Electrical, Computer, and Systems Engineering

ECSE

Department of Electrical, Computer, and Systems Engineering
at Rensselaer Polytechnic Institute

ECSE.RPI.EDU

Celebrating 200 Years of Legacy and the Road Ahead

It has been a memorable year celebrating the RPI Bicentennial! There was a big party during the Reunion Weekend in late September with a Ferris wheel, food trucks, and a drone show welcoming alumni, campus, and the community. Many ECSE alumni returned to celebrate the occasion with us. It is also a good time to appreciate and reflect on the history of ECSE. The Electrical Engineering program at RPI was founded in 1907. Since then, our graduates have contributed to the digital revolution that has impacted every aspect of our lives – from microprocessors and digital cameras to power transistors and power grids, and now onto AI and quantum computing. To educate the next generation of innovators, we are renewing our faculty and staff, updating our curriculum, providing new facilities, and connecting our students with industry and alumni.

The Mercer XLab, endowed by Doug Mercer '77, is a fantastic resource for students to tinker and explore. Its renovation was completed in September 2024. The Grand Re-opening of this beautiful facility was celebrated with a ribbon-cutting, lab tours, a student project showcase, and a panel discussion on the "Future of Common Sense" moderated by the Mercer XLab inaugural director Shayla Sawyer. Students can access well-equipped benchtop space and multi-layer PCB printers, receive training from other students, and compete for the Golden Hammer Award in the Take It-Break It-Make It Contest! Student clubs are using the Mercer XLab Clubhouse to meet, brainstorm, and socialize.

RPI's IBM Quantum System One was unveiled in April. Every RPI student, staff, and faculty can now access this state-of-the-art machine, the first on a university campus. ECSE offers two quantum-related courses: Quantum Electronic Devices and Applications by Alex Patterson and Quantum Computer Programming by Zhiding Liang (with Computer Science). ECSE students are also active in the Quantum Computing Club.

We continue to lead the semiconductor curriculum and workforce development efforts at RPI. James Lu works with experts from major semiconductor companies to regularly offer two industry-focused courses on semiconductor manufacturing to students from multiple departments. These courses anchor our new Master in Semiconductor Technologies (MaST) degree, approved by the New York State Education Department this year. RPI also partners with HVCC for the RPI-HVCC Semiconductor Scholar program to create a student pipeline.

With our emphasis on hands-on experience and collaboration with industry, it is no surprise that RPI and ECSE students are highly sought after by industry. To help recruit their talents, companies are setting up annual industry scholar awards to recognize student achievements and encourage them to apply for internship and co-op opportunities. The Constellation Energy Student Award recognizes outstanding students with interests in power engineering, and the GlobalFoundries Semiconductor

John Wen
Russell Sage Professor and Department Head
Electrical, Computer, and Systems Engineering

Scholar Award recognizes outstanding students with interests in semiconductor technologies.

It is always gratifying to hear the impact of ECSE on our alumni. In my interview with Reid Wiseman '97, the commander of the NASA Artemis II mission, he reminisced about George Nagy's course on Computer Organization and Logic Design (COLD) and why he brought the COLD textbook with him during his deployment on a carrier. In a memorable recent talk given by Nick Donofrio '67, he mentioned the impact of Prof. Jose (Pepe) Borrego when he was an undergraduate EE student. In the celebration of the Dean's Faculty Fellow supported by Rich Felak '66, '67 and his wife Joan, Rich highlighted the impact of Prof. Eric T.B. Gross on his education and career. Three ECSE graduates, Nick Miller '79, '80, George Pappas '91, '92, and Kiruba Sivasubramaniam Haran '97, '00, were inducted as members of the 2024 Class of the National Academy of Engineering (NAE). ECSE alumnus B. Jayant Baliga '71, '74 is the 2024 winner of the prestigious Millennium Prize, recognizing his leadership in the invention, development, and commercialization of the Insulated Gate Bipolar Transistor (IGBT).

ECSE students and faculty continue to garner recognition this year: Rich Radke won the 2024 IEEE Signal Processing Society Regional Distinguished Teacher Award and is a co-winner of the 2024 William H. Wiley 1866 Distinguished Faculty Award. Luigi Vanfretti was awarded the Invited Professorship by École Centrale de Lyon and was a Visiting Scholar at the University of Calgary. Ali Tajer won the School of Engineering Research Excellence Award. Michael Shur was named a Distinguished Lecturer by the IEEE Sensors Council 2025-2027. John Wen was recognized in the 2024 Class of ARM Champions. Multiple ECSE students received awards for their research, including the Best Student Paper at Power Systems and Electrical Technology (PSET), the Best Paper Award at Dominion Energy, the Belsky Award, and the Grainger Power Engineering Award.

In the coming year, we are gearing up for the first phase of the ADRoIT (Autonomous Drone and Robotics Innovation Technologies) Lab by renovating the '87 gym pool area. This is a joint effort with the Department of Mechanical, Aerospace, and Nuclear Engineering (MANE) and will benefit the growing research and education activities in robotics and autonomy at RPI. The Mercer XLab will continue to grow and engage more students, both from ECSE and beyond. We will have our ABET accreditation visit in fall 2025 to highlight our efforts to continuously improve our pedagogical approaches and strengthen student learning. RPI has a long legacy of working closely with industry and contributing to the benefit of society. We would like to call on all ECSE alumni to help with student engagement and advising, curriculum input, and collaborative research.

Mercer XLab Grand Renovation Opening Celebration

The Douglas A. Mercer '77 Innovation and Exploration Laboratory (Mercer XLab) officially re-opened on September 25, 2024, after a year-long renovation. The ribbon-cutting ceremony was followed by a student project showcase and a panel discussion.

Doug Mercer was inspired by hands-on tinkering when he was a student almost 50 years ago. He wanted to provide today's RPI students with tools, space, and mentorship to explore, learn, and create. Doug Mercer endowed the initial Mercer Lab in ECSE more than a decade ago. Prof. Mona Hella guided the lab for the first ten years into a significant resource for the department's research and education. In 2022, Doug Mercer provided an additional endowment to expand the facility into the Mercer XLab, with the goal to accelerate innovation in pedagogy and mu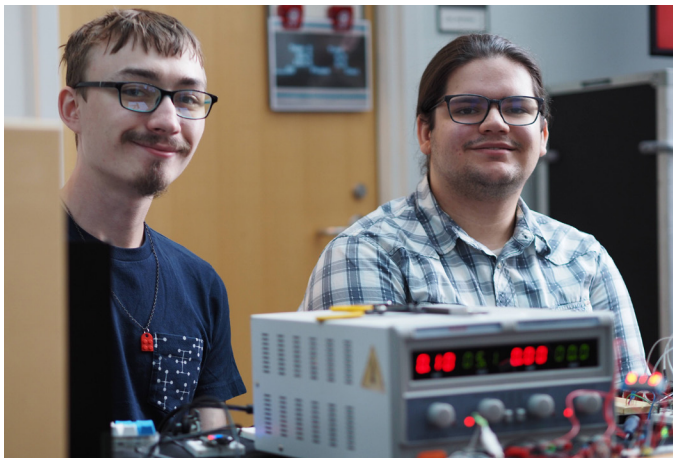ltiply learning opportunities. After a major redesign and renovation, the expanded Mercer XLab has more than doubled the space, consisting of the main lab space, the student club space, and the Take-It/Break-It/Make-It Lab. The main lab space has multiple reconfigurable workbenches. Each workbench has a soldering station, power supply, oscilloscope, and function generator. The student club space has multiple whiteboards, display monitors, and storage lockers. The T-B-M Lab has a fume hood and testing equipment for students to safely take apart, test, and re-engineer electronic devices. The Mercer XLab will be staffed by students and supervised by ECSE faculty and staff. The complete list of Mercer XLab facilities and partnership opportunities can be found at the Mercer XLab Partnership page.

The Mercer XLab Ribbon-Cutting was preceded by short speeches by President Marty Schmidt, Doug Mercer, Dean of Engineering Shekhar Garde, and the Mercer XLab inaugural

director Shayla Sawyer. Following the ribbon-cutting ceremony, multiple student clubs and project demonstrations filled the CBIS Atrium to showcase their creativity and their enthusiasm for the Mercer XLab.

The celebration was capped off with a stimulating panel discussion entitled "What is the future of Common Sense?" moderated by Shayla Sawyer. The panelists included:

• Amitava 'Babi' Mitra, Founding Executive Director, New Engineering Education Transformation (NEET), MIT.

