



Michigan  
Technological  
University

# 2020 ANNUAL REPORT

## ELECTRICAL AND COMPUTER ENGINEERING

### Plexus Innovation Lab

Will Double as  
Electronics Makerspace

page 8



# FROM THE CHAIR

## Glen Archer Principal Lecturer and Interim Chair

Hello from the beautiful Michigan Tech campus on the Keweenaw Waterway. I am Glen Archer, the interim chair of the Department of Electrical and Computer Engineering (ECE), and I am very proud to present our 2020 annual report, which covers Department activity for the 2020 fiscal year.

2020 was another year of tremendous transition. In March, Michigan Tech, along with other higher education institutions, shifted from mainly face-to-face instruction to temporary “at-a-distance” instruction. This was achieved only through incredible effort and dedication from the faculty, staff, and students. Widespread faculty training and centralized support for the new tools of remote education, including our laboratory experiences, were the focus of our attention and effort. Through summer, new course delivery modalities were prepared to meet any eventuality the fall semester might bring. This was a period of high ambiguity as the faculty and staff prepared for social distancing in classrooms and labs and other pandemic-related constraints. I am so proud of our people; their individual and collective response to COVID-19 has been inspiring.

In March, it was also my great privilege to take Dr. Dennis Wiitanen downstate to reconnect with our alumni in the power industry, where Michigan Tech has a pervasive presence. We visited

old colleagues and refreshed our understanding of the industry’s needs. This recommitment to our long-standing relationship will bear much fruit as the industry moves forward.

In April, ECE received approval from the University Senate and the Board of Trustees to establish a Bachelor of Science in Robotics Engineering degree. This program fills a gap in Michigan Tech’s degree offerings between electrical engineering, mechanical engineering, and computer science. Robotics engineering applies these disciplines to automation design—in manufacturing and in other areas of human endeavor. We expect early-career graduates to apply their knowledge and skills to find creative solutions to engineering problems involving robots or robotic systems in industrial and research and development settings. Our graduates will leverage their engineering analysis and design capabilities to develop successful technical, professional, and/or entrepreneurial leadership positions.

I am proud to introduce our new academic advisor and outreach coordinator, Liz Fujita. It has been my great privilege to work with her for years in her role as the pre-college outreach program director. Her funding proposals to the Michigan Space Grant Consortium in collaboration with the Society of Women Engineers have already brought success to our outreach program. She will be the academic advisor for the computer engineering program, and you can read more about her plans for ECE on page 16.

Near the end of the academic year, Dr. Ashok Ambardar announced his intention to retire from active faculty life. Dr. Ambardar began his 44-year career at Michigan Tech as a visiting instructor in 1976. He served as ECE’s

University Senate representative and guided the undergraduate electrical and computer engineering curriculum for 30 years. Read more about Dr. Ambardar’s decorated career on page 14. His departure from our company will be challenging, but his wise counsel and mentoring have left us all well prepared to weather that loss.

Although slightly outside the scope of the academic year, I can’t close this letter without an acknowledgement of the tragic death of a good friend and honored colleague, Dr. Roger Kieckhafer, who died July 17 in a vehicle-bicycle accident. Among his many other roles, Roger was a valued ECE faculty member. A Department tribute highlights his life and achievements on page 25.

This is only a small sample of what’s in store for you in this ECE annual report. We have been busy. But we are not so busy that a phone call (906-487-2789) or email (gearcher@mtu.edu) from our alumni isn’t a welcome distraction. If you have stories you want to share or just want to hear about what’s going on this week, please don’t hesitate to reach out.

Glen Archer  
Interim Chair, Department of Electrical and Computer Engineering

### On the Cover

Plexus Innovation Lab Will Double as Electronics Makerspace

### Electrical and Computer Engineering

Michigan Technological University - 906-487-2550  
1400 Townsend Drive, Houghton, MI 49931-1295

# WELCOME

## Middlebrook Named HKN Professor of the Year

Dr. Chris Middlebrook is the 2020 Eta Kappa Nu (HKN) Professor of the Year. The students said Middlebrook is easygoing and funny—he keeps classes light and fun while still getting the required material across and uses their feedback to maximize understanding. Likewise, homework is pointed toward further understanding of the material. Says a nominator: “Professor Middlebrook has taken the PCB Fabrication course and turned it into an incredible experience for students with guest lectures and the lab component.” He is hoping to develop this into a focus area and grow the Department’s use of these methods in the future. He has also been an integral part in the foundation of a new student organization, IPC and Electronics.

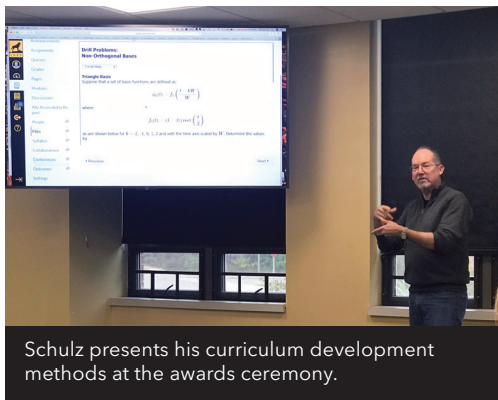


## Schulz Receives CTL Instructional Award



Schulz (left) receives the award from Mike Meyer, director of the CTL.

Dr. Tim Schulz received a 2019 Center for Teaching and Learning (CTL) Instructional Award for his outstanding progress in online course curriculum and learning tool development. He received the award from Mike Meyer, director of the CTL, at an awards ceremony held October 22, 2019. Schulz was chosen from a pool of Deans’ Teaching Showcase award recipients, and was recognized as an “important contributor to Tech’s teaching mission.”



Schulz presents his curriculum development methods at the awards ceremony.

### Table of Contents

- 2 Welcome from the Interim Chair
- 4 Faculty Directory
- 6 Faculty Highlights
- 7 AutoDrive Challenge 2020
- 8 Plexus Innovation Lab Will Double as Electronics Makerspace
- 10 Faculty Profile: Tony Pinar
- 11 Faculty Publications
- 14 Retirement: Ashok Ambardar
- 15 Staff Profile: Chuck Sannes
- 16 Staff Highlights
- 17 Graduate Student Awards
- 18 Michigan Tech Brings Learning Home with Husky Bites
- 20 ECE Undergrad Paige Fiet: First IPC Board of Directors Student Member Liaison
- 21 Senior Design
- 22 Enterprise
- 24 Undergraduate Student Awards
- 25 Faculty Tribute: Remembering Roger Kieckhafer
- 26 Contracts and Grants
- 27 Department Statistics

**Writing and Editing**  
Maryann Wilcox, ECE  
Jessie Tobias, UMC

**Design**  
Phil Mcleod, UMC

# 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

## Durdu Guney

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

## Trever Hassell

Senior Lecturer  
MS, Electrical Engineering, Michigan Technological University  
Power electronics and control systems

## Nagesh Hatti

Professor of Practice  
MS, Software Engineering, Birla Institute of  
Technological Sciences  
MBA, Texas Christian University  
Software development, supply chain management

## 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

## 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

## Anthony (Tony) Pinar

Lecturer  
PhD, Electrical Engineering, Michigan Technological University  
Machine learning, signal and image processing, data fusion,  
electronic design

**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

**George Semouchkin**

Instructor  
PhD, Material Science and Engineering, Saint Petersburg State  
Technical University, Russia  
Optics, photonics, signal and image processing

**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

**Seyed (Reza) Zekavat**

Professor  
PhD, Electrical Engineering and Telecommunications, Colorado  
State University  
Wireless localization systems, wireless power transfer, statistical  
signal processing



# FACULTY HIGHLIGHTS

## Sabbatical and Leave Activity



Elena Semouchkina

During sabbatical leave in the spring 2020 semester, **Elena Semouchkina** wrote the major portion of an original scientific manuscript to be published by Elsevier. The approximately 400-page book is titled “Dielectric Metamaterials and Metasurfaces for Transformation Optics and Photonics.” By the end of her leave, Semouchkina had completed four of its eight chapters.

The book will present new, mostly unpublished

material on dielectric metasurfaces obtained by Semouchkina’s research team at Michigan Tech, along with material partially included in previous publications. It introduces a new and hot frontier research field and includes more knowledge about solid state physics. Semouchkina believes it will have “significant impact in metamaterial research,” and intends it to provide a thorough, complete, and correct description of optical properties of dielectric metastructures.

Semouchkina hopes to finish the remaining chapters by the end of 2021. She said all contributors (Dr. George Semouchkin and former and current PhD students) and their contributions will be listed in the beginning of the book.

## New Faculty



Nagesh Hatti

**Nagesh Hatti** joined the Department Electrical and Computer Engineering as a professor of practice in spring 2020. He holds a master’s in software engineering from Birla Institute of Technology and Science, India, and a BE in Telecommunication Engineering from Bangalore University, India. He also has an MBA in Supply Chain Management from Texas Christian University.

Hatti is originally from Bangalore, India, and has

lived in the US for 16 years. Prior to coming to Michigan Tech, he worked in the technology and supply chain industries for 18 years, most recently serving as technical program manager for Schneider in Green Bay, Wisconsin, and manager of supply chain operations support for American Airlines in Fort Worth, Texas.

“The longest place I worked in my career is at American Airlines—for about 11 years,” said Hatti. “I love everything about airplanes. That job gave me a chance to see big cities and small towns all over the US and also some international places.”

He has also held various other roles in industry, including systems engineer, IT analyst, senior commodity manager, financial analyst, project manager, program manager, and supply chain manager.

Hatti loves working in the University environment—he has found there is a certain energy and enthusiasm not generally found in the corporate world. And, he loves being able to make an impact in the lives of Michigan Tech students. In addition to his role as a professor of practice, he is a faculty advisor to the IT Oxygen Enterprise team. In his personal time, he enjoys watching British crime shows.

