
<tr>
<th>Project</th>
<th>Sponsor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird-window sensor: Detecting bird-window collisions to further ornithological research and the efficacy of window treatments to prevent collisions</td>
<td>Visual and Performing Arts and School of Forest Resources and Environmental Science</td>
</tr>
<tr>
<td>Bluetooth dongle: Designing a custom Bluetooth PCB to interface with iRobot devices used by the Engineering Fundamentals department</td>
<td>Engineering Fundamentals</td>
</tr>
<tr>
<td>Broomball domination: Performing upgrades and maintenance on the electronic broomball scoreboards as well as creating mobile apps to access broomball schedules, scores, and statistics</td>
<td>Inter-Residence Housing Council</td>
</tr>
<tr>
<td>Ford EV charging: Examining alternative charging algorithms for multi-car EV charging stations</td>
<td>Ford Motor Co.</td>
</tr>
<tr>
<td>Pleased to heat you: Building a sun-tracking solar panel system with integrated power monitoring and smartphone app integration</td>
<td>ECE Department</td>
</tr>
<tr>
<td>Radio frequency control: A design project for changing frequencies on the communications systems on military aircraft</td>
<td>System Engineering Research Center</td>
</tr>
<tr>
<td>Sweet sound: Creating a low-cost, highly configurable DSP kit for visual and performing arts students to use in loudspeaker design projects</td>
<td>Visual and Performing Arts</td>
</tr>
</tbody>
</table>

**Undergraduate Student Awards**

- **2018 Carl S. Schjonberg Award for Outstanding Undergraduate Student in Electrical and Computer Engineering**  
  **Lanna R. Pirkola**

- **2018 Departmental Scholar Award**  
  **Elizabeth (Liz) Adams**

- **2018 Women of Promise Martha Sloan Scholarship**  
  **Christine Cauley**
ECE Academy Class of 2018

Seven alumni were inducted into the ECE Academy Class of 2018. The purpose of the Academy is to honor outstanding graduates of the Department of Electrical and Computer Engineering at Michigan Techn. Election to the Academy is made by the Executive Committee of the faculty, and recognizes excellence and leadership in the engineering profession and civic affairs.

This induction honors some of the most successful of the more than 9,600 ECE alumni of Michigan Tech. Portraits of the new Academy members will be added to the prominent display in the lobby of the EERC building, to inspire and motivate future generations of students in electrical and computer engineering.

Jeffery (Jeff) Feldt ’84 received a Bachelor of Science in Electrical Engineering from Michigan Tech in 1984 and an MBA from Grand Valley State University in 1996; he is a registered professional engineer in Wisconsin and Michigan. Feldt has 35 years of experience in the electric utility industry. He is general manager of Kaukauna Utilities in Kaukauna, Wisconsin. Feldt has held numerous leadership positions on state and national electric trade associations and power supply agencies. For the past seven years he has served as chairman of the WPPI Energy Board of Directors in Sun Prairie, Wisconsin. He was a member of the Board of Directors of the American Public Power Association (APPA), and served as chairman of APPA’s R&D program, Demonstration of Energy & Efficiency Developments (DEED), both in Washington, DC. He has served as president of the Michigan Municipal Electric Association and the Municipal Electric Utilities of Wisconsin. He is the recipient of the APPA John Preston Personal Service Award and the MEUW Donald L. Smith Distinguished Service Award. He serves on the Fox River Navigational Authority Board of Directors, and the City of Kaukauna’s Industrial Park Commission, Plan Commission, and Redevelopment Authority. Like a number of Huskies, he competed in Lake Superior Pro Rally (LSPR) races. He was the co-driver in cars #98 and #543 in the mid-2000s.

Jon Jipping ’91 earned a Bachelor of Science in Electrical Engineering from Calvin College in 1988, and a Master of Science in Electrical Engineering, concentrating in power systems, from Michigan Tech in 1991. He is a registered professional engineer in the state of Michigan. Early in his career he joined Detroit Edison, where he held positions of increasing responsibility in transmission operations and planning, and received the company’s Sarah Sheridan Award for exceptional customer service in the deployment of new technology for an industrial customer. He is currently executive vice president and chief operating officer for ITC Holdings Corp. There, he is responsible for system operations, planning engineering, supply chain, field construction and maintenance, and information technology. Jipping is one of the original employees to start ITC in 2003, beginning his tenure as director of engineering. He rose to vice president of engineering and subsequently senior vice president of engineering. Jipping is currently serving as chair of the External Advisory Board of Michigan Tech’s College of Engineering and is a former member and chair of the External Advisory Committee for the Department of Electrical and Computer Engineering. Jon has served on industry boards and committees with the Edison Electric Institute, the Electric Power Research Institute, and the North American Transmission Forum.