• Christine Looser, Senior Director of Solution Design at Minerva Project, Associate Professor at Minerva University.

• Sean Austin, CEO and Founder, Helios.

• May Lee, Chief Strategy Officer for Institutional Impact, RPI.

Rensselaer Polytechnic Institute Develops New Courses in Semiconductors in Partnership With Industry

With the CHIPS and Science Act, the United States' commitment to becoming a global leader in semiconductor manufacturing once again was formalized. After the recent global chips shortage, combined with the pervasiveness of chips in our everyday products from refrigerators, to cars, to watches, it is now a national priority to ensure that semiconductors are produced domestically for economic and security reasons.

Rensselaer Polytechnic Institute is committed to educating the next generation of semiconductor experts. Building upon its 200-year history in technological education, Rensselaer is partnering with leaders in the semiconductor industry to offer curricula tailored to workforce needs.

In Rensselaer's latest offering this fall, James Lu, Ph.D., professor and curriculum chair in electrical, computer, and systems engineering (ECSE), enlisted the help of 23 leading industry experts from 10 semiconductor companies to co-teach Topics in Advanced Materials, Metrology, and Equipment for Semiconductor Manufacturing.

"There has been much interest in this class," said Lu. "Students at any university or community college rarely, if ever, have the opportunity to learn about the technological advancements in

materials, metrology, equipment, automation, data analytics, and infrastructures that enable semiconductor manufacturing."

Technical leaders from industry-leading companies and organizations such as IBM, Applied Materials, ASML, Tokyo Electron, DuPont, Entegris, GlobalFoundries, Screen, SUNY UAlbany CNSE, and more, together with Lu, bridge some of the academia-industry gaps by teaching students these critical skills and knowledge and sharing their first-hand, real-world experience, all of which the semiconductor industry urgently needs.

"About 70 students specializing in a broad range of engineering disciplines are participating. Half of the students are graduates and half are undergraduates. It is unusual for a topics course to have such a high enrollment with such a diverse student body. I expect that this collaboration will become another model for academia-industry collaboration in Education and Workforce Development (EWD) that can be scaled nationally," said Lu.

This course comes on the heels of Topics in Microelectronics Manufacturing, which was first offered in the spring. It was co-taught by Lu and a team of 11 leading industry experts from

GlobalFoundries, and it was received overwhelmingly positively by students. Additionally, GlobalFoundries lecturers were impressed by the high quality of student work and how much they learned.

"These new semiconductor manufacturing courses at Rensselaer represent the union of academia and industry to address real-world needs," said Shekhar Garde, Ph.D., dean of Rensselaer's School of Engineering. "Our ability to return semiconductor manufacturing to the United States hinges on the development of the engineering talent needed to sustain and elevate the industry. We look forward to these courses serving as models that can be scaled nationally to meet that need."

The new course offerings are a result of Rensselaer's participation in the American Semiconductor Innovation Coalition (ASIC), which comprises over 200 corporations, academic institutions, national labs, and nonprofit organizations working toward increasing domestic semiconductor manufacturing, establishing a secure supply chain, introducing next-generation technology efficiently, and ensuring workforce needs are met now and in the future. It has been estimated that the U.S. will need approximately 50,000 new semiconductor engineers and technicians in the next five years, a number that far exceeds current graduation rates nationwide.

"Academia-industry collaboration adds cutting-edge, real-world content to the fundamentals taught in core courses," said Dave Medeiros, senior director of engineering in the CTO Office at Entegris. "We hope that these courses inspire students to become the next generation of semiconductor manufacturing engineers so

Student Spotlight 💡
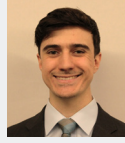
Gregory Daniel Matuck
B.S., May 2024

Major: Electrical Engineering with a Focus in Micro/Nano-electronics and Photonics

Work/Internship Experience: Intern in the Substation Design Department at Central Hudson, Electrical Engineer for US Army Futures Command at Watervliet Arsenal through the SMART scholarship from the Department of Defense.

Projects/Research: My capstone project at RPI was creating a prototype thermocouple welder for Dynamic Systems Inc. for use in tandem with their proprietary device known as the Gleeble. The new welder utilized a solenoid driven dropping mechanism instead of the old spring-loaded design, which improved the consistency of the spot weld placement.

My IED project, named "ModuRobu" was building a modular robot prototype for automating maintenance tasks such as lawn mowing and salt dispensing. The prototype was successfully built and the modularity aspect was achieved with inexperienced users being able to swap the modules within two minutes. Sensors were implemented for safety purposes as well as energy efficiency.

Additionally, through Dr. Lu's Semiconductor Fab Technologies I was a part of a team that tested our own YOLOv8 model for single wafer defect detection. Through this course my team was invited to present our findings with this machine learning application at GlobalFoundries.

Future Plans: Fulfill my service commitment with the Department of Defense, and explore my interests in renewable energy, semiconductor manufacturing, and power systems.

Fun Facts About Me: I lived in Germany for almost 3 years and hiked the Zugspitze there. I play in a band and am a songwriter.

they can use these skills to strengthen the semiconductor industry in the United States. Their advanced skills will make them highly sought-after talent by companies across the country."

In a class assessment, students agreed that the academia-industry collaboration was successful and beneficial, and the vast majority plan to pursue careers in the microelectronics industry. These two courses are just the beginning: Rensselaer is also developing a series of curricula and programs, including concentrations, minors, certificates, master's degrees, short courses and workshops, training for working professionals, and more to enhance its already robust offerings in micro and nanoelectronics.

ECSE Student Organizations

The ECSE department is home to a variety of active student organizations that organize social and professional development events throughout the year. We asked several organizations to tell us about themselves in their own words.


The **ECSE Undergraduate Student Council** is a new initiative launched last year aiming to build community within the department. Elected by the ECSE student body, we serve as the students' voice in discussions with department faculty. Additionally, we organize a variety of social and academic events, forging connections between students. Last Spring, in collaboration with the ECSE Graduate Student Council, we organized a department-wide ice skating event. As finals season approached, we worked with professors to put on a massive study session for core ECSE courses. The Undergraduate council has had success in engaging the department and we are excited to continue this work in the coming semester! We have made great steps in building the department's community, and we look forward to advancing this effort.

The **ECSE Graduate Student Council** works to create a sense of community within the ECSE graduate program. This work primarily involves organizing social events and activities throughout the semester, such as a Halloween costume party. We also work to increase graduate student success by hosting informational sessions on succeeding at various milestones in the graduate program, such as the RQE (Research Qualifying Exam). Additionally, we help communicate graduate students' issues and concerns to the department. This year, we also began coordinating events with the Undergraduate Student Council to create a broader sense of community in the ECSE department, culminating in an ECSE ice skating event. We look forward to similar events in the future.

At the **RPI Robotics Club** our goal is to inspire young roboticists. We do so by providing a creative space for students to explore different fields of robotics. In the past year, we achieved this by hosting five different projects for students to experiment with: Laser Tag Robot, Robotic Art Installation, Robotic Arm, Driving Couch, and NHRL Combat Robotics. With each of these projects, students explored various implementations of mechanical design, electronics development, and software integration for different applications of robotics. In addition, we hosted events that connect our students with industry professionals and Ph.D. researchers, including a seminar series with Ph.D. students that showcased various applications of robotics, and explored how the students pursued their passions. At the end of seminars, our members network with the speakers to gain more knowledge and build valuable connections. In the future, we hope to continue our current efforts while providing more ways for students to learn about and explore their interests in robotics!
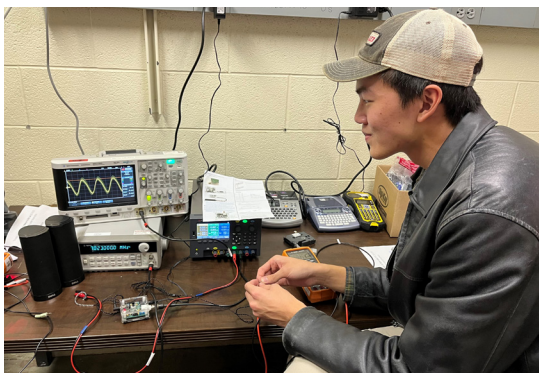
The **W2SZ Amateur Radio Club** enjoyed a banner year in 2024, with membership numbers soaring to new heights. Our airwaves buzzed with activity as we engaged in a Chess-Over-the-Air tournament with other colleges, hosted hands-on radio and antenna-building workshops, and maintained regular radio nets for on-air meetups. The club's innovative spirit shone through with exciting projects like ammo can radio systems and radio firmware hacking. The crowning achievement of our year was undoubtedly the inaugural "Flea at RPI" electronics flea market in April. This ambitious event drew nearly 200 technology enthusiasts from both the campus and local community, showcasing W2SZ's commitment to technological innovation and community engagement. Looking ahead, W2SZ remains dedicated to pushing the boundaries of our technical capabilities, strengthening community ties, and introducing the captivating world of amateur radio to even more RPI students.