# Three courses. Three semesters. All online.

Michigan Tech offers online graduate certificates, including:

- Control Systems
- Electronics Materials and Processing
- Network and Communication Systems
- Signal and Image Processing

**Step Up. Tech Up. Move Up.**

Elevate your ambitions and propel your career forward with an online graduate certificate or degree from Michigan Technological University

[mtu.edu/techup](https://mtu.edu/techup)



**Michigan  
Technological  
University**



# Plexus Innovation Lab

## Will Double as Electronics Makerspace



A desire to recruit and hire more Michigan Tech students led Plexus Corporation to sponsor a new laboratory in the Department of Electrical and Computer Engineering. The 1,230-square-foot Plexus Innovation Lab in the Electrical Energy Resources Center (EERC) will function as a makerspace focused on electronics and open to students from different disciplines.

Tech students will benefit from the lab's equipment, allowing them hands-on experience in designing and testing electronics.

"I'm very pleased to see this strong investment in student learning by Plexus," said Janet Callahan, dean of the College of Engineering. "The partnership of Plexus with Michigan Tech will impact students and faculty for many years to come."

The lab was born out of a longstanding relationship between Michigan Tech and Plexus. Based in Neenah, Wisconsin, the corporation employs dozens of Huskies in areas from mechanical engineering to biomedical engineering to electrical

engineering. A team of MTU alumni from Plexus return to Tech to recruit more Huskies at each Career Fair, and other alumni regularly come to campus to give lectures.

Michigan Tech alumna Christina Jufliak '13 '14 wanted to benefit both her employer and the University. After earning a BS in Biomedical Engineering and an MBA the following year, she started her career at Plexus as a product engineer and is currently a functional manager.

"As an MTU student, I saw firsthand the school's efforts to provide relevant and hands-on experiences for students to prepare them for their careers," said Jufliak. "I am very excited and grateful that the Plexus Innovation Lab will continue supporting these efforts, prepping students to take on internships and full-time positions within their respective fields."

ECE faculty member Chris Middlebrook headed the laboratory project for Michigan Tech, ensuring the space and equipment meet the needs of students.



"Thanks to this generous donation from the Plexus Corporation, our students now have the incredible opportunity to enhance and expand their educational experience through the use of our new Plexus Innovation Lab," said Middlebrook. "The Plexus team has been actively engaged in the planning and execution of the creation of an electronics makerspace, demonstrating their steadfast investment in the Michigan Tech community."

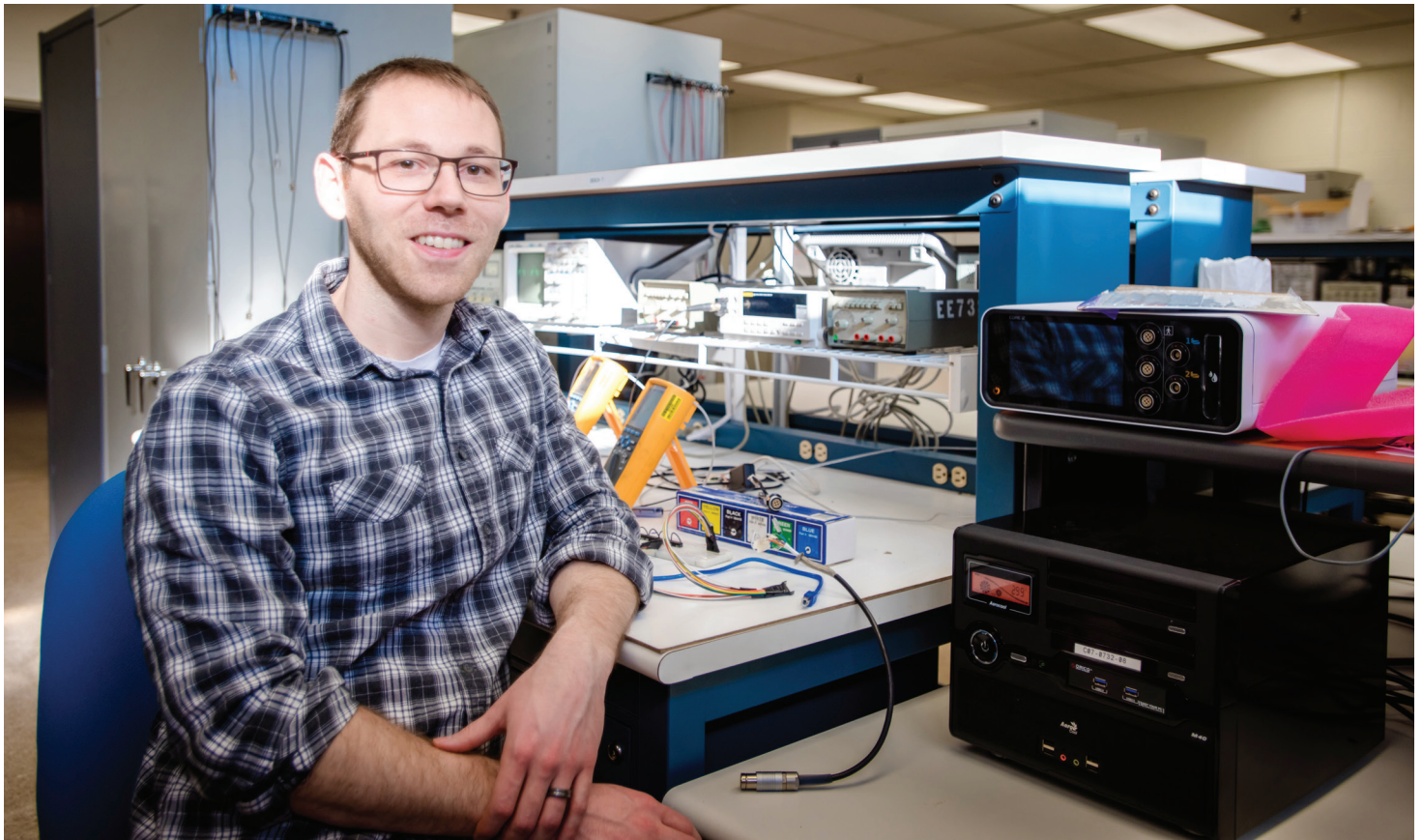
"Plexus is proud to expand our partnership with Michigan Tech through our sponsorship of the Plexus Innovation Lab," said Mike Running, senior vice president of global engineering solutions and aftermarket services at Plexus. "The investment in this lab creates a space for students to gain hands-on electronics experience and develop the problem-solving skills and innovative thinking necessary to aid in creating products that build a better world."

The Plexus Innovation Lab is one of several corporate partnerships on campus. To learn more, contact **Glen Archer** at [gearcher@mtu.edu](mailto:gearcher@mtu.edu) or 906-487-2789.



# ▶ FACULTY PROFILE

## Tony Pinar



As a coordinator for Michigan Tech's Senior Design program, ECE lecturer Tony Pinar mentors students working on the final big design project of their senior year.

"My favorite time of the academic year is the second half of the spring semester," he said. "Student projects begin to come together, and their hard work is more tangibly exhibited when they can show it off in in-person demos."

Senior Design is more like a first job than a last class, and many projects are sponsored by industry. In 2020, the COVID-19 pandemic threw a wrench into team plans when MTU moved all instruction remote in March, while students were on spring break.

"Of all the chaos and various impacts that resulted from the switch to remote instruction, this was perhaps the most heartbreaking for me," Pinar said. "So many hardworking teams were just about to cross the finish line, but after spring break the finish line was effectively moved miles away."

"Most teams have found ways to efficiently interact and make progress remotely," he continued. "Some continue to develop hardware and test it in the laboratory—while observing social distancing guidelines—and other teams have software-based projects that don't require bench space."

Pinar expects software-based projects like these to be more prevalent post-COVID, specifically for computer engineering students.

"So far students have had great success on these projects, despite working totally remotely," he said. "I think this helps the students prepare for the future when they will likely be working on a large project with many peers, some of whom may not even be in the same country."

Pinar described the spring 2020 pivot to remote instruction as "difficult."

"Luckily the students were forgiving," he said. "I caught my stride after a few weeks and I think it actually made my courses better."

"In a classroom setting it is easy to explain expectations, how the course will flow, what kind of assignments to expect, etc.," he explained. "But remotely, it is inevitable that students will encounter pieces of the course they may not have been briefed about. This forces me, as the instructor, to make the online component as clear and intuitive as possible. This is something I think will improve my courses even after we return to face-to-face classes."

▶▶ So far students have had great success on these projects, despite working totally remotely. ▶▶

# FACULTY PUBLICATIONS

## Journal Articles and Selected Conference Publications

PN.D. Spike, T. Boal, D. Chopp, A. Kurup, J. Rice, **J.P. Bos**, and D. Robinette, "Model Based Development of Autonomous Vehicle Controls and Sensing in a Student Design Competition," *SAE Technical Papers*, 2020.

E. Hedayati and **J.P. Bos**, "Modeling Standard Plenoptic Camera by an Equivalent Camera Array," *Optical Engineering*, vol. 59, no. 7, article 73101, 2020.

S. Hajmohammadi, **S.V. Nooshabadi**, **G.E. Archer**, **J.P. Bos**, and A. Struther, "Parallel Hybrid Bispectrum-Multi-Frame Blind Deconvolution Image Reconstruction Technique," *Journal of Real-Time Image Processing*, vol. 16, no. 4, pp. 919-929, 2019.

J. Naglak, C. Greene, C. Majhor, N. Spike, **J.P. Bos**, and W.W. Weaver, "Autonomous Power Grid Formation for Surface Assets Using Multiple Unmanned Ground Vehicles," *2020 IEEE Aerospace Conf.*, pp.1-8, 2020.