Dr. Paul Juodawlkis ’86 received his Bachelor of Science in Electrical Engineering from Michigan Tech in 1986, a Master of Science degree from Purdue University in 1988, and a PhD degree from the Georgia Institute of Technology in 1999, all in electrical engineering. Juodawlkis has focused his career on the development of advanced technology for national security as both a research engineer and was a technical manager at the Massachusetts Institute of Technology (MIT) Lincoln Laboratory in 1988. He was on the team that developed the Airborne Seeker Test Bed (ASTB) platform. He flew 150 missions on the ASTB, including a test campaign in support of Operation Desert Shield in 1991. After completing his doctoral degree, he returned to the Laboratory to conduct applied research in the areas of photonic subsystems and compound-semiconductor optoelectronic components. He has served as a leader of the Electro-Optic Materials and Devices Group (2008-2014) and the Quantum Information and Integrated Nanosystems Group (2014-present). He is a Fellow of both the Institute of Electrical and Electronic Engineers (IEEE) and The Optical Society (OSA). He has authored or coauthored more than 130 peer-reviewed journal and conference publications in the photonics field. He has served as a member of the External Advisory Committee for Michigan Tech’s Department of Electrical and Computer Engineering (2000-2015). He has held leadership positions in, and received the Distinguished Service Award from, the IEEE Photonics Society.

Michael A. Pulick ’86 grew up in Livonia, Michigan, with four siblings who all went on to become engineers after attending Michigan Tech. He received a Bachelor of Science in Electrical Engineering. Later, he earned a Master’s of Business Administration from the University of Chicago. Pulick spent
Mark J. Rich ’80 earned a Bachelor of Science in Electrical Engineering from Michigan Tech in 1980, and a Master’s of Science in Electrical Engineering from Stanford University in 1991. Early in his career, he was director of the Communication and Signals Technology Laboratory at SRI International. Rich was co-founder and CTO of SkyPilot Networks, where he developed the mesh architecture for commercial broadband wireless infrastructure services. He also developed distributed and heterogeneous communications system and protocols for military communications and sensing applications with Fantastic Data, LLC. He went on to work at Atheros Communications where he managed the Systems Engineering Department.

From 2010 to 2014, Rich was a program manager at the US Defense Advanced Research Projects Agency (DARPA) Strategic Technology Office. His program thrusts involve distributed sensor and communication systems for ISR systems and heterogeneous communication technology. From DARPA, Rich lead leading research into advanced radio architectures at Google. His final position as VP of Connected Fleet at Airbus united his passions of flying and communication to design the airline communications for the next five to 10 years. Rich holds patents in digital audio broadcasting, polyvector modulation, mesh communications protocols and architectures, and antenna systems. He also served on the Defense Science Board panel for tactical battlefield communications.

Dennis O. Wiitanen ’63 ’67 earned a Bachelor of Science in Electrical Engineering from Michigan Tech in 1963, and shortly thereafter, joined Michigan Bell as an electrical engineer. He later returned to Michigan Tech to pursue graduate study, and while working as a graduate teaching assistant, he decided that he wanted to make teaching his career. After completing his Master of Science in Electrical Engineering at Michigan Tech in 1967, he enrolled in the PhD program in Electrical Engineering at the University of Missouri-Rolla (now the Missouri Institute of Science and Technology). Hired as assistant professor of electrical engineering by his alma mater, Wiitanen was eager to begin until Professor Walt Anderson, then assistant chair of electrical engineering at Michigan Tech, convinced him to accept the same position at Michigan Tech. The newly minted Dr. Wiitanen accepted in August 1970 and stayed on for the next 42 years, retiring in August 2012. During his tenure, Wiitanen’s emphasis was on the power program. After developing a strong undergraduate program, he turned his attention to the graduate program in power. He was successful in acquiring multiple industrial research contracts and external student fellowships. The addition of several faculty expanded the program’s breadth and depth, which included the addition of a viable and ongoing PhD program in power. Wiitanen is proud of the fact that the undergraduate elective sequence in power systems was the most popular sequence in the department; he taught more than 1,000 students in power systems during his career. He is very pleased to join several of them as members of the ECE Academy. At the time of his retirement, the Department and the Office of Advancement raised about $500,000 in philanthropic funds, and by adding that to an existing endowed fund, were able to create the Dennis Wiitanen Endowed Professorship in Electric Power Systems, a position currently held by Bruce Mork.