The **IEEE Electronics Packaging Society (EPS)** is a technical society within IEEE committed to advancing the manufacturing and design of microsystems packaging. Our mission is to give students the knowledge, tools, and community they need to thrive in our field and the semiconductor industry at large. We offer hands-on skill development so students can learn and practice the tool sets used in leading companies, and we host networking events that connect them with professionals from academia and industry. We also arrange opportunities to visit cutting-edge semiconductor facilities in the Capital Region, offering an inside look at the technologies driving our field. Whether you're already focused on semiconductors or simply exploring your options, no matter your major, EPS is the society for you!

Student Spotlight

Shu-Wei (Wendy) Chen
B.S., Spring 2025

Major: Electrical Engineering and Computer & Systems Engineering (dual)

Minor: Economics

Work/Internship Experience: I was a Test Engineer at Amazon Robotics Manufacturing while on co-op in Fall 2024. I worked on upgrading and validating test systems for the autonomous "Hercules" robots used in Amazon fulfillment centers to improve their accuracy and efficiency.

Projects/Research: I worked in the LESA center on occupancy sensor development. In particular, I designed determination logic to resolve out-of-range distance errors in the small time-of-flight (ToF) sensors we use in the Smart Conference Room to detect people.

On-campus Activities/Organizations: I'm involved with the Engineering Ambassadors, a group of RPI engineering students devoted to inspiring younger students with what we've learned in our majors, technological breakthroughs, and real-world challenges. I'm also active in the Robotics Club, where we design robots and algorithms to make fun and interesting projects that students can contribute to and lead. Finally, I'm a member of the Tau Beta Pi Engineering Honor Society and participate in Women's Club Basketball.

Future Plans: I plan to pursue a Master's degree in Electrical Engineering and get some work/industrial experience in electronics and circuit design.

Fun Facts About Me: My favorite Studio Ghibli movie is *Totoro*!

The **Institute of Electrical and Electronics Engineers (IEEE)** is the world's largest professional organization dedicated to advancing technology for the benefit of humanity. IEEE @ RPI offers students access to a community of peers and connections to faculty and industry professionals who drive innovation in countless technical fields. In the past academic year, we successfully hosted two research socials and one mini-colloquium on the evolution of semiconductor technology. Building on this success, we aim to surpass our previous efforts in the upcoming academic year with an increase in both the number and quality of events, including educational workshops and networking opportunities. Also, our new IEEE Electronics Packaging Society will start its operations, focusing on educating students about the forefront of heterogeneous integration and facilitating connections with professionals in packaging and integrated circuit design. Through these initiatives, our organizations aim to serve as a bridge between student, researcher, and industry professional.

RPI and GlobalFoundries Partner on Semiconductor Workforce Development

Building on several ongoing collaborations, Rensselaer Polytechnic Institute (RPI) and GlobalFoundries (GF) are working together to further grow and strengthen the semiconductor workforce in the region.

RPI has launched a partnership program with GF to provide their employees with opportunities to pursue degrees and enhance their skills in semiconductor technology. Through dedicated RPI scholarships and GF's tuition assistance program, GF employees will be able to pursue a new Master of Science in Semiconductor Technology (MaST) degree and take part in other graduate programs including Rensselaer at Work certificates.

Under the expanded partnership, GF has pledged a gift totaling $150,000 over the next three years to sponsor RPI students who have a strong interest in the semiconductor industry, interwoven with an internship opportunity. The initiative aims to incentivize students to join the semiconductor industry.

"When industries and educational institutions seek ways to work together, great things happen," said Rebecca Doerge, Ph.D., provost at RPI. "This advancement of our ongoing partnership with GF further solidifies the Capital Region's preeminence as a hub of semiconductor research and manufacturing while addressing workforce development needs that are at the core of the CHIPS initiative."

"At GF, we are committed to fostering a diverse and skilled semiconductor workforce. Our partnership with RPI is a testament to our dedication to developing the next generation of innovators and leaders in the semiconductor industry," said Hui Peng Koh, vice president and general manager at GF in Malta, NY. "Together, we are creating opportunities that will drive technological advancements and strengthen the industry."

This expanded partnership builds upon GF and RPI's existing collaborative workforce development portfolio, which includes:

• Leveraging and expanding on the success of the collaboration between RPI and GF on unique industry-university courses focused on cutting-edge chips topics.

• Engaging RPI students in paid internships, co-ops, and job opportunities each year.

• Hosting students and faculty in the RPI-Hudson Valley Community College Semiconductor Scholars program at GF's Malta, New York facility.

• Collaborating on STEM outreach initiatives to K-12, community colleges, and beyond to enhance the semiconductor workforce pipeline.

In addition to investing in workforce development, GF and RPI plan to explore joint semiconductor research and work together to attract top researchers to lead these projects.

"RPI has a strong history of semiconductor research, education, and innovation. With the growing workforce demands of the chip industry in upstate New York, we are committed to developing and supporting new programs and partnerships with industry," said Shekhar Garde, Ph.D., dean of the RPI School of Engineering. "We have enjoyed a wonderful partnership with GF around workforce development and look forward to deepening our collaborations."

The RPI-GF initiative furthers regional and nationwide efforts to reshore semiconductor manufacturing in the United

States. According to a 2022 report from Deloitte, the global semiconductor industry is expected to surpass one trillion dollars in revenue by 2030. However, the industry faces a significant talent shortage, with more than one million additional skilled workers needed over the next six years.

Thanks to the CHIPS and Science Act of 2022, which aims to make the United States a leading chips manufacturer, universities, including RPI, and leading semiconductor companies like GF are preparing the workforce that will not only run semiconductor fabs but also innovate the essential chips of the future.

Advanced Power Electronics

ECSE-4963 | Taught by Zheyu Zhang

Advanced power electronics techniques and systems, as well as their modeling and applications. Topics include advanced power electronics converters with emerging wide bandgap power semiconductors, modeling and analysis, design and control, spectral and dynamic characteristics of pulse-width modulation, ac-dc converters with active power factor correction, soft-switching converters, and EMI filter design, as well as its applications on electric vehicles, more electric aircraft, and grids. Course assignments include projects involving simulation, analysis, and measurement.

Intro to Robot Programming

ECSE-4965 | Taught by Kimberly Oakes

This course provides an introduction to Robot Operating System (ROS), a widely used middleware for robot programming. Students will learn the basic components of ROS, how to utilize and write ROS packages, gain experience utilizing simulation software, and apply the concepts to physical platforms.

Intro To Quantum Electronic Devices

ECSE-4967 | Taught by Alex Patterson

As technologies based on quantum phenomena continue to proliferate, an understanding of the underlying physics of how these systems operate is critical for work in those fields. This course will begin by providing a foundation in the basic theory of quantum mechanics, such as the interpretation of wave functions, solutions to the Schrodinger equation for simple potentials, and formalism (i.e. Hilbert spaces, Hermitian operators and observables). The course will then focus on applying those fundamentals to develop tools for finding solutions to realistic quantum systems and to understand the physical models behind modern nanoscale technologies such as quantum tunneling-based devices, quantum dots and nanowires, superconductors, and quantum computing hardware (qubits, gates, circuits).

ECSE Alumnus B. Jayant Baliga '71, '74 Wins the 2024 Millennium Technology Prize

Dr. Bantval Jayant Baliga '71, '74 is the Winner of the 2024 Millennium Technology Prize for his innovation that has enabled dramatic reduction in worldwide electrical energy and petrol consumption.

The award recognizes Baliga's leadership in the invention, development, and commercialization of the Insulated Gate Bipolar Transistor (IGBT). Since its development in the 1980s, the IGBT has been the most important semiconductor device for making electrical energy use and petrol consumption more efficient and less polluting during the last 40 years.