**J.P. Bos**, D. Chopp, A. Kurup, and N. Spike, "Autonomy at the End of the Earth: An Inclement Weather Autonomous Driving Data Set," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 1141507, 2020.

S. Kysar, **J.P. Bos**, and P. Young, "C-SLAM: Six Degree of Freedom Point Cloud Mapping for Any Environment (Conf. Presentation)," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 114150E, 2020.

S. More and **J.P. Bos**, "Comparing Machine Learning and Neural Network-Based Approaches for Sign Detection and Classification in Autonomous Vehicles," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 114150H, 2020.

**J.P. Bos** and S. More, "Comparing Machine Learning and Neural Network-Based Approaches for Sign Detection and Classification in Autonomous Vehicles (Conf. Presentation)," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 114150H, 2020.

D.J. Chopp, N. Spike, **J.P. Bos**, and D. Robinette, "Multi Point Pure Pursuit," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 1141505, 2020.

C. Greene, J. Naglak, C. Majhor, **J.P. Bos**, and W.W. Weaver, "Near Field Wireless Power Transfer via Robotic Feedback Control," *2020 IEEE Aerospace Conf.*, pp. 1-7, 2020.

C.D. Majhor, J.E. Naglak, C.S. Greene, W.W. Weaver, and **J.P. Bos**, "Recharging of Distributed Loads via Schedule Optimization with Autonomous Mobile Energy Assets," *2020 IEEE Aerospace Conf.*, pp. 1-9, 2020.

J.R. Beck and **J.P. Bos**, "Saturation of Anisoplanatic Error over Slant Paths through Non-Kolmogorov Turbulence," *Laser Communication and Propagation through the Atmosphere and Oceans IX*, vol. 11506, article 115060N, 2020.

A. Kurup, S. Kysar, Sam, and **J.P. Bos**, "SVM Based Sensor Fusion for Improved Terrain Classification," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 114150G, 2020.

P. Young, S. Kysar, and **J.P. Bos**, "Unreal as a Simulation Environment for Offroad Autonomy," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, vol. 11415, article 114150F, 2020.

**J.P. Bos**, "Anisoplanatic Differential Tilt Measurements in the 2009 Laser Communications System Experiment," *Propagation Through and Characterization of Atmospheric and Oceanic Phenomena*, article PW4C-4, 2019.

J. Beck and **J.P. Bos**, "Differential Tilt-Variance in the Michigan Tech Laser Communication System Experiment Data," *Laser Communication and Propagation through the Atmosphere and Oceans VIII*, vol. 11133, article 111330G, 2019.

S. Kysar, D.J. Chopp, A.M. Kurup, J. Rice, **J.P. Bos**, and D. Robinette, "Localization and Mapping Performance of Two LiDAR Systems in Unstructured Environments," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2019*, vol. 11009, article 110090L, 2019.

**J.P. Bos**, "Point-Spread Correlations in Blind Deconvolution of Long-Range, Horizontal Path, Light-Field Imagery," *Laser Communication and Propagation through the Atmosphere and Oceans VIII*, vol. 11133, article 111330U, 2019.

N. Spike, **J.P. Bos**, J.E. Beard, and D. Robinette, "Wheel Alignment Effects on Autonomous Vehicle Control vs. Human Driver in Simulation," *Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2019*, vol. 11009, article 110090C, 2019.

B. Zhou, **J.B. Burl**, and A. Rezaei, "Equivalent Consumption Minimization Strategy with Consideration of Battery Aging for Hybrid Electric Vehicles," *IEEE Access*, 2020.

B. Zhou, **J.B. Burl**, and A. Rezaei, "Effect of Battery Temperature on Fuel Economy and Battery Aging when Using Equivalent Consumption Minimization Strategy for Hybrid Electric Vehicles," *SAE Technical Papers*, March 2020.

C. Cao, Z. Wu, and **B. Chen**, "Electric Vehicle-Grid Integration with Voltage Regulation in Radial Distribution Networks," *Energies*, vol. 13, no. 7, April 2020.

M. Cheng and **B. Chen**, "Nonlinear Model Predictive Control of a Power-Split Hybrid Electric Vehicle with Consideration of Battery Aging," *Journal of Dynamic Systems, Measurement and Control*, vol. 141, no. 8, August 2019.

L. Wang and **B. Chen**, "Distributed Control for Large-Scale Plug-in Electric Vehicle Charging with A Consensus Algorithm," *Intl. Journal of Electrical Power and Energy Systems*, vol. 109, pp. 369-383, July 2019.

J. Oncken, J. Orlando, P. Bhat, B. Narodzonek, C. Morgan, D. Robinette, **B. Chen**, and J. Naber, "A Connected Controls and Optimization System for Vehicle Dynamics and Powertrain Operation on a Light-Duty Plug-In Multi-Mode Hybrid Electric Vehicle," April 2020.

Z. Wu, C. Cao, and **B. Chen**, "Transactive Energy Based Approach for Large-Scale Plug-In Electric Vehicle Charging Control," *2019 IEEE PES Asia-Pacific Power and Energy Engineering Conf.*, December 2019.

X. Wang, A. Khameneian, P. Dice, **B. Chen**, M. Shahbakhti, J.D. Naber, C. Archer, Q. Qu, C. Glugla, and G. Huberts, "Control-Oriented Model-Based Burn Duration and Ignition Timing Prediction with Recursive-Least-Square Adaptation for Closed-Loop Combustion Phasing

# FACULTY PUBLICATIONS

Control of Spark-Ignition Engines," *ASME 2019 Dynamic Systems and Control Conf.*, October 2019.

P.K. Bhat, J. Oncken, and **B. Chen**, "Generation of Optimal Velocity Trajectory for Real-Time Predictive Control of a Multi-Mode PHEV," *2019 IEEE 90th Vehicular Technology Conf.: VTC2019-Fall*, September 2019.

H. Wang, J. Oncken, and **B. Chen**, "Receding Horizon Control for Mode Selection and Powertrain Control of a Multi-Mode Hybrid Electric Vehicle," *2019 IEEE 90th Vehicular Technology Conf.: VTC2019-Fall*, September 2019.

X. Wang, A. Khameneian, P. Dice, **B. Chen**, M. Shahbakhti, J.D. Mahdi, C. Archer, Chad, Q. Qu, C. Glugla, and G. Huberts, "Model-Based Combustion Duration and Ignition Timing Prediction for Combustion Phasing Control of a Spark-Ignition Engine Using In-Cylinder Pressure Sensors," *2019 ASME/IEEE Intl. Conf. on Mechatronic and Embedded Systems and Applications*, August 2019.

S.R. Devaragudi and **B. Chen**, "MPC-Based Control of Autonomous Vehicles with Localized Path Planning for Obstacle Avoidance under Uncertainties," *2019 ASME/IEEE Intl. Conf. on Mechatronic and Embedded Systems and Applications*, August 2019.

C. Cao, **B. Chen**, and J.D. Harper, "The Hardware-in-the-Loop Simulation of Vehicle-Grid Integration in a Distribution Grid," *2019 IEEE Power & Energy Society General Meeting (PESGM)*, August 2019.

**C.T. Middlebrook**, "Electro-Optic Modulator, Microwave Photonic Link Including an Electro-Optic Modulator, and Method of Communicating a Signal with an Electro-Optic Modulator," copyright no. 10,345,674.

C.L. Schelly and **J.M. Pearce**, "Bridging the Social and Environmental Dimensions of Global Sustainability in STEM Education with Additive Manufacturing," *Integrating 3D Printing into Teaching and Learning, Brill Sense*, pp. 155-172, 2019.

**J.M. Pearce**, "A Review of Open Source Ventilators for COVID-19 and Future Pandemics," *F1000Research*, vol. 9, 2020.

I.T. Heikkinen, G. Marin, N. Bihari, C. Ekstrum, P.J. Mayville, Y. Fei, Y.H. Hu, M. Karppinen, H. Savin, and **J.M. Pearce**, "Atomic Layer Deposited Aluminum Oxide Mitigates Outgassing from Fused Filament Fabrication-Based 3-D Printed Components," *Surface and Coatings Technology*, vol. 386, article 125459, 2020.

B.R. Hubbard and **J.M. Pearce**, "Conversion of Self-Contained Breathing Apparatus Mask to Open Source Powered Air-Purifying Particulate Respirator for Fire Fighter COVID-19 Response," 2020.

B.V. Mohan, J. Mayandi, J.M. Pearce, K. Muniyasamy, and V. Veerapandy, "Demonstration of a Simple Encapsulation Technique for Prototype Silicon Solar Cells," *Materials Letters*, article 128028, 2020.

**J.M. Pearce**, "Distributed Manufacturing of Open Source Medical Hardware for Pandemics," *Journal of Manufacturing and Materials Processing*, vol. 4, no. 2, pp. 49, 2020.

**J.M. Pearce**, "Energy Conservation with Open Source Ad Blockers," *Technologies*, vol. 8, no. 2, pp. 18, 2020.

C.L. Schelly, D. Bessette, K. Brosemer, V.S. Gagnon, K.L. Arola, A.P. Fiss, **J.M. Pearce**, and K.E. Halvorsen, "Energy Policy for Energy Sovereignty: Can Policy Tools Enhance Energy Sovereignty?" *Solar Energy*, vol. 205, pp. 109-112, 2020.

D.C. Denkenberger, M.J. Brandemuehl, J. Zhai, and **J.M. Pearce**, "Finite Difference Heat Exchanger Model: Flow Maldistribution with Thermal Coupling," *Heat Transfer Engineering*, pp. 1-15, 2020.

C. Heise and **J.M. Pearce**, "From Open Access to Open Science: The Path From Scientific Reality to Open Scientific Communication," *SAGE Open*, vol. 10, no. 2, article 2158244020915900, 2020.

**J.M. Pearce**, "Limiting Liability with Positioning to Minimize Negative Health Effects of Cellular Phone Towers," *Environmental Research*, vol. 181, article 108845, 2020.

