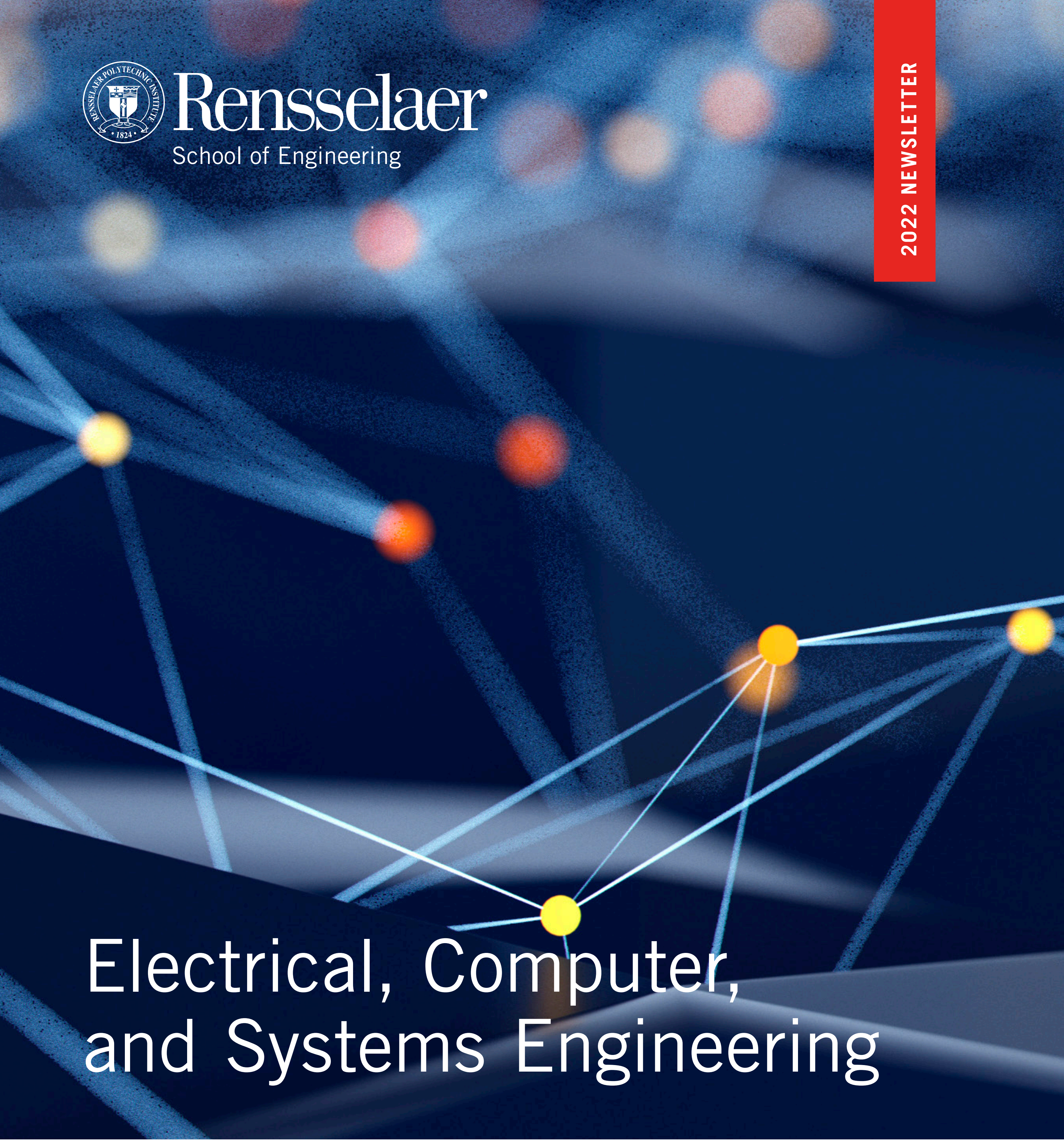


Rensselaer
School of Engineering

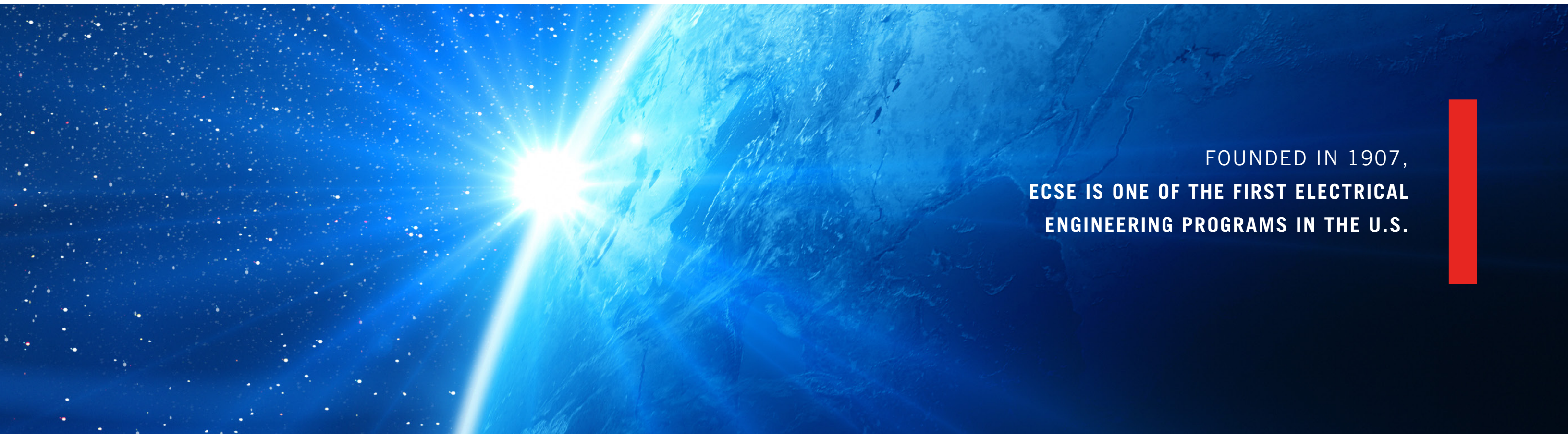
2022 NEWSLETTER

Electrical, Computer, and Systems Engineering

ECSE

Department of Electrical, Computer, and Systems Engineering at Rensselaer

ECSE.RPI.EDU



Looking Back on the Past Year

This past academic year marked the welcomed transition back to on-campus operations and in-person instruction. While the Omicron variant raged all around us at the end of 2021 and in early 2022, the number of cases on campus remained relatively low due to mask, testing, vaccination, and booster requirements. While we have not fully reached the pre-pandemic state yet, we are in the process of returning to a greater degree of normalcy this fall semester.

A key positive that came out of this historic episode is that we have now developed strong, resilient online communities that share information, provide support, boost morale, and even strategize for the future in near real-time. With COVID-19 now receding from the pandemic phase into the endemic phase, our goal is to continue, and strengthen, this bond to prepare us to meet future challenges and opportunities.

We have a lot to look forward to in the coming year. We welcomed the 19th president of Rensselaer Polytechnic Institute, Dr. Martin (Marty) Schmidt, in July. Dr. Schmidt graduated from our department in 1981 with a bachelor's degree in electrical engineering. He went on to the Massachusetts Institute of Technology (MIT) to obtain his master's and doctoral degrees, and stayed at MIT as a faculty member for 34 years. He was the MIT provost from 2014 to 2022 before deciding to return to his alma mater. Dr. Schmidt is a world-renowned researcher in the design, fabrication, and application of micro-electromechanical systems. His inventions have led to seven start-ups, including several he cofounded. He has been a skillful administrator at MIT, leading and contributing to the formation of the Schwarzman College of Computing, the online learning platform edX, and initiatives on diversity, equity, and inclusion, as well as student wellness and mental health. We are thrilled to have such an accomplished individual as our next president and colleague in the department.

We celebrated many recognitions of the Electrical, Computer, and Systems Engineering (ECSE) faculty this year:

- Manoj Shah, former professor of practice, now senior research scientist in ECSE, was elected as a member of the prestigious National Academy of Engineering in recognition of his contribution to the design, analysis, and applications of electric machines over 34 years at GE Research.