The Millennium Technology Prize is one of the world's largest technology prizes. It is awarded once every two years by Technology Academy Finland, an independent foundation established by Finnish industries, academic institutions, and the government of Finland. The prize was inaugurated in 2004.

Dr. Baliga received his B.Tech in Electrical Engineering from the Indian Institute of Technology, Madras in 1969, and his MS (1971) and Ph.D. (1974) in Electrical Engineering from Rensselaer Polytechnic Institute.

Dr. Baliga worked for 15 years at the General Electric Research and Development Center in Schenectady, New York. He invented the insulated gate bipolar transistor in the early 1980s. It is a transistor switch that is now in use in most machines and devices using electricity, from kitchen appliances, medical devices, and electric cars to the electric power grid itself. It has resulted in estimated cost savings of over $15 trillion. He joined North Carolina State University in 1988 as a Full Professor, was promoted to Distinguished University Professor in 1997, and is currently the Progress Energy Distinguished University Emeritus Professor.

Dr. Baliga gave the Millennium Technology Prize Lecture on his groundbreaking innovation, IGBT, at the University of Helsinki on October 31, 2024.

Zhe Xu
Ph.D., EE '18

I received B.S. and M.S. degrees in Electrical Engineering from Tianjin University in 2011 and 2014, respectively. I got my Ph.D. degree in Electrical Engineering from ECSE in 2018 under the guidance of Prof. Agung Julius. I'm currently an Assistant Professor in the School for Engineering of Matter, Transport, and Energy at Arizona State University. Before joining ASU, I was a postdoctoral researcher in the Oden Institute for Computational Engineering and Sciences at the University of Texas at Austin. My research interests include formal methods, autonomous systems, control systems, and reinforcement learning. I received the Howard Kaufman '62 Memorial Fellowship from ECSE, the ASU Fulton Schools of Engineering Top 5% Teaching Recognition Award, and the NSF CAREER Award.

In my CAREER proposal, I proposed scalable, interpretable, and data-efficient learning and control approaches that enable agents in a cyber-physical system to reason over learning processes, coordinate effectively with other agents, and enhance operational capabilities to complete complex tasks in the presence of competitors or adversaries, and swiftly adapt to novel tasks and environments. My proposed approaches may facilitate the advancement of temporal causal reinforcement learning and control of cyber-physical systems by leveraging the reasoning capabilities of temporal logics and causal diagrams in single-agent, multi-agent, and swarm systems settings.

Saurabh Sihag
Ph.D., EE '20

I received my Ph.D. degree in Electrical Engineering under the supervision of Prof. Ali Tajer in 2020. Before that, I had received my Bachelor's and Master's degrees in Electrical Engineering from the Indian Institute of Technology, Kharagpur in 2016. As a doctoral student, my research focused on theoretical and empirical foundations of statistical analyses and signal processing over graph-structured data. I also got the opportunity to apply my expertise to practical problems in identifying biomarkers of neurodegeneration as an intern in the computational neuroscience group at IBM Research. I have worked as a postdoctoral researcher in Prof. Alejandro Ribeiro's lab at the University at Pennsylvania since 2021, where I built upon my learning experiences at RPI to develop novel and theoretically grounded machine learning algorithms for understanding brain aging in various health conditions, such as Alzheimer's disease, frontotemporal dementia, and Parkinson's disease. I joined the University at Albany as an Assistant Professor in the Department of Electrical and Computer Engineering in Fall 2024, where my research program will broadly focus on developing theoretical principles of artificial intelligence and their applications in healthcare domains.

Reid Wiseman Reflects on His Journey from RPI to Commanding the Artemis II Mission

Gregory Reid Wiseman received his Bachelor of Science (1997) degree in Computer and Systems Engineering at Rensselaer Polytechnic Institute and his Master's degree in Systems Engineering from Johns Hopkins University in 2006. He became a naval aviator in 1999 and graduated from the Naval Test Pilot School in 2004. He was selected as a NASA astronaut candidate in 2009 and flew to the International Space Station in 2014.

He sat with ECSE head John Wen for an interview on July 9, 2024 (the day after Hurricane Beryl hit Houston). The following is an excerpt from the interview. The full version is accessible at https://ecse.rpi.edu/news/reid-wiseman.

John Wen

Hi Reid, thank you very much for taking the time out of your busy schedule, especially right after Hurricane Beryl, for this interview. You grew up in Maryland and you came to RPI in 1993 and received your Bachelor's degree in Computer and Systems Engineering in 1997. What inspired you to pursue a career in engineering and what made you decide to choose RPI in particular?

Reid Wiseman

I loved building models, flying remote control airplanes, and playing with LEGO bricks, Capsela, and Lincoln Logs. I also loved trains and planes and construction equipment. I learned in high school a little bit about engineering and I realized that engineering embodied what I loved. What brought everything together was math and science; it was creation, and it was execution. In the 1990s, computers were all the rage. My brother had an Apple II at home and video games were becoming big. I thought engineering sounded amazing and I wanted to learn more about computers. I knew I wasn't as interested in the programming side, the computer science side, I was more interested in the microprocessor side. I had a friend from high school who was at RPI and he was enjoying it. It was an extremely hard school, and I wanted that. I didn't want to go to college just to get a degree. I wanted to go to college to really challenge myself.

John Wen

In some of your speeches, you mentioned that while you were commissioned on an aircraft carrier, you brought a copy of the textbook of COLD, Computer Organization and Logic Design.

Reid Wiseman

This is the book I took, *Logic and Computer Design Fundamentals* by Morris Mano and Charles Kime. I really fell in love with this, designing a microprocessor. I realized it's way harder than I ever thought it would be, but the initial stages of AND gates, OR gates, NAND gates, and putting together designs and logic diagrams; the binary thinking about the way all this stuff works together, making adders, making time clocks – I just I loved it. I absolutely loved it. It's like doing a Sudoku puzzle to me, it's so much fun. For me, this [type of book] is relaxing, and it's a way to exercise a different part of my brain and try to stay sharp on some of the stuff that I learned at RPI.

John Wen

That was amazing. What do you remember about that course or other courses that you had at RPI?

Reid Wiseman

That course was taught by Professor [George] Nagy. The first thing that I remember is his enthusiasm for teaching and then his difficulty in hearing. Students would ask a question, and he would just keep rolling right along, but I think the reason that that worked out so well for me, is probably three different things. Professor Nagy for sure, just because I think he's so passionate. Second was the content. That was the first class at RPI that was really my major. Freshman year was great. I loved relearning calculus. I liked relearning physics. I had never done calculus based physics, so that was a true treat to get to actually see calculus at work in physics. But it was really in COLD, Computer Organization and Logic Design, where I got to focus on my major. The third thing for me was that's also the first time that I met the people that were in my major teaming together, studying together. There were a few brilliant people. Craig Romei, who was a Navy submariner, was a good friend. He could do wire diagrams like nobody's business. He already understood everything about capacitance, resistance, Ohm's law. He was like my tutor in that class. And then my roommate for all four years, Marc Eigner, that was where I really started to see his true brilliance at work. He really didn't even need to go to class. He was so smart, he already knew the answer. It was fun to work with those two folks in particular.

John Wen

Could you describe your career after you graduated from RPI?

Reid Wiseman

I got commissioned from RPI and I went straight to Navy Flight School in Pensacola, Florida. I had never really flown an airplane before. Although there was this one guy at RPI, I don't remember his name, that had a private pilot's license. Before I went to flight school, we went and rented a plane and flew all around the Adirondacks. It terrified me in that airplane. I thought we were going to die multiple times as he performed stalls and showed me the effects of wind coming low over the mountains. But in the end, he was just doing normal things. I just had never been in a small airplane before. I went to flight school and I started flying the T-34, which is a single engine prop airplane. It was just like computer organization and logic design where, for the first time, I was doing something and it was just easy. I loved it. I didn't even need to think about it. I was just doing it and it came very naturally. From Pensacola, Florida, I moved to Kingsville, Texas, which is way down south in Texas almost on the Mexico border. That's where I learned to fly jets in the T-45. That took about a year. That was much harder, much more intense and intimidating, but it went well. My grades were great, but that was where I started to also feel some fear mixed in with the joy, like night formation flying, close to another airplane. Then from Kingsville, Texas I moved to Norfolk, Virginia. I flew F-14s for four years, met my late wife, and then moved to Patuxent River, Maryland. I went to the

United States Navy Test Pilot School and flew approximately 30 different aircraft. Then I flight tested the T-45, F-18s, and I did a lot of work on aircraft carriers. That was the most fun flying I've ever had in my life. I went back to Virginia Beach for a staff tour with the Navy and that's where I got picked up soon after for NASA. In 2009 I came to NASA and have been in Houston ever since.