A. Alexandre, F.A. Cruz Sanchez, H. Boudaoud, M. Camargo, and **J.M. Pearce**, "Mechanical Properties of Direct Waste Printing of Polylactic Acid with Universal Pellets Extruder: Comparison to Fused Filament Fabrication on Open-Source Desktop Three-Dimensional Printers," *3D Printing and Additive Manufacturing*, 2020.

A.L. Petsiuk and **J.M. Pearce**, "Open Source Computer Vision-Based Layer-Wise 3D Printing Analysis," 2020.

B.R. Hubbard and **J.M. Pearce**, "Open Source Digitally Replicable Lab-Grade Scales," 2020.

N.G. Skrzypczak, N.G. Tanikella, and **J.M. Pearce**, "Open Source High-Temperature RepRap for 3-D Printing Heat-Sterilizable PPE and Other Applications," 2020.

B. Savonen, J.K. Gershenson, J.K. Bow, and **J.M. Pearce**, "Open-Source Three-Dimensional Printable Infant Clubfoot Brace," *Journal of Prosthetics and Orthotics*, vol. 32, no. 2, pp. 149-158, 2020.

N. Gallup, A.M. Pringle, S. Oberloier, N.G. Tanikella, and **J.M. Pearce**, "Parametric Nasopharyngeal Swab for Sampling COVID-19 and Other Respiratory Viruses: Open Source Design, SLA 3-D Printing and UV Curing System," 2020.

F.A. Cruz Sanchez, H. Boudaoud, M. Camargo, and **J.M. Pearce**, "Plastic Recycling in Additive Manufacturing: A Systematic Literature Review and Opportunities for the Circular Economy," *Journal of Cleaner Production*, article 121602, 2020.

A. Kulkarni, G.D. Soraru, and **J.M. Pearce**, "Polymer-Derived SiOC Replica of Material Extrusion-Based 3-D Printed Plastics," *Additive Manufacturing*, vol. 32, article 100988, 2020.

T.K. Meyer, N.G. Tanikella, M.J. Reich, and **J.M. Pearce**, "Potential of Distributed Recycling from Hybrid Manufacturing of 3-D Printing and Injection Molding of Stamp Sand and Acrylonitrile Styrene Acrylate Waste Composite," *Sustainable Materials and Technologies*, article e00169, 2020.

A. Petsiuk, N.G. Tanikella, S. Dertinger, A. Pringle, S. Oberloier, and **J.M. Pearce**, "RepRapable Automated Open Source Bag Valve Mask-Based Ventilator," 2020.

K.A. Alvarado, A. Mill, Aron, **J.M. Pearce**, A. Vocaet, and D. Denkenberger, "Scaling of Greenhouse Crop Production in Low Sunlight Scenarios," *Science of The Total Environment*, vol. 707, article 136012, 2020.

S.C. Dertinger, N. Gallup, N.G. Tanikella, M. Grasso, S. Vahid, P.J. Foot, and **J.M. Pearce**, "Technical Pathways for Distributed Recycling of Polymer Composites for Distributed Manufacturing: Windshield Wiper Blades," *Resources, Conservation and Recycling*, vol. 157, article 104810, 2020.

# FACULTY PUBLICATIONS

T.B. Peffley and **J.M. Pearce**, "The Potential for Grid Defection of Small and Medium Sized Enterprises Using Solar Photovoltaic, Battery and Generator Hybrid Systems," *Renewable Energy*, vol. 148, pp. 193-204, 2020.

I.T.S. Heikkinen, H. Savin, J. Partanen, J. Seppala, and **J.M. Pearce**, "Towards National Policy for Open Source Hardware Research: The Case of Finland," *Technological Forecasting and Social Change*, vol. 155, article 119986, 2020.

T.P. Pasanen, G. von Gastrow, I.T.S. Heikkinen, V. Vahanissi, H. Savin, and **J.M. Pearce**, "Compatibility of 3-D Printed Devices in Cleanroom Environments for Semiconductor Processing," *Materials Science in Semiconductor Processing*, vol. 89, pp. 59-67, 2019.

J.M. Pearce and E. Prehoda, "Could 79 People Solarize the US Electric Grid?" *Societies*, vol. 9, no. 1, pp. 26, 2019.

N. Jovanovic, **J.M. Pearce**, and J. Praks, "Design and Testing of a Low-Cost, Open Source, 3-D Printed Air-Bearing-Based Attitude Simulator for CubeSat Satellites," *Journal of Small Satellites*, vol. 8, no. 2, pp. 859, 2019.

R. Selvapriya, J. Mayandi, V. Ragavendran, V. Sasirekha, J. Vinodhini, and **J.M. Pearce**, "Dual Morphology Titanium Dioxide for Dye Sensitized Solar Cells," *Ceramics International*, vol. 45, no. 6, pp. 7268-7277, 2019.

A.A. Adesanya and **J.M. Pearce**, "Economic Viability of Captive Off-Grid Solar Photovoltaic and Diesel Hybrid Energy Systems for the Nigerian Private Sector," *Renewable and Sustainable Energy Reviews*, vol. 14, article 109348, 2019.

J. Vinodhini, J. Mayandi, R. Atchudan, P. Jayabal, V. Sasirekha, and **J.M. Pearce**, "Effect of Microwave Power Irradiation on TiO<sub>2</sub> Nano-Structures and Binder Free Paste Screen Printed Dye Sensitized Solar Cells," *Ceramics International*, vol. 45, no. 4, pp. 4667-4673, 2019.

D. Denkenberger, **J.M. Pearce**, A.R. Taylor, and R. Black, "Food Without Sun: Price and Life-Saving Potential," *Foresight*, vol. 21, no. 1, pp. 118-129, 2019.

C. Heise and **J.M. Pearce**, "From Open Access to Open Science: The Path from Scientific Reality to Open Scientific Communication," 2019.

D.J. Byard, A.L. Woern, R.B. Oakley, M.J. Fiedler, S.L. Snabes, and **J.M. Pearce**, "Green Fab Lab Applications of Large-Area Waste Polymer-Based Additive Manufacturing," *Additive Manufacturing*, vol. 27, pp. 515-525, 2019.

R. Venkatesan, J. Mayandi, **J.M. Pearce**, and V. Venkatachalapathy, "Influence of Metal Assisted Chemical Etching Time Period on Mesoporous Structure in As-Cut Upgraded Metallurgical Grade Silicon for Solar Cell Application," *Journal of Materials Science: Materials in Electronics*, vol. 30, no. 9, pp. 8676-8685, 2019.

A.R. Taylor, D. Denkenberger, and **J.M. Pearce**, "Integrative Risk Management for Abrupt Catastrophes Destroying 10%-20% of Global Food Supply," 2019.

A.L. Petsiuk and **J.M. Pearce**, "Low-Cost Open Source Ultrasound-Sensing Based Navigational Support for the Visually Impaired," *Sensors*, vol. 19, no. 17, pp. 3783, 2019.

K. Chen, J. Zha, F. Hu, X. Ye, S. Zou, V. Vahanissi, **J.M. Pearce**, H. Savin, and X. Su, "MACE Nano-Texture Process Applicable for Both Single- and Multi-Crystalline Diamond-Wire Sawn Si Solar Cells," *Solar Energy Materials and Solar Cells*, vol. 191, pp. 1-8, 2019.

M.J. Reich, A.L. Woern, N.G. Tanikella, and **J.M. Pearce**, "Mechanical Properties and Applications of Recycled Polycarbonate Particle Material Extrusion-Based Additive Manufacturing," *Materials*, vol. 12, no. 10, pp. 1642, 2019.

L. Azzouz, Y. Chen, M. Zarrelli, **J.M. Pearce**, L. Mitchell, G. Ren, and M. Grasso, "Mechanical Properties of 3-D Printed Truss-Like Lattice Biopolymer Non-Stochastic Structures for Sandwich Panels with Natural Fibre Composite Skins," *Composite Structures*, vol. 213, pp. 220-230, 2019.

N. Kretzschmar, S. Lipponen, V. Klar, **J.M. Pearce**, T.L. Ranger, J. Seppala, and J. Partanen, "Mechanical Properties of Ultraviolet-Assisted Paste Extrusion and Postextrusion Ultraviolet-Curing of Three-Dimensional Printed Biocomposites," *3D Printing and Additive Manufacturing*, vol. 6, no. 3, pp. 127-137, 2019.

S.S. Sule, A.L. Petsiuk, and **J.M. Pearce**, "Open Source Completely 3-D Printable Centrifuge," *Instruments*, vol. 3, no. 2, pp. 30, 2019.

A. Ravindran, S. Scsavnicki, W. Nelson, P. Gorecki, J. Franz, S. Oberloier, T.K. Meyer, A.R. Barnard, and **J.M. Pearce**, "Open Source Waste Plastic Granulator," *Technologies*, vol. 7, no. 4, pp. 74, 2019.

E. Prehoda, **J.M. Pearce**, and C.L. Schelly, "Policies to Overcome Barriers for Renewable Energy Distributed Generation: A Case Study of Utility Structure and Regulatory Regimes in Michigan," *Energies*, vol. 12, no. 4, pp. 674, 2019.

**J.M. Pearce**, M. Khaksari, and D. Denkenberger, "Preliminary Automated Determination of Edibility of Alternative Foods: Non-Targeted Screening for Toxins in Red Maple Leaf Concentrate," *Plants*, vol. 8, no. 5, pp. 110, 2019.

M. Sadatgol, N. Bihari, **J.M. Pearce**, and D. Guney, "Scalable Honeycomb Top Contact to Increase the Light Absorption and Reduce the Series Resistance of Thin Film Solar Cells," *Optical Materials Express*, vol. 9, no. 1, pp. 256-268, 2019.