Arjang Roshan-Rouz ’92 received a Bachelor of Science in Electrical Engineering from Michigan Tech in 1992. Early in his career, he worked for both Bosch North America and the Ford Motor Company. He holds an Executive MBA degree from the Broad School of Business at Michigan State University, and he is also a graduate of the Executive Program at the University of Michigan Ross School of Business. Roshan has 25 years of international executive experience in managing and growing businesses in industries related to automotive, specialty chemicals, material technology, and electronics, in addition to managing businesses in Asia-Pacific and Europe while living in these regions. From 1998 to 2016 he worked for Umicore, a global materials technology group, managing various businesses and ventures. He was senior vice president for energy and surface technologies while based in Belgium, and prior to this appointment, he was senior vice president of the Automotive Catalysts Division in the Asia-Pacific region. Throughout his executive tenure, Roshan has established a track record of success in sustainably growing businesses in various markets including Asia-Pacific, Europe, and North America, along with transforming underperforming global ventures. In February 2016, Roshan was appointed president and chief executive officer of 5N Plus, Inc., in Montreal, Quebec, a leading producer of engineered materials for various industries, including pharmaceutical, healthcare, renewable energy, aerospace, security, sensing, and imaging.

ECE ACADEMY
External Advisory Committee

The mission of the External Advisory Committee is to serve the Department of Electrical and Computer Engineering in an advisory capacity, providing counsel to the department chair and the faculty from the viewpoint of industry. The aim of these activities is to improve the quality of electrical and computer engineering education at Michigan Tech and provide ECE graduates, who are valuable assets, to industry employers.

David Aho
Eaton Cooper Power Systems

Ellen M. Bauman
IBM

Keith Behnke
Stryker Instruments

Anthony Champagne
Nexteer Automotive

Rob Cooke
GS Engineering

Jonathan Doane
MIT Lincoln Laboratory

Ben Galloway
Dematic Corporation

Brett Giem
Chrysler Technology Center

Gordon (Gordie) Halt
ITC Holdings

Steve Kennell
Retired

Eric Larson
3M Corporate Research

Ken Leisenring
Ford Motor Company

William Lepak
ArcelorMittal

Steve S. Mathe
Harris Corporation

David Perry
Retired

David Rowe
Systems Control, A Division of North Star Industries, Inc.

Matt Schroeder
General Motors

Jerrod Shaffer
Plexus Engineering Solutions

Nirmal Singh
Detroit Edison

Jeff Wells
Retired
### Contracts and Grants

Engineering research and development are key to technological progress and economic revitalization, and the ECE Department at Michigan Tech is busy doing its part. Our faculty, graduate students, and undergraduates work together in modern, well-equipped laboratories to bring practical solutions to real-world problems in signal processing, wireless communications, computer-aided design, energy systems, electronic materials and devices, photonics, and much more. We are eager to tackle new challenges and always looking for new opportunities that are well matched to the interest and expertise of our faculty.