John Wen

Is it like in the movie *Top Gun*?

Reid Wiseman

I remember being in the movie theater watching *Top Gun*, so that probably influenced me to go fly the F-14 because that thing was just amazing looking, but it was very difficult to fly. For *Top Gun 2*, several of my friends were the advisors on that movie. I know the guy who did all the flight tests, the former Blue Angel. A lot of my friends helped write the script for them. So *Top Gun* was as close to my real life as a movie will ever get for being in the Navy. There was movie magic going on, but a lot of the commentary, the way they spoke, the things they were talking were exactly on the money. And the sheer amount of physical demand was realistic. Just like anything, the first time you do it, it's hard. When you've done it a hundred times, it gets easier and when you do it a thousand times, you don't even think about it. But you learn very quickly what the limits of your body are and it's different every day, what your diet is, how much rest you got. At the beginning of every mission in a fighter jet, you do what's called a g warm-up maneuver where you pull 4g and then you pull 6g and you warm up your body and make sure you're doing well. And some days you would go and pull 6g and the world would shrink down to a soda straw, and you would be a little bit lightheaded and see stars. You're thinking, OK, today is just not my day to be able to go do this because you don't want to induce loss of consciousness, g-loc, that could be a deadly problem.

John Wen

When did you decide to become an astronaut?

Reid Wiseman

I don't think that you ever decide to become an astronaut. I clearly had thought about it as a kid. The Challenger disaster was formative in my mind. RPI was formative, too, because George Low has a strong link at RPI. *Apollo 13* came out while I was at RPI and they did a viewing in the big Freshman lecture hall, DCC 308. I remember that I was thinking, oh my god, this is completely awesome. So that definitely helped build it up. Then I went and flew, and I liked flying. Then I became a test pilot, and I liked bringing the engineering side into the flying.

John Wen

A lot of students and kids say I want to be an astronaut one day. How should they go about it?

Reid Wiseman

For an undergrad student or a kid in the 5th grade, the core thing that you need to do is to find something that you love doing. I went through computer engineering and then I was a pilot in the Navy. I loved it. If those aren't the things you love, don't do those in an attempt to be an astronaut. Find the things you love to do and do them as well as you possibly can. The other side of it is you have to be able to be a good crewmate. You have to get out from behind the desk, from behind a computer. You have to go for a hike. You have to go do a team sport or go camping with your friends. Those sorts of ingredients are critical when you're going to spend six months of your life in a small spacecraft with five other people. I think these two ingredients are the primary critical ingredients: find something you love, and then get outside and do stuff.

John Wen

Could you share a little bit about your experience as an astronaut? What are some of the most challenging mission projects or tasks that you had to deal with?

Reid Wiseman

I'll start with the basics of being an astronaut. For a NASA astronaut going to the International Space Station, you have to learn to speak Russian. You have to learn how to operate the robotic systems on the Space Station. They're not small little robots, it's a very, very large robotic arm, the SSRMS, the Space Station Robotic Manipulator System. You have to learn how to spacewalk. You have to learn your systems to a fairly good degree, not to an engineering level, but to an operator level, where you have to understand how your impact on the system can change or if the system starts to fail, how you can correct it. You have to learn about emergencies — what happens if there's a fire or a leak. Looking across those five categories of things that we have to do, by far the most physically and mentally demanding is spacewalk training and spacewalking. Spacewalk training is physically demanding. It's not as mentally demanding because you're not going to die if you mess up. You're just going to be embarrassed by your grades. But when you're outside the International Space Station, and you're doing a real spacewalk, they're seven hours long, and you have a myriad of tools on you, and you have some extremely expensive equipment that you're either upgrading or fixing because it broke, and you're looking at this hundred billion dollar spaceship that you're crawling all around, it's very intricate and detailed and elaborate and fragile – you don't want to hurt it. The other side of that is you're just one mistake away from killing yourself or your crewmate, and all of that combined together, it's like ketchup. Ketchup is supposed to be the most intense flavor that the human mouth can sense. It goes to all five quadrants immediately, and that's what spacewalking does. It maximizes your physical, it maximizes your mental. When you come in after seven hours outside, you're just done. There was nothing left of me. I had no physical strength left, I had no mental strength left. All I wanted to do was sleep.

John Wen

Wow. Do you worry about space debris at all, like we see in some movies?

Reid Wiseman

I don't think I worry about it the way you worry about a tornado or a hurricane, but you see its presence all the time. If it's big enough to do damage to the Space Station, it's tracked by ground and they'll either slow or speed up the Space Station to change its orbital period just a tiny bit to get us out of the way. But when I went out for my first spacewalk, I was shocked. There are thousands of little tiny dings. We had a chip in our window, like when a rock hits your window on the highway, and it creates a bullseye. We had one of those occur on our cupola windows when I was up there, so I saw the effects of it all the time. Looking ahead for Artemis, and our Space Station as well, if you plot out the risks to the loss of crew, the chart is off the scale for space debris. The impact of space debris is by far the highest risk in the mission, which is shocking.

John Wen

Do you have any advice for current and future RPI students who may want to follow your footsteps?

Reid Wiseman

I say it all the time when I talk about RPI, it teaches you failure resistance. For the first time in many students' life at RPI, they probably have met failure and had to overcome it in an academic sense. Just knowing how to study as hard as you can and get up the next day and continue on. Just learning how to sense failure and overcome that failure. I think we are living in a society now where failure is a bad word. People would rather take the straight and narrow and not ever experience any sort of pain or failure. That is just not how we grow. We grow by trying new things. If those things don't work out, we have something to fall back on. So the thing I would like most to say to RPI students is when you walk out of there with that undergraduate degree from RPI, it's like you have climbed that mountain and no one can ever take that away from you. However high you get, if you fall back down, that's your floor now. You have a degree, a four-year degree from an amazing school and no one will ever take that away from you. So go out and take some risks. Try some things that are outside the norm and see if they work for you. If they do, great. And if they don't, change your path, regroup, and go at it another day. I think that advice works across the board, but I definitely think that would resonate with an RPI student because they know what success looks like, and I guarantee they know what failure feels like and they know that tomorrow is always a better day and usually from failure comes your best successes.

RPI and HVCC Launch Semiconductor Workforce Development Program

Rensselaer Polytechnic Institute and Hudson Valley Community College have welcomed the inaugural class of RPI-HVCC Semiconductor Scholars. Funded by the 2022 CHIPS and Science Act, the Scholars program is one of many efforts in the Capital Region and around the country to prepare more students to enter the semiconductor industry.

The initial cohort of scholars has six first-year students in the Engineering Science AAS degree at HVCC who will explore future careers in the semiconductor industry while working with RPI faculty mentors in RPI's state-of-the-art labs and facilities. The program provides scholars with financial merit awards for their first two years at HVCC and a summer research internship at RPI. If accepted to RPI, scholars will receive significant financial aid to complete a bachelor's or combined bachelor's and master's degree.

According to a 2022 report from Deloitte, the global semiconductor industry is expected to surpass one trillion dollars in revenue by 2030. However, the industry faces a big talent shortage, with more than one million additional skilled workers needed over the next six years.

With the RPI-HVCC Semiconductor Scholars Program, RPI and HVCC are working to meet these projected workforce demands by establishing a talent pipeline that will recruit and prepare students from across New York and the country.

"HVCC's Engineering Science and Technology programs attract talented and diverse students from upstate New York who are passionate about technology and its impact on the society," said Shekhar Garde, Ph.D., dean of RPI's School of Engineering. "The Scholars program attracts and cultivates talent for the

growing semiconductor industry in our region. Importantly, the program also serves as a model that can be scaled up across the country by tapping into talent from community colleges."

"We are thrilled to partner with RPI to offer this unique opportunity to our Engineering Science students," said Roger Ramsammy, Ph.D., president of Hudson Valley Community College. "We have more than 500 students now enrolled in degree and certificate programs leading to employment in the semiconductor industry, and it is our goal to support them in every way possible as they gain essential skills and experience leading to careers. The Semiconductor Scholar Program is a creative partnership that combines the faculty expertise and resources at Hudson Valley with additional financial support and experience at RPI and in the field that will help to fill the talent pipeline in our region and beyond."