D.R. Shonnard, E. Tiplado, V. Thompson, **J.M. Pearce**, G.T. Caneba, and R.M. Handler, "Systems Analysis for PET and Olefin Polymers in a Circular Economy," *Procedia CIRP*, vol. 80, pp. 602-606, 2019.

**J.M. Pearce**, "Towards Quantifiable Metrics Warranting Industry-Wide Corporate Death Penalties," *Social Sciences*, vol. 8, no. 2, pp. 62, 2019.

V. Klar, **J.M. Pearce**, P. Karki, and P. Kuosmanen, "Ystruder: Open Source Multifunction Extruder with Sensing and Monitoring Capabilities," *HardwareX*, vol. 6, article e00080, 2019.

D. Riley, L. Burnham, B. Walker, and **J.M. Pearce**, "Differences in Snow Shedding in Photovoltaic Systems with Framed and Frameless Modules," *2019 IEEE 46th Photovoltaic Specialists Conf.*, pp. 0558-0561, 2019.

L. Burnham, D. Riley, B. Walker, and **J.M. Pearce**, "Performance of Bifacial Photovoltaic Modules on a Dual-Axis Tracker in a High-Latitude, High-Albedo Environment," *2019 IEEE 46th Photovoltaic Specialists Conf.*, 2019.



## Ashok Ambardar

The Department would like to honor associate professor Ashok Ambardar, who retired in 2020 at the beginning of the 2020-21 academic year. Ambardar began educating electrical engineers at Michigan Tech in 1976, shortly after earning his PhD in Electrical Engineering from the University of Wyoming. It was the same year the “new building” (now the Electrical Energy Resources Center) was opened. “With all elevators working!” he noted. He made assistant professor in 1978.

Ambardar wrote four books during his 44-year academic career, primarily on analog and digital signal processing, including *Digital Signal Processing: A Modern Introduction* and *DSP Concepts using MATLAB*. He also authored 16 refereed journal articles and eight invited presentations.

Only three people in the history of Michigan Tech’s Distinguished Teaching Academy Award have won it twice at two different levels—once as an assistant professor and once as an associate or full professor. One of them is Ambardar, who, in a feat that surprises absolutely no one at all, demonstrated such excellence in teaching over such a long period that he won his two awards 16 years apart—in 1983 and

1999. He was named Eta Kappa Nu (HKN) Professor of the Year “several times.” (He won enough times that he asked not to be listed on the ballot anymore.)

Ambardar leaves a lasting impact on the Department. As Kit Cischke remarked at the Department’s virtual graduation reception in December, “While many of us as faculty still use notes to ensure we stay on track during our lectures, Dr. Ambardar would simply walk in with his coffee mug, start writing on the board, and off you went. At the end of 50 minutes, he had filled up the board and the students’ heads. One of my own guiding principles for exams came from him: If I can do it in 15 minutes, you can do it in an hour.”

Cischke finished by highlighting some of Ambardar’s favorite sayings. “It’s fitting to let him have the last word on himself,” said Cischke. “This man considers himself dangerous, possesses arms—two of them—and may not be pacified without the use of special treats. Approach with caution and always carry a stick or big bar—preferably dark chocolate, studded with almonds.”

## ▶ STAFF PROFILE



▶▶ My favorite thing is calibration—trying to keep the lab instruments up to specs. I also do quite a bit of purchasing for Senior Design, Enterprise, faculty and lab supplies, and equipment. ▶▶

### Chuck Sannes

Chuck Sannes is the Department’s laboratory supervisor, a position he has held for almost 11 years. He earned a BS in Electrical Engineering in 1988 and has been with Michigan Tech for 17 years in two spans—from 1993 to 2000, and 2010 to 2020.

Prior to his current position, he spent three years as an electronic assembler, three years as an electronic technician, 15 years as an electrical/design engineer, and almost seven years as a research associate.

Sannes enjoys working with students to enhance the practical side of electrical engineering. “My favorite thing is calibration—trying to keep the lab instruments up to specs,” he said. “I also do quite a bit of purchasing for Senior Design, Enterprise, faculty and lab supplies, and equipment.” He likes the challenge of debugging instruments when they are not working properly, too.

From Sannes’s view, COVID-19 has been a challenge. “Because in many of our labs the hands-on experience with circuits and equipment is very important,” he said.

Lab work has continued thanks to changes in seating, extra sanitization, and technology.

“Most of our labs are set up for one person per bench. That has helped with social distancing,” said Sannes. “We provide supplies for the students to sanitize the bench and equipment as they enter and before they leave the labs.”

“Another challenge is in social distancing [with] the teaching assistants when they need to help a student troubleshoot the circuits, setups or code,” he added. “We have provided webcams on each bench so the student can screen share with the TA and they can view the circuits, setups, and code remotely.”

Outside of Michigan Tech, Sannes enjoys spending time with his family—he and his wife have three daughters and eight grandchildren. He and his wife are also proud to work as mentors at Life Outreach of Houghton and Baraga Counties, helping provide young parents with information and experience on pregnancy, child care, and development.

# STAFF HIGHLIGHTS

## New Staff



**Liz Fujita** is the Department's CpE undergraduate advisor and outreach specialist. In her role, she is committed to student support, success, and mentorship. She also manages, coordinates, and develops outreach and recruitment efforts, including Michigan Tech Summer Youth Programs (SYP), the Admissions Open House, Preview Day, text campaigns, local workshops, developing virtual workshops, and writing grants to support outreach efforts.

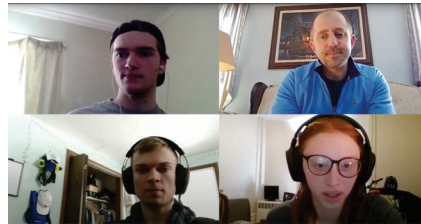
"I advise our computer engineering undergraduate students, helping with everything from schedules to co-op planning to general success," said Fujita. "I find the phase of life that college students are in to be dynamic, challenging, rewarding, and complex."

Fujita is a proud Huskies alumna, graduating in 2012 with dual bachelor's degrees in mathematical sciences and social sciences. She received her EdM in Education Policy, Organization, and Leadership from the University of Illinois Urbana-Champaign in 2019.

Prior to joining ECE, she was an assistant director for the Michigan Tech Center for Educational Outreach, working as part of the team that manages programs like SYP, Mind Trekkers, and local college access programming efforts. She has served on MTU's Reading as Inquiry selection committee, Leading Scholars selection committee, and Diversity Council. As a lover of all things trivia, she is also the staff advisor to the Quiz Bowl student organization.

Fujita describes herself as an avid reader, podcast listener, and board game enthusiast, as well as a "backyard chicken keeper, veggie gardener, runner, and novice-but-enthusiastic mountain biker." She lives in Chassell, Michigan, with partner Nathan Miller and three cats.

## Student Outreach During COVID-19



The Department's outreach efforts pivoted to a digital format for spring 2020. Virtual tour videos allowed student engagement on Preview Day, and ECE student ambassadors

assisted with Admissions texting campaigns and met with prospective Huskies on Zoom.

"During such a tumultuous time, we are glad to have been able to chat with prospective students even when on-campus visits were not taking place," said Liz Fujita, CpE undergraduate advisor and outreach specialist.

The Department also worked to build outreach events specifically for the virtual environment. "Blue Marble Security Enterprise piloted an all-remote programming workshop using the MIT App Inventor to teach students foundational app development skills," said Fujita. "After the first run with students from Dollar Bay-Tamarack City Area Schools, ECE secured a grant from the Michigan Space Grant Consortium to purchase technology to run that virtual workshop in the future."

"The first program was far from polished," she added. "But it laid groundwork for ongoing efforts, including increased access to the devices needed for students to successfully complete the activities."

The Department also restructured its Summer Youth Programs (SYP) curriculum from the ground up for an online atmosphere. "This enabled us to participate as one of the pilot departments for VYP—Virtual Youth Programs—run through the Center for Educational Outreach," Fujita explained. "Students received boxes containing everything they needed to learn about basic electronic components—breadboards, resistors, LEDs—introductory programming with an Arduino board, and a handheld photonics experiment."

## Staff Directory

<b>Judy Burl</b>	ECE Undergraduate Advisor	<b>Chito Kendrick</b>	Managing Director, Microfabrication Facility
<b>Liz Fujita</b>	CpE Undergraduate Advisor and Outreach Specialist	<b>John Pakkala</b>	Graduate Academic Advisor
<b>Michael Goldsworthy</b>	Research Associate (joint with School of Technology)	<b>Chuck Sannes</b>	Laboratory Supervisor
<b>Alexandra Holmstrom</b>	Administrative Aide/ Graduate Program Coordinator	<b>Mark Sloat</b>	Research Associate
<b>Michele Kamppinen</b>	Staff Assistant	<b>Maryann Wilcox</b>	Office Manager/ Technical Communications Specialist