**ECE Contracts and Grants Awarded for FY18, July 2017 to June 2018**

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Sponsor</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise: Oshkosh Baja LCV Suspension Design - Phase 1</td>
<td>Glen Archer</td>
<td>Oshkosh Corp.</td>
<td>$8,500</td>
</tr>
<tr>
<td>Grid-Scale Energy Storage Systems, Training</td>
<td>Lucia Gauchia</td>
<td>ITC Holdings Corp.</td>
<td>$36,979</td>
</tr>
<tr>
<td>Robust Terrain Identification and Path Planning for Autonomous Ground Vehicles in Unstructured Environments</td>
<td>Jeremy Bos</td>
<td>University of Michigan/US Department of Defense</td>
<td>$40,000</td>
</tr>
<tr>
<td>Enterprise: Development of Consumer Electric Vehicle Driving Efficiency Training System--Phase IV</td>
<td>Christopher (Kit) Cischke</td>
<td>Ford Motor Co.</td>
<td>$15,000</td>
</tr>
<tr>
<td>Enterprise: Smart Charging EV App Development--Phase II</td>
<td>Christopher (Kit) Cischke</td>
<td>Ford Motor Co.</td>
<td>$15,000</td>
</tr>
<tr>
<td>Graduate Research Fellowship</td>
<td>Ian Cummings, co-PI Timothy Havens</td>
<td>National Science Foundation</td>
<td>$46,000</td>
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<tr>
<td>CAREER: Leveraging Heterogeneous Manycore Systems for Scalable Modeling Simulation and Verification of Nanoscale Integrated Circuits</td>
<td>Zhuo Feng</td>
<td>National Science Foundation</td>
<td>$523,618</td>
</tr>
<tr>
<td>Distributed Array Processing for Aperture Level STAR</td>
<td>Timothy Havens</td>
<td>MIT Lincoln Laboratory/US Department of Defense</td>
<td>$50,000</td>
</tr>
<tr>
<td>Microfabrication Facility Services</td>
<td>Chito Kendrick</td>
<td>Microdevice Engineering Inc.</td>
<td>$15,127</td>
</tr>
<tr>
<td>Various Sponsors: Fabrication of Wafers on Silicon Dioxide</td>
<td>Chito Kendrick</td>
<td>University of Calgary</td>
<td>$1,673</td>
</tr>
<tr>
<td>PARA Board Build 2</td>
<td>Christopher Middlebrook</td>
<td>AIon Science and Technology/US Department of Defense</td>
<td>$24,883</td>
</tr>
<tr>
<td>Power System Protection in a Smartgrid Perspective-Prosmart</td>
<td>Bruce Mork</td>
<td>Norwegian University of Science and Technology</td>
<td>$231,821</td>
</tr>
<tr>
<td>Collaborative Research: ACI-CDS&amp;E: Highly Parallel Algorithms and Architectures for Convex Optimization for Realtime Embedded Systems (CORES)</td>
<td>Saeid Nooshabadi</td>
<td>National Science Foundation</td>
<td>$349,988</td>
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<tr>
<td>Packetized Energy Management: Coordinating Transmissions and Distribution</td>
<td>Sumit Paudyal</td>
<td>University of Vermont</td>
<td>$4,835</td>
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<tr>
<td>CAREER: Operation of Distribution Grids in the Context of High-Penetration Distributed Energy Resources and Flexible Loads</td>
<td>Sumit Paudyal</td>
<td>National Science Foundation</td>
<td>$500,000</td>
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<tr>
<td>Senior Design: Medical Device Tool One-Wire Communication Emulator</td>
<td>Anthony (Tony) Pinar</td>
<td>Stryker Instruments</td>
<td>$17,500</td>
</tr>
<tr>
<td>Senior Design: Instrument Transformer Signal Conditioner</td>
<td>Anthony (Tony) Pinar</td>
<td>S&amp;C Electric Co.</td>
<td>$17,500</td>
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<tr>
<td>The Amon Hen Project</td>
<td>Michael Roggemann</td>
<td>Applied Technology Associates</td>
<td>$74,212</td>
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<tr>
<td>Developing Anisotropic Media for Transformation Optics by Using Dielectric Photonic Crystals</td>
<td>Elena Semouchkina</td>
<td>National Science Foundation</td>
<td>$337,217</td>
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<tr>
<td>CPS: Medium: Collaborative Research: An Actuarial Framework of Cyber Risk Management for Power Grids</td>
<td>Chee-Wooi Ten</td>
<td>National Science Foundation</td>
<td>$348,866</td>
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<tr>
<td>Meta-Stability of Pulsed Load Microgrids</td>
<td>Wayne Weaver</td>
<td>Sandia National Laboratories</td>
<td>$111,000</td>
</tr>
<tr>
<td>Autonomous Microgrids: Theory Control Flexibility and Scalability</td>
<td>Wayne Weaver</td>
<td>US Department of Defense, US Navy</td>
<td>$249,944</td>
</tr>
</tbody>
</table>

Due to disclosure restrictions, some awards may not be listed.
Prometheus Borealis

Named for the Greek deities of knowledge, learning, and the north wind, Michigan Tech’s team Prometheus Borealis was one of eight collegiate teams in North America selected to participate in the inaugural GM/SAE AutoDrive Challenge. The objective of the three-year competition is to convert a Chevrolet Bolt into a SAE Level 4 autonomous vehicle. Level 4 autonomy means that the vehicle drives itself in most environments with little or no human intervention. The Michigan Tech team comprises some 40 students from multiple disciplines in the Robotic Systems Enterprise, which is hosted in the ECE Department and advised by Assistant Professor Jeremy Bos. In the first year, students developed and implemented their vehicle design in Houghton, and spent spring break road-testing the vehicle at Road America in Elkhart Lake, Wisconsin.

The first year of the competition culminated in an on-site evaluation event at the GM Proving Grounds in Yuma, Arizona, where the students placed second in concept design. The second year-end competition event will take place May 29–June 4, 2019, in Ann Arbor, Michigan.