"HVCC's School of STEM is proud to have a long-standing collaboration with RPI that includes a formal articulation agreement with a direct pathway for our Engineering Science students to complete their four-year degrees and beyond at RPI. The RPI-HVCC Semiconductor Scholar program provides our students with exposure early in their careers to the growing and exciting field of semiconductors," said Hector Rodriguez, Ph.D., School of STEM dean at HVCC.

"This collaboration illustrates RPI's and HVCC's shared commitment to growing the semiconductor workforce in the Capital Region," said Martin A. Schmidt '81, Ph.D., president of RPI. "This program's unique strength is that it goes beyond creating a degree pathway and invests in students through mentorship and immersive experiences. Students will be able to see themselves working in the semiconductor industry, and that can make such a difference in their career path."

During a recent visit to the RPI campus, the six scholars — Minh Ho, Katie Ziegler, Andrew Lee, Aiden Fedorowicz, Lucas Cook, and Hunter Weber — toured the Micro and Nanofabrication Cleanroom, a 6,000-square-foot Class 100 space, where university, government, and industry researchers create and test new chips, and where the scholars will get hands-on experience during their summer research internship at RPI.

Following the tour, the six scholars attended a reception where they networked with RPI and HVCC engineering faculty and leaders. During the reception, each scholar shared his or her career aspirations and interest in semiconductors.

- **Minh Ho**, who immigrated to the United States from Vietnam eight years ago, knew he wanted to be an engineer while helping his father fix cars. He hopes to apply what he learns about semiconductors to a job in the automotive industry, which depends more and more on chips as electric and autonomous vehicles become more common.

- **Katie Ziegler** is considering going into the biomedical field. She wants to know more about semiconductors because of their applications in medical diagnosis and treatments.

- **Andrew Lee** hopes to specialize in industrial engineering and work on supply chain issues. The semiconductor industry has a great need for supply chain management, Lee said, so he is interested in learning more about the complex processes that go into making chips.

- **Aiden Fedorowicz** hasn't yet picked a career path, though he is considering either mechanical or electrical engineering as a focus. Right now, he's most excited to learn more about semiconductors and engage with RPI faculty.

- **Lucas Cook** knew from an early age that he wanted to be an engineer, but it was a high school entrepreneurship and product development program that first got him interested in semiconductors. He sees semiconductors as an important link between all engineering fields.

- **Hunter Weber** hopes to become an electrical and computer engineer, so semiconductors are a natural fit.

As a result of the program, students are expected to see a variety of outcomes, including enhanced job opportunities in upstate New York's semiconductor manufacturing industry and the growing microelectronics sector in the United States, unique opportunities to build higher level skills, and new ways to contribute to national security and prosperity by helping to build future chips in the United States, and especially in the upstate New York region.

In ECSE, the scholars benefitted from the guidance and expertise of Professor of Practice Muhsin Celik. In Summer 2024, the scholars were a part of our on-campus Chips Immersive Program along with other high school, college, and graduate school students from across the US, Taiwan, and Japan. This summer immersion program was full of team project activities, instruction by RPI faculty, and field trips to nearby R&D and manufacturing facilities. The scholars also worked on individual projects in the newly renovated MercerX Lab. They finished ALU (Arithmetic Logic Units) chip layouts, built guitar pedal circuits, and constructed a Long-range digital radio connecting the RPI and HVCC campuses. In addition to Prof. Celik, Prof. Shayla Sawyer, ECSE technician Chris Rinaldi, and graduate research assistant Dan Fiumara were instrumental to the effort.

Digitalizing Electricity with High-Power Electronics for Energy Systems on Earth and Beyond

Power electronics, a crucial yet often invisible technology, could have given Thomas Edison the edge in The War of the Currents against Westinghouse and Nikola Tesla in the late 1880s if it had existed at the time. By applying solid-state electronics for efficient control and conversion of electric power, power electronics serves as the foundation for rapidly evolving energy systems for many applications we rely on today.

High-efficiency power converters are pivotal in achieving carbon neutrality by enabling renewable energy generation and the electrification of various sectors. The integration of renewable energy sources is intrinsically linked to advancements in power electronics. Inverter-Based Resources (IBRs) powered by this technology are poised to dominate future electricity generation, enabling the seamless integration of renewable energy and energy storage into the modern power grid. Moreover, power electronics significantly influence electric energy consumption across diverse fields such as e-mobility, robotics, logistics, and consumer electronics. Recently, the demand for sustainable computing has emerged as a critical energy issue. Data centers powering energy-intensive artificial intelligence (AI) applications require highly efficient and reliable power electronics solutions to convert high-voltage grid power into the low-voltage levels needed for AI chips.

ExPERT (Exponential Energy Power Electronics Research Team) @ Rensselaer, led by ECSE Assistant Professor Zheyu Zhang, delves into the realm of high-performance power electronics through vertical integration from chips to systems. Zhang's research focuses on the characterization of emerging wide bandgap (WBG) power semiconductors, and the modeling, protection, and condition monitoring of WBG-empowered power electronics. The ultimate goal is to overcome application challenges, such as highly reliable and resilient solar inverters for renewable generation, light-triggered solid-state protection for high-voltage power grids, and shunt regulators designed to operate in the extreme cold of space, such as on the moon.

The lack of awareness of power electronics, coupled with growing demands, has contributed to an increasing workforce shortage. The application-oriented nature of power electronics involves hands-on and field experience, which requires costly
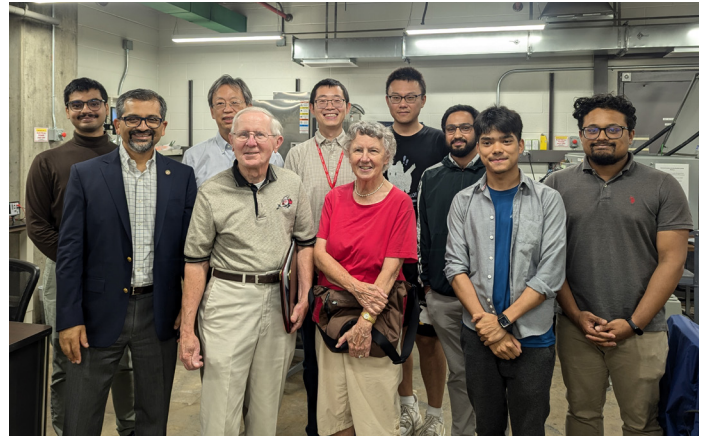
Above: Rich and Joan Felak, Prof. Zhang and his graduate students, Dean Garde, and Prof. Wen, during Felaks' visit of Prof. Zhang's power electronics lab in August 2024.
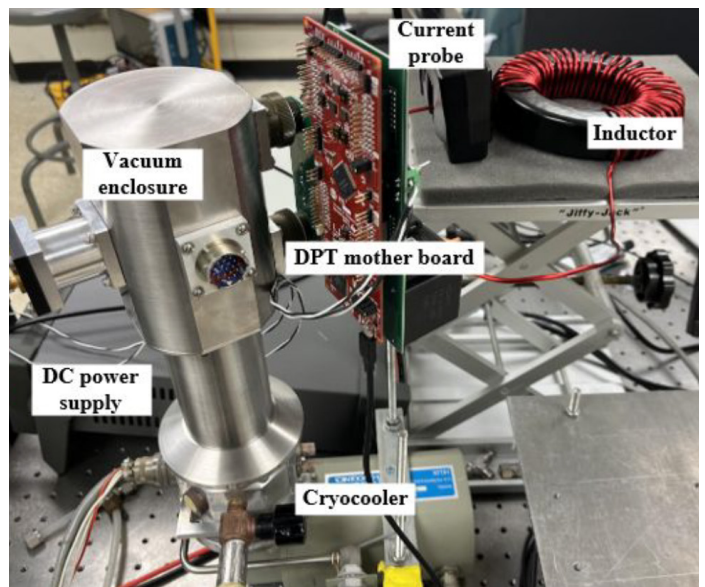
laboratory setups for hardware prototyping and experimentation. Zhang is dedicated to bridging these gaps by raising awareness through the integration of research, education, and outreach, developing enhanced curriculum and hands-on learning tools, and establishing a network for dissemination. Currently, Zhang is working with Professor Shayla Sawyer, Director of the Mercer XLab, to innovate hands-on practice through virtual learning experiences, offering quick and equitable access for ECSE students to Zhang's cutting-edge research facilities through the Mercer XLab.