# GRADUATE STUDENT AWARDS

## ECE Fellowships 2019-20

### Ian Cummings

National Science Foundation Graduate Research Fellowship Program

### James Davis

Earl R. & Ellanette F. Lind Memorial Endowed Fellowship

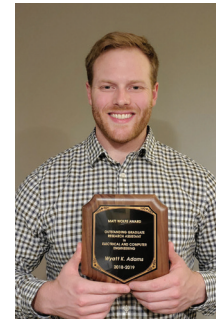
### Shane Oberloier

Earl R. & Ellanette F. Lind Memorial Endowed Fellowship



### James Davis

2019 Jonathan Bara Award for Outstanding Graduate Teaching Assistant



### Wyatt Adams

2019 Matt Wolfe Award for Outstanding Graduate Research Assistant

## ECE Doctoral Degrees: Summer 2019 to Spring 2020

PhD Graduate	Advisor(s)	Program	Dissertation Title
Wyatt Adams	Durdu Guney	Electrical Engineering	Enhancing the Resolution of Imaging Systems by Spatial Spectrum Manipulation
Chong Cao	Bo Chen	Electrical Engineering	Study of Electric Vehicle Charging Strategies and Energy Management in Power Distribution Systems
Ian Cummings	Timothy Havens and Timothy Schulz	Electrical Engineering	Aperture-Level Simultaneous Transmit and Receive (STAR) with Digital Phased Arrays
Elizaveta Egorova	Bruce Mork and Jeffrey Burl	Electrical Engineering	Development of the Coil Volume Method for Time-Domain Simulation of Internal Faults in Transformers
Omkar Javeri	Soner Onder	Electrical Engineering	Demand-Driven Execution Using Future Gated Single Assignment Form
Khalid Khan	Chee-Wooi Ten and Lucia Gauchia Babe	Electrical Engineering	Lithium-Ion Battery Degradation Evaluation Through Bayesian Network Method for Residential Energy Storage Systems
Wensheng Sun	Zhaohui Wang	Electrical Engineering	Online Learning of the Spatial-Temporal Channel Variation in Underwater Acoustic Communication Networks
Hemanth Kumar Vempala	Bruce Mork	Computer Engineering	Advancements in Time-Domain Modeling of Power System Disturbances



# HUSKY

## Michigan Tech

### Brings Learning Home with Husky Bites

"Craving some brain food? Join College of Engineering Dean Janet Callahan and a special guest at 6 p.m. (EDT) each Monday for a new, 20-minute interactive Zoom webinar, followed by Q&A," reads the inaugural announcement for Husky Bites, a series of free interactive Zoom programs debuted by Michigan Tech's College of Engineering in May 2020 in response to the pandemic and widespread stay-at-home orders.

Each family-friendly session is BYOC (bring your own curiosity) and features a new topic presented by Michigan Tech faculty volunteers—who weave in a bit of their own personal journey to engineering, too. ECE lecturer and researcher **Tony Pinar** presented on June 22 with a session titled "How Do Machines Learn?"

"Machine learning has become a popular tool in the digital world," says Pinar. "For people outside the field, it seems almost magical that a machine could learn."

Machine-learning algorithms do indeed "learn," though the process is not as

glamorous as many people think. And not only that, says Pinar, they can be fooled. In "How Do Machines Learn?" he demystified machine learning for students and showed them how it's done.

"Machine learning is actually a subfield of AI, or artificial intelligence," says Pinar. "That's a buzz word for simulating intelligence with a machine."

Machine learning, he explained, is a collection of algorithms, biologically inspired neural networks, that allow a computer to learn properties from observations, often with the goal of prediction.

"One pretty common misconception is that AI and machine learning are new," he says. "While the field has made leaps in the last few decades, some aspects of machine learning were developed in the 1800s, probably by Gauss." Carl Friedrich Gauss, the German mathematician, is considered to be one of the greatest mathematicians of all time.

Pinar's own research interests are in applied machine learning and data fusion. "It is exciting to me to watch the cutting edge move forward, see what sticks and what doesn't, and observe how the directions of the field evolve," he says. "It's also rewarding to work on open-ended and novel problems that are in their infancy and at the cutting edge of today's technology."

"Often, the strongest solutions to be found are multidisciplinary, where people from many different fields work on the same problem," he adds.

The Husky Bites series features engineers from multiple fields across the College of Engineering.

"We created Husky Bites for anyone who likes to learn, across the universe," said Callahan, who cohosts each session with the faculty presenter. "Everyone is welcome, and bound to learn something new. We are hoping entire families will enjoy it."

Every Monday at 6 p.m.

# BITES

Free 20-minute Interactive  
Zoom Webinars

Hosted by  
**Dean Janet Callahan**



zoom

Although Husky Bites sessions were initially planned to run only from May 2020 into August 2020, the series has been so well received, it has been continued—and ECE's **Jeremy Bos, Joshua Pearce, Paul Bergstrom, Chee-Wooi Ten, Tim Schulz,** and **Kit Cischke** have been featured as presenters. Links to video sessions from fall 2020 and spring 2021 are available on the Husky Bites website at [mtu.edu/huskybites](https://mtu.edu/huskybites)

“ Often, the strongest solutions to be found are multidisciplinary, where people from many different fields work on the same problem. ”

## Husky Bites topics include:

- Space, Satellites, and Students
- Shipwrecks and Underwater Robots
- A Quieter Future (Acoustics)
- Through the Looking Glass! Geospatial Wizardry
- Color-Changing Potions and Magical Microbes
- Scrubbing Water—How and Why?
- Hey, There's Materials Science and Engineering in Your Golf Bag!
- Biomedical Engineering the Future
- How Do Machines Learn?
- What's Next After FIRST Robotics?
- Control Systems—Math in Motion

# ECE Undergrad Paige Fiet: First IPC Board of Directors Student Member Liaison



Michigan Tech electrical engineering undergraduate student **Paige Fiet** was elected to serve as the first student member liaison on the IPC Board of Directors in June 2020, and is also the recipient of a \$1,000 scholarship from the IPC Education Foundation (IPCEF).

Fiet is the president of the IPC & Electronics Student Chapter at Michigan Tech, which is advised by Chris Middlebrook. She is a summer employee at Calumet Electronics in Calumet, Michigan.

As student member liaison, Fiet will attend all board meetings, and her position includes a full voting board seat. She will serve until December 2021.



In a press release, IPC said the student member liaison position was created in response to increased student member involvement in IPC and the potential for student members, as the emerging workforce, to influence workforce development. The nomination/election process was developed with input from IPC Student Chapter advisors, and every IPC Student Chapter member was eligible to vote.

"We discovered that our IPC student members are eager to learn more about the industry and to engage with IPC member companies to understand the skills needed to get a job," said IPC President and CEO John Mitchell in the release. "What better way to understand the student experience and to connect to our next generation of engineers than to add a full voting board seat for an IPC Student Chapter member? We are very excited to welcome Paige to the IPC Board of Directors."

Fiet was also quoted: "It is an honor for me to have been chosen and I feel like I will get invaluable experience and insight into the inner workings of IPC," she said. "I hope to convey the needs of the students to the Board of Directors. I also intend to learn how to better reach the IPC Student Chapter members and show them how involvement with IPC can benefit them."

Fiet's \$1,000 scholarship is one of 25 awarded by the foundation to IPC student members in 2020. According to IPCEF, the awards' intent is "not only to reduce the financial burden, but also to encourage students to enhance their knowledge and skills of real-world industry-related experiences."

In response, Fiet thanked the foundation. "I've been involved with IPC for the past year and have been impressed by their work in the industry as well as with students such as myself," she said.

 This scholarship is going to help me continue my journey towards my undergraduate degree in electrical engineering. I plan to continue my studies at Michigan Tech in the electrical engineering program with an anticipated graduation in December of 2021. 

# SENIOR DESIGN



Larry Kennedy Industry Innovation Award Winner: EMP Mitigation Testing Senior Design Team. Pictured (from left): Chris Bousho, team advisor John Lukowski, Darin Shillair, Joshua Romanowski, Alexander Kellogg, Jacob Phelan, and Addison Waege. The team was sponsored by Systems Control of Iron Mountain, Michigan.

## 2019-20 Senior Design Teams

Project	Sponsor	Advisor
<b>Low-Cost Underwater Acoustic Modem:</b> Develop an affordable, modular underwater acoustic modem.	ECE Department	Tony Pinar
<b>Future Vehicle Stopping:</b> Explores technologies to stop and disable military ground vehicles without harming occupants.	SERC	John Lukowski
<b>Snap Ring Packaging Improvement:</b> Design an automatic detangling mechanism for fasteners during manufacturing and assembly.	Hugo Benzing	Trever Hassell
<b>Cell Signal Measuring Tool:</b> Develop a cellular signal measurement tool to aid technicians in the placement of antennas.	ITC Holdings	John Lukowski
<b>Ground Force Commander Simulator:</b> Develop a mobile application for training ground force commanders remotely.	SERC	Tony Pinar
<b>EMP Testing of Electrical Equipment Enclosures/Buildings:</b> Develop standard and testing procedure for evaluating EMP susceptibility in buildings and enclosures.	Systems Control	John Lukowski
<b>Development of a Hardware-in-the-Loop Simulator:</b> Develop a PLC hardware-in-the-loop simulator for the design and development of custom injection molding machines.	Roberts Sinto	Trever Hassell
<b>SICK Lidar Challenge:</b> Propose and develop a proof of concept for identifying road markings that need repainting based on reflectivity measured with a SICK lidar unit.	ECE Department	Tony Pinar
<b>Smart Pet Door:</b> Design a "smart" pet door that unlocks for household pets and prevents unwanted animals from entering.	ECE Department	Trever Hassell

## Blue Marble Security Enterprise 2019-20 Advisor: Glen Archer

Project	Sponsor
Oshkosh Baja Suspension	Oshkosh Corporation
ArcelorMittal Predictive of Steel Galvanizing Line	ArcelorMittal
GM Cost Effective Pickpoint	General Motors
Deringer-Ney Slip Ring	Deringer-Ney
Autobot	–
Outreach	–

## Wireless Communication Enterprise 2019-20 Advisor: Kit Cischke

Project	Sponsor
<b>Bluetooth Speaker:</b> Build a Bluetooth speaker from scratch.	ECE Department
<b>Ford Smart Home:</b> Develop a home energy dashboard and energy storage system.	Ford Motor Company
<b>Ford Smart Charge:</b> Develop a more efficient way to charge electric vehicles at multivehicle charging kiosks.	Ford Motor Company
<b>RFID Antenna Testing:</b> Test a variety of antennas inside an appliance to determine which gets the best reception.	Whirlpool
<b>SIMPA:</b> Build a mini power grid for use while regular power grid is down.	ECE Department
<b>Steel Coil Quality Monitoring:</b> Monitor the quality of steel coils on the pickling line at a plant.	ArcelorMittal
<b>Smart Office:</b> Use RFID tags to set chair height and other desk preferences.	ECE Department
<b>Sweet Sound:</b> Design a user-friendly and inexpensive DSP in a loudspeaker design project with the Visual and Performing Arts program at Michigan Tech.	ECE Department
<b>LED Fan Display:</b> Motor control, display encoding, and power distribution for displaying an image on a rotating fan blade.	ECE Department

## Robotic Systems Enterprise 2019-20 Advisor: Jeremy Bos

Project	Sponsor
<b>SAE AutoDrive Challenge:</b> Build, design, and document a Level 4 autonomous vehicle system over four years.	General Motors/SAE



Jonathon Beute, project lead for the VISSION subteam for Prometheus Borealis of the Robotic Systems Enterprise, sits with “Borealis Prime” on campus after a stellar performance at the virtual AutoDrive Challenge year three competition. The VISSION subteam placed second in the Social Responsibility category after submitting written standards for accessible autonomous vehicles for vision- and hearing-impaired individuals. The VISSION subteam’s project for year four entails using the car’s camera to detect lane lines, traffic signs, and other road markers.