Faculty Transition

Professor Joe Chow

On December 18, ECSE and the RPI community gathered for a luncheon, and online WebEx, to celebrate Prof. Joe Chow's transition to Senior Research Scientist, starting in 2024, after a distinguished 37-year career at RPI. John Wen, Kurt Anderson, Paul Chow, Tetiana Bogodorova, and Denis Osipov shared the impact that Joe had on the department, the school, the Institute, and their careers. Joining remotely, Murat Arcak, Aranya Chakrabortty, Kowk Cheung, Pengwei Du, Agung Julius, and Aparna Gupta shared their appreciation. John Wen read remarks by Dean Shekhar Garde, Koushik Kar, and Meng Wang.

Prof. Chow received his B.S. EE and B. Math degrees from the University of Minnesota in 1974, and his M.S. and Ph.D., both in Electrical Engineering, from the University of Illinois Urbana-Champaign in 1975 and 1977, respectively. He was with General Electric from 1977 to 1987. He joined RPI as an Associate Professor in 1987, was tenured in 1990 and promoted to Full Professor in 1992. Joe Chow served as the Acting Chair of ECSE 1999-2000, the Interim Associate Dean of Engineering for Research 2003-2005, the Associate Dean of Engineering for Research and Graduate Programs 2005-2011, and the Administrative Dean of Engineering 2013-2014. He was named Institute Professor of Engineering in 2017.

Joe Chow is a renowned researcher in power systems. He has received numerous awards and recognitions, including election to the National Academy of Engineering, IEEE Fellow, the IEEE Power and Energy Society Charles Concordia Power System Engineering Award, the IEEE Power and Energy Society Outstanding Power Engineering Education Award, the IEEE Control Systems Society Control Systems Technology Award, the American Automatic Control Council Donald P. Eckman

Award, the R&D 100 Award, and numerous best paper awards. He has written 5 books, 3 monographs, 4 edited volumes, 25 book chapters, 156 journal papers, and 209 conference papers. According to Google Scholar, he has over 18,000 citations and an h-index of 66. His research has been funded by NSF, DOE, EPRI, NYSERDA, NYISO, and many other agencies, national labs, and companies. He was the campus director of the NSF Engineering Research Center Ultra-wide-area Resilient Electric Energy Transmission Network (CURENT) from 2011-2020. He has three current grants from DOE, NSF, and Grid Protection Alliance that will continue into 2024-2026. Joe is a dedicated educator and an excellent teacher. He graduated 28 Ph.D. students and developed or taught numerous courses in the areas of power systems and control systems. He is a generous mentor of younger faculty and a tireless champion of nominating colleagues for RPI or external awards. He is truly an exemplary senior faculty. Prof. Chow plans to continue active research and will transition to his new role as a senior research scientist in the department. ECSE will continue to draw on his experience and wisdom even after his retirement from the tenured Full Professor position.

Professor Rich Radke Recognized by IEEE for Innovative Pedagogy

ECSE Professor Rich Radke was awarded the 2023 IEEE Signal Processing Society Regional Distinguished Teacher Award for his career contributions to signal processing education. Radke's YouTube channel contains hundreds of videos about digital signal processing, engineering probability, and image processing that reach much further than the RPI campus.

Most recently, Radke has applied his inventive teaching approach to immersing students in the fast-moving field of generative artificial intelligence (AI). "Generative AI is changing so quickly that the course I teach one semester is going to be very different when I teach it the next," Radke said. "But that's part of what keeps things fun," he added. "There is no better way to learn something than to teach it to someone else. Part of the reason I wanted to develop a course on generative AI was to challenge myself to learn about a topic that some of my students probably knew more about than I did," Radke said.

However, the course isn't called "Generative AI." "I wanted the course to be about more than learning how to use the technology. I wanted my students to engage in the artistic applications and ethical considerations related to generative AI. So, I called it 'Computational Creativity,'" Radke said.

Radke applies creativity to his pedagogy as well. He creates short videos for his courses that students watch before class to frame the day's material. He also records his lectures using methods borrowed from social media live streamers, toggling between multiple cameras in real time to capture course notes, drawings, computer code, images, and video clips.

Each Computational Creativity video has the same distinctive thumbnail image: A sheep wearing a silver sweater, a baseball hat, and gold chains standing in a countryside meadow. It was generated, naturally, by AI. "The sheep has become the mascot of the course. I created it with DALL-E, an AI image generator, based on the prompt 'realistic photograph of a wealthy hip-hop sheep wearing gold chains in a green field at golden hour,'" said Radke. "It's representative of the course because it captures the wildly imaginative things you can make with these tools."

Students must also get creative in the course's assignments. Students work in teams to collect their own data and use that data to train generative AI models to generate similar images. These teams have collected everything from images of leaves on the RPI campus to rock-climbing holds at a local climbing gym. "The big reason why I have the students collect their own data is because it gets them thinking about where the data used to train generative AI models comes from and gives us a good segue into learning about the ethical and legal issues around the topic," Radke explained.

Later in the course, students were challenged to use generative AI tools to create videos, which can also be viewed on YouTube. One project of note created an anime-style video featuring scenes from the RPI campus. In another impressive creation, students created hilarious multi-scene videos from a single prompt.

In addition to working in teams, students in Computational Creativity collect feedback on their work from other students in the class, helping them learn from each other and pushing them to keep refining their projects. The course also introduces students to the artistic, social, and ethical issues around generative AI through in-class discussion and guest speakers from the areas of law and the visual arts.

In addition to his award from IEEE, Radke was also recently recognized by Rensselaer as the recipient of the William H. Wiley 1866 Distinguished Faculty Award. This award was established in 1977 by the late Edward P. Hamilton '07, a 34-year trustee of Rensselaer. He set up an endowment in memory of his uncle, William H. Wiley, an alumnus of the Class of 1866. Nominations are made by the faculty, and the recipient is chosen by the Faculty Committee on Honors. The award is based on excellence in teaching, productive research, and interest in the totality of the educational process.

New Faculty Spotlight

Esen Yel
Assistant Professor

Esen Yel's research goal is to achieve safe, trustworthy, and generalizable autonomy for systems under uncertainty. Esen supervises the Reliable Intelligent Systems Lab (RISL), focusing on methods for improving the safety and adaptability of robotics systems by building upon concepts and tools from control theory, machine learning, and safety verification. At RPI, she enjoys teaching courses related to robotics and automated decision-making.

Before joining RPI, Esen was a postdoctoral scholar at Stanford University, where she was part of the Stanford Intelligent Systems Lab. She obtained her Ph.D. degree in systems engineering from the University of Virginia in 2021.

In her free time, Esen enjoys hiking (and is very excited about upstate New York's trails), playing ultimate frisbee, and yoga. She also collects vintage photographs.
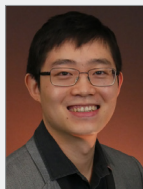
Zheyu Zhang
Assistant Professor

Zheyu Zhang's research focuses on high-performance power electronics using cutting-edge power semiconductors. Leading the ExPERT (Exponential Energy Power Electronics Research Team) lab, his research spans power electronics characterization and applications in renewable energy, electrification, and space power.

Zheyu earned his Ph.D. in electrical engineering from the University of Tennessee, Knoxville, in 2015. Prior to joining RPI, he gained valuable experience at General Electric Research in Niskayuna, NY, and Clemson University in Charleston, SC.

Outside of his professional endeavors, Zheyu channels his competitive spirit into sports, particularly enjoying table tennis. "It's often assumed all Chinese are good at table tennis, and in my case, it happens to be true!" Additionally, Zheyu shares a passion for gardening with his wife.

Muhsin Celik
Professor of Practice

Muhsin Celik instructs ECSE undergraduate and graduate engineering students in microelectronics and integrated circuit manufacturing. Prior to joining RPI, Muhsin spent over 25 years in the semiconductor industry, with extensive experience in advanced technology development, new product introductions, and business operations. He most recently worked at GlobalFoundries as a Senior Director leading the 14nm FINFET program, and held various executive positions for fab expansions, business operations and transformation. Earlier in his career, Muhsin worked on transistor technology development for PowerPC High Performance applications in Motorola Advanced Products Research and Development Labs in Austin before moving to Grenoble, France with Freescale Semiconductor. His industrial experience continued back in the USA with a variety of leadership positions. He worked at the IBM International Semiconductor Development Alliance in Fishkill, NY and later became the STMicroelectronics Project Leader in the IBM Alliance at Nanotech in Albany, NY.