## AutoDrive Challenge 2020

**Michigan Tech’s Team Prometheus Borealis** placed second overall in the third AutoDrive Challenge year-end competition with an overall score of 810 points out of 1,000 possible.

Originally slated to be held at the Transportation Research Center in East Liberty, Ohio, the competition was instead held virtually because of the COVID-19 pandemic. Prometheus Borealis won trophies in four of six categories, placing second in Social Responsibility Report, Social Responsibility Event, and Concept Design Report, and third in Concept Design Event.

The fourth AutoDrive Challenge competition is scheduled for June 2021 at the Mcity Test Facility in Ann Arbor, Michigan.

## IT Oxygen Enterprise 2019-20 Advisors: Nagesh Hatti (ECE), James Walker (Computer Science)

### Project

**Medical Transportation Scheduling and Management System (Phase II):**  
Complete hardware installation and refine current medical transportation scheduling and management system.

### Sponsor

Little Brothers Friends of the Elderly

### X-Box Project:

Create an app that will serve as an advertisement for the Enterprise team.

Microsoft

# ▶ UNDERGRADUATE STUDENT AWARDS



**Katy Lichy**  
2020 Carl S. Schjonberg Outstanding Undergraduate Student



**Andrew Bratton**  
2020 Departmental Scholar



**Samantha Fincannon**  
2020 ECE Woman of Promise

## External Advisory Committee

The goal of the External Advisory Committee is to ensure the ECE academic program aligns with industry to produce graduates with skills desired by today's companies. Each year at their spring meeting, the EAC members—volunteers from many different industries—observe ECE's Senior Design and Enterprise team presentations and poster displays. They select the team showing the highest level of project management, applied engineering, and application to industry to receive the Larry Kennedy Industry Innovation Award.

**Dave Aho**  
Eaton

**Rob Cooke**  
Calumet Electronics

**Ken Leisenring**  
Ford Motor Company

**David Rowe**  
Systems Control

**Ellen Bauman**  
IBM

**Ben Galloway**  
Dematic

**Bill Lepak**  
ArcelorMittal

**Nathan Saliga**  
FCA

**Keith Behnke**  
Stryker

**Brett Giem**  
FCA

**Nick Luther**  
Plexus

**Nirmal Singh**  
DTE Energy

**Scott Blecke**  
Great Lakes Energy

**Gordie Halt**  
ITC Transco

**Steve Mathe**  
Harris

**Jeff Wells**  
Frontier

**Kim Cannon**  
Plexus

**Steve Kennell**  
FMTCS

**Heidi Mueller**  
Ford Motor Company

**Craig Zinser**  
General Motors

**Brent Carlson**  
3M Engineering

**Kurt LaFrance**  
CMS Energy

**Tim Obermann**  
Milwaukee Tool

**Tony Champagne**  
Nexteer

**Eric Larson**  
3M

**Dave Perry**  
Retired

## Remembering Roger Kieckhafer

By Glen Archer, Principal Lecturer and Interim Chair



Associate Professor Roger Kieckhafer was an inventor, engineer, researcher, educator, veteran, and valued faculty member at Michigan Technological University. He died July 17, 2020, in a tragic vehicle-bicycle accident. He was 69.

The loss to the faculty and staff in the Department of Electrical and Computer Engineering and the College of Engineering is immense. We will not recover quickly from the shock of his death.

Roger received his bachelor's degree in nuclear engineering from the University of Wisconsin-Madison in 1974 and earned his master's and PhD in electrical engineering from Cornell University in 1982 and 1983, respectively. The years between were spent in service to the US Navy as a nuclear officer aboard the Trident missile submarine *USS Abraham Lincoln*. He also supervised the construction of the *USS Indianapolis*. Roger's time in industry was well spent, producing several patents that were licensed to Allied Signal, now Honeywell Corporation.

Roger was fond of classical music, particularly opera, and sang in the Copper Country Chorale, often accompanied by his daughter Maggie

on organ. He also sang in the prestigious Pine Mountain Music Festival, including the premiere of the opera *Rockland*, based on the story of the 1906 miner strike in Rockland, Michigan.

Roger was instrumental in creating the computer engineering degree program at Michigan Tech. Working with Linda Ott, chair of the Department of Computer Science, which at that time was part of the College of Sciences and Arts, he bridged the gap between two departments in two separate colleges, crafting a program that educated hundreds—a new breed of engineer steeped in both worlds.

Even after the development of the computer engineering program, Roger's collaboration with the Department of Computer Science continued.

In the words of computer engineering faculty member Kit Cischke: "For Roger, it always boiled down to what was best for our students. The content of our classes. The things our students needed to know to get good jobs. The assignments. The kinds of things they needed to do in the real world. Students were forever contacting Roger after graduation, saying, 'Thanks for teaching me that. I'm using it every day in my job.'"

In the days following his death, Roger's former students reached out to express their grief and sadness. They shared how much Roger meant to them during their time at Michigan Tech and how well he prepared them for the success they enjoy today. One of those students was Joseph Rabaut. "I can't tell you how devastated I am," he said. "Dr. Kieckhafer was an amazing person and one of the

Roger cared deeply for his students, his family, and his profession. That may be a source of comfort we can draw on in our sadness and grief. The impact he had on hundreds of lives will shine on.

"We worked together on a strategic hiring initiative, multiple curricular issues, reorganization discussions and countless other issues," said Ott. "Roger was always supportive. He clearly believed that we would have stronger programs working together rather than competing."

Roger was a strong advocate for the ABET accreditation process in the ECE Department. He led the initial ABET accreditation of the computer engineering program. The procedures and processes he set in place then are still in play nearly 20 years later, guiding the Department's subsequent accreditation for both its electrical engineering and computer engineering degrees.

best professors at Tech. He helped me a lot throughout the past few years, giving me advice and recommendations, and helping me understand computer engineering. I don't really know what else to say, because words can't really describe losing him."

Roger cared deeply for his students, his family, and his profession. That may be a source of comfort we can draw on in our sadness and grief. The impact he had on hundreds of lives will shine on.

As suggested by several people, a scholarship fund will be set up in Roger's memory.

# CONTRACTS AND GRANTS

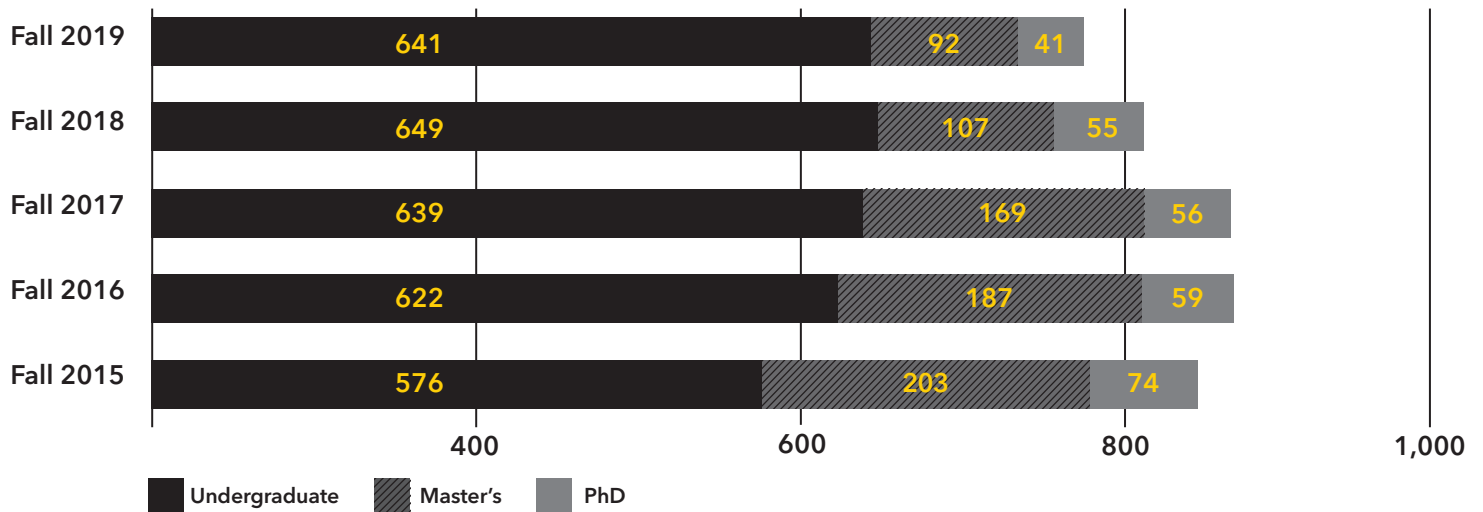
Engineering research and development are key to technological progress and economic revitalization, and the ECE Department at Michigan Tech is busy doing its part. Our faculty, graduate students, and undergraduates work together in modern, well-equipped laboratories to bring practical solutions to real-world 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 are always looking for new opportunities that are well matched to the interest and expertise of our faculty.