Muhsin grew up in Ankara, Turkey. After receiving his Electrical and Electronics Engineering degree from Middle East Technical University in Ankara, he came to the USA for his graduate studies. He completed his M.S. and Ph.D. in Electrical Engineering at North Carolina State University in 1998.

He lives with his wife in Niskayuna, NY where he is active in the community and enjoys tennis, hiking and kayaking.

Chris Rinaldi
Senior Academic Support Technician

Chris supports the ECSE labs and provides assistance to faculty and students regarding parts, materials, and equipment needed for projects and coursework. He maintains the instrumentation and parts inventory for the department in general as well as for the new Mercer XLab. He works closely with Prof. Shayla Sawyer, assisting in building training programs, providing support for students and XLab staff, and developing models for lab integration into ECSE and RPI culture.

Chris has over 25 years of experience in science, engineering, and technology. He previously worked for Plug Power as a hydrogen systems and fuel cell technician and worked many years for GE Healthcare in microelectronics fabrication and X-Ray detector development and manufacturing. He received a BS in Electrical Engineering from Fairfield University.

Chris is an experienced musician and for fun enjoys playing guitar in various arrangements. He integrates his interest in electronics with his love of music and enjoys working on amps and audio gear. Chris loves the outdoors and spends his leisure time camping, biking, hiking, and sleeping in a hammock.

ECSE 2024 Commencement Celebration

The celebration was held on Thursday, May 16, 2024 from 12:00 to 2:00 PM at the Hilton Garden Inn (Sage Ballroom), Troy, New York.

ECSE B.S., M.S. and Ph.D. graduates from August 2023, December 2023, and May 2024 gathered with their families, friends, faculty, and staff to celebrate their graduation! Over lunch, graduates were honored, as were departmental award winners and students who completed Focus Areas.

2023-2024 ECSE Awards

Faculty Awards

Rich Radke, 2024 William H. Wiley 1866 Distinguished Faculty Award

Rich Radke, 2024 IEEE Signal Processing Society Regional Distinguished Teacher Award

Ali Tajer, School of Engineering Research Excellence Award

Luigi Vanfretti, Invited Professorship, École Centrale de Lyon

Luigi Vanfretti, Visiting Scholar, University of Calgary

John Wen, 2024 Class ARM Champions

Student Awards

Allen B. Dumont Prize

Pengxiang Huang
Burak Varici

The Charles M. Close '62 Doctoral Prize

Fernando Fachini
John Rollinson

The Henry J. Nolte Memorial Prize

William Keegan
Nikko Simons

The Ricketts Prize

Tiancheng Bao
Henry Lamkin

4.0

Brandon Nathaniel Fogg

The Wynant James Williams Prize

Om Anavekar
Andrew Prata

The Harold N. Trevett Award

Yixiang Wang

Jerry Dziuba Graduate Service Award

Jonathan Fried
Meltem Tatli

Steve Dombrowski Undergraduate Service Award

Farris Nefissi

Constellation Energy Scholarship

Eric Carson
Tommy Kabiawu
Gregory Matuck

Dr. Alireza Seyedi '99, '04 Teaching Assistant Award

Meng Zhang

The Eric T. B. Gross Endowed Graduate Award

Srijita Bhattacharjee
Anmol Dwivedi

The Baliga '74 Award for Graduate Student Support

John Rollinson

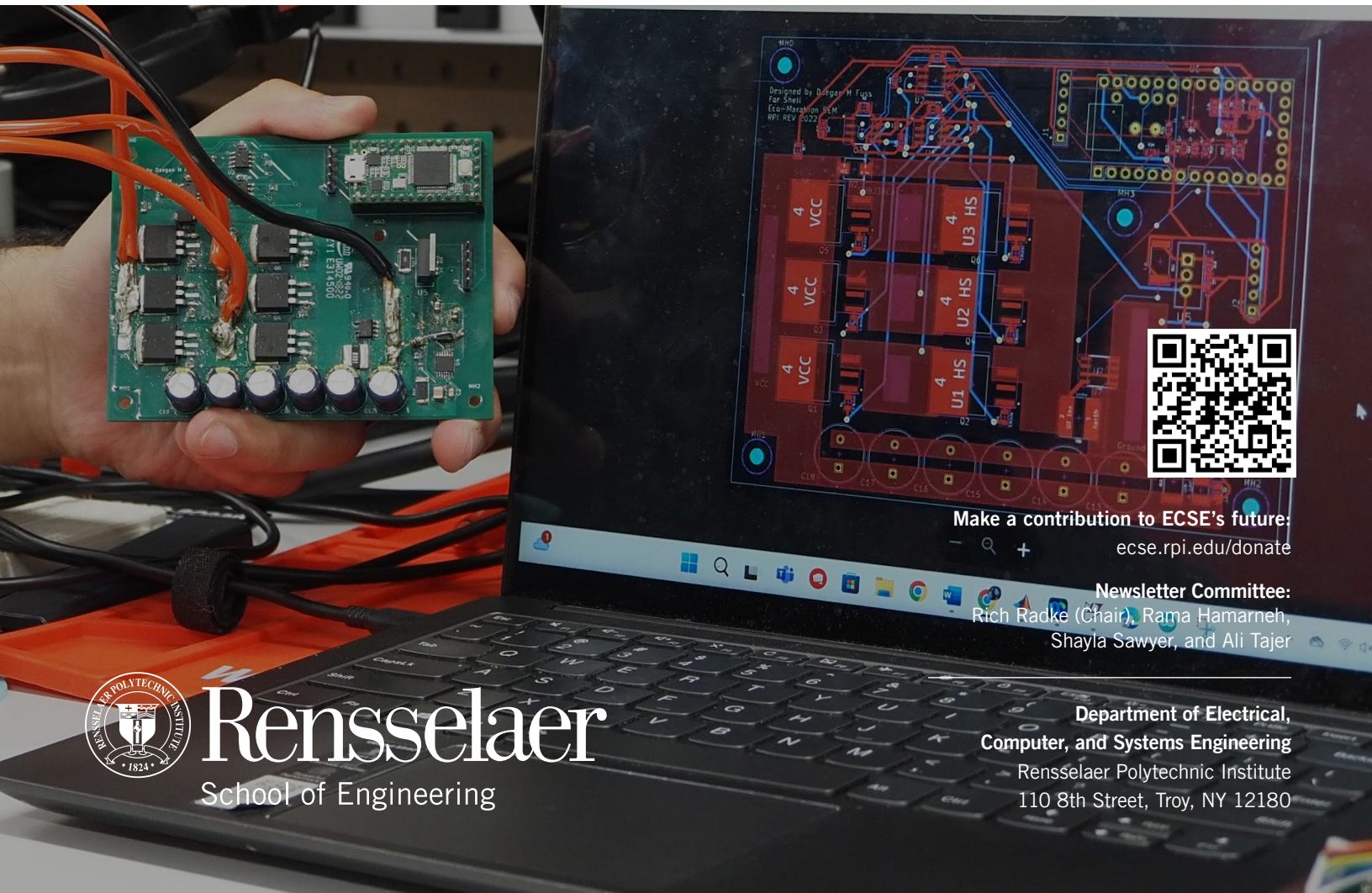## 2024 Grainger Power Engineering Awards & Ceremony

Benjamin Lee and Francisco Sandoval were the 2024 recipients of the prestigious Grainger Scholars Award.

On April 10, 2024, at the annual Grainger Scholars ceremony, two ECSE students received the prestigious Grainger Scholars Award, which is given every spring. Nicholas W. Miller, Principal at HickoryLedge LLC, gave a talk to start the awards, after which the award winners shared their journey to studying Electric Power. Funding for the awards is provided by the Grainger Foundation, a private organization based in Lake Forest, IL which supports U.S. technical education and workforce development. The foundation has been awarding this scholarship to RPI students in the electric power field for the last fourteen years. ECSE awardees must demonstrate superior academic performance and future promise for work or research in the field of energy sources and systems, especially electric power.

Make a contribution to ECSE's future:
ecse.rpi.edu/donate

Newsletter Committee:
Rich Radke (Chair), Rama Hamarneh,
Shayla Sawyer, and Ali Tajer

Rensselaer
School of Engineering

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