## ECE Contracts and Grants Awarded: Fiscal Year 2020, July 2019 to June 2020

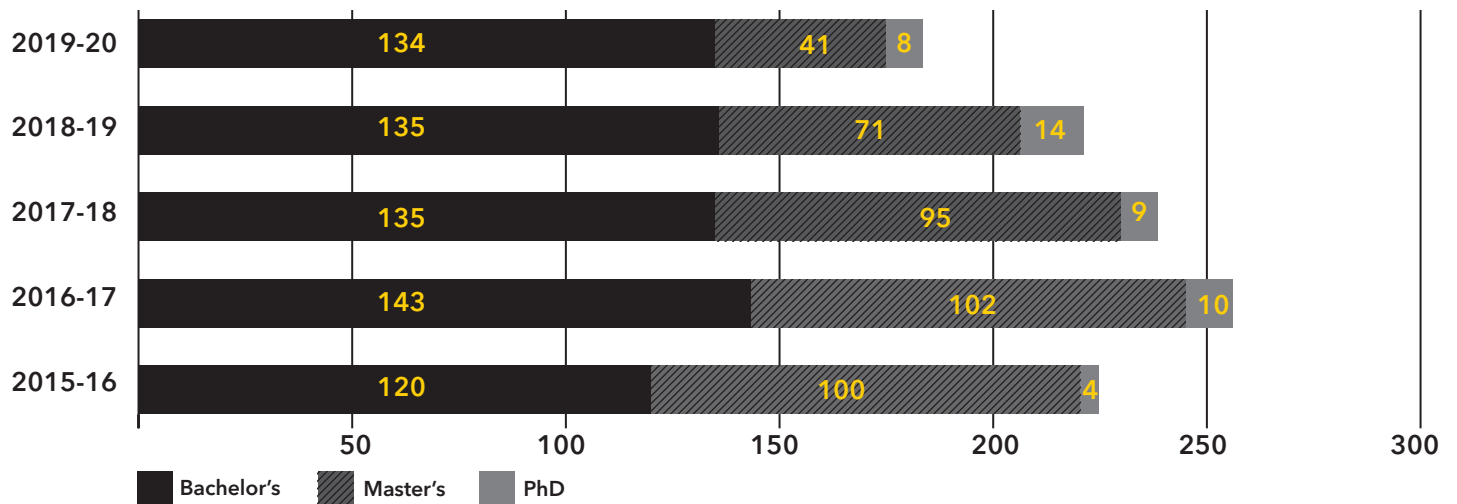
Title	PI Name	Sponsor	Award
CAREER: An Ecologically Inspired Approach to Battery Lifetime Analysis and Testing	Lucia Gauchia Babe	National Science Foundation	\$7,800
Power System Protection in a Smartgrid Perspective-Prosmart	Bruce Mork	Norwegian University of Science and Technology	\$34,843
Senior Design: Snap Ring Packaging Improvement	Tony Pinar	Hugo Benzing LLC	\$17,500
Enterprise: Slip Ring Test Bed Proof of Concept	Glen Archer	Deringer-Ney Inc.	\$17,500
Enterprise: Smart Home Energy Management System (SHEMS) Interface-For Global Data Insight Analytics (Ford GDI&A)	Glen Archer	Ford Motor Company	\$15,000
Enterprise: Phase IV-Smart Charging EV App Development	Christopher Cischke	Ford Motor Company	\$15,000
Enterprise: Phase II SHEMS Interface	Christopher Cischke	Ford Motor Company	\$15,000
Discovery of Signatures Anomalies and Precursors in Synchrophasar Data with Matrix Profile and Deep Recurrent Neural Networks	Chee-Wooi Ten	University of California	\$99,732
Clearview Spotter Scope	Michael Roggemann	Kestrel Corp.	\$199,972
Senior Design: Development of a PLC Hardware-in-the-Loop Simulator	Tony Pinar	Roberts Sinto Corp.	\$17,500
Machine Learning for Human-Based Visual Detection Metrics	Timothy Havens	Signature Research Inc.	\$120,000
ProDig-Power System Protection and Control in Digital Substations	Bruce Mork	Norwegian University of Science and Technology	\$422,859
Senior Design: SERC Ground Force Commander Simulator	Tony Pinar	Stevens Institute of Technology	\$5,000
Enterprise: Oshkosh Baja LCV Suspension Design-Phase III	Glen Archer	Oshkosh Defense LLC	\$8,500
Senior Design: SERC Future Vehicle Stopping	Tony Pinar	Stevens Institute of Technology	\$5,000
Enterprise: REID Antenna Development for a Laundry Machine	Christopher Cischke	Whirlpool Corporation	\$8,625
Enterprise: Robot Leader Follower	Jeremy Bos	National Center for the Advancement of STEM Education	\$10,000
Consulting for Utilities on Risk Management	Chee-Wooi Ten	Protect Our Power	\$25,000
NPT-03/04: Localization Tracking and Classification of On-Ice Underwater Noise Sources Using Machine Learning	Timothy Havens	US Department of Defense	\$99,792
Robust Terrain Identification and Path Planning for Autonomous Ground Vehicles in Unstructured Environments	Jeremy Bos	University of Michigan	\$100,038
Senior Design: Develop Electro-Magnetic Pulse Mitigation Testing For Electrical Equipment Enclosure Buildings	John Lukowski	Systems Control Inc.	\$17,500
Michigan Tech Electrical Engineering Outreach Program for Pre-College Students to Build Early Interest in STEM Areas	Glen Archer	"University of Michigan/ Michigan Space Grant Consortium"	\$10,000
Increasing Student Interest in STEM Through Use of the AMJOCH Observatory Located at Michigan Tech	Christopher Middlebrook	"University of Michigan/ Michigan Space Grant Consortium"	\$3,000
Meta-Stability of Pulsed Load Microgrids	Wayne Weaver	Sandia National Laboratories/ US Department of Defense	\$37,400
Power Electronics Design Integration and Component Selection for AquaHarmonics Inc 1:7 Scale Wave Energy Converter Device	Wayne Weaver	AquaHarmonics Inc./ US Department of Energy	\$60,000
Real-Time Simulator for Advanced Energy Network Planning Optimization and Control	Wayne Weaver	US Department of Defense	\$200,000

# DEPARTMENT STATISTICS

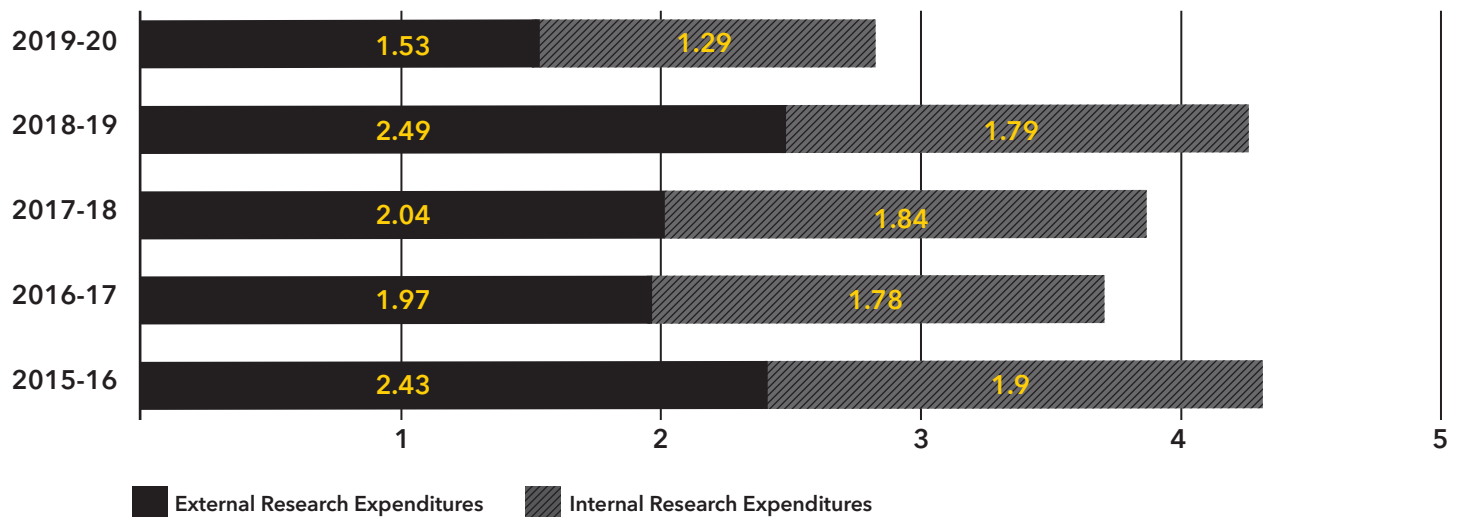
## ECE Enrollment



## ECE Degrees Awarded



## ECE Research and Sponsored Programs (Expenditures in Millions)



## Electrical and Computer Engineering

---

Michigan Technological University  
1400 Townsend Drive  
Houghton, MI 49931-1295



**An opportunity to give back**

Support the electrical and computer engineers of tomorrow with a gift to the Michigan Tech ECE Department. Your generosity improves individual lives and helps build innovative programs that give our students an advantage. All gifts, large and small, are important to the Department.

**Tomorrow needs engineers. Tomorrow needs Michigan Tech.**

[mtu.edu/ece/department/giving](https://mtu.edu/ece/department/giving)



**Michigan  
Technological  
University**

Michigan Technological University is an Equal Opportunity Educational Institution/Equal Opportunity Employer that provides equal opportunity for all, including protected veterans and individuals with disabilities. 350710521