- Assistant Professor Tianyi Chen won the National Science Foundation CAREER award based on his research on distributed intelligence for future wireless networks.
- Professor Shayla Sawyer was honored with the Rensselaer Trustees' Outstanding Teacher Award in recognition of her innovative and inclusive teaching methodology.
- Associate Professor Ali Tajer received the James M. Tien '66 Early Career Award for his research contributions in information theory and signal processing.

ECSE faculty and students continue to conduct cutting-edge and high-impact research. For example:

- ECSE faculty are active in the Artificial Intelligence Research Collaboration (AIRC), a multi-year initiative between Rensselaer and IBM that started in 2017. In the past year alone, ECSE faculty Tianyi Chen, Agung Julius, Koushik Kar, Santiago Paternain, Ali Tajer, and Meng Wang have received AIRC grants to pursue collaborative projects with IBM researchers.
- ECSE faculty have won research grants from funding agencies such as the National Science Foundation, Army Research Office, Air Force Research Lab, National Institutes of Health, National Aeronautics and Space Administration, and Office of Naval Research. These include Shayla Sawyer's work on using engineered bacteria as bioelectronic environmental sensors, Birsen Yazici's work on deep learning for radar imaging, Luigi Vanfretti's work on electric aircrafts, Hussein Abouzeid's

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

work on spectrum allocation and virtual reality in operating rooms, and projects led by Agung Julius (with Mona Hella and myself) on human circadian rhythm estimation and regulation.

- ECSE faculty work closely with industry through SBIR/STTR projects and public-private consortiums, including Kyle Wilt's work on sensor networks for aircraft health monitoring, Mona Hella's work on glass-based terahertz antennas, and projects led by myself, Agung Julius, and Santiago Paternain and funded by the Advanced Robotics for Manufacturing Institute to improve industrial robot performance for demanding manufacturing tasks.
- ECSE faculty play key roles in several new Institute-wide initiatives: the Institute of Energy, the Built Environment, and Smart Systems (EBESS); the Institute for Data, Artificial Intelligence, and Computation (DAIC); and the Center for Engineering and Precision Medicine (CEPM). Bob Karlicek is the co-director of EBESS.

Higher education, and, indeed, education in general, is going through rapid transformations. The pandemic has only accelerated the pace. There is a huge amount of material related to ECSE courses online, but effective curation for individual needs remains elusive. Meanwhile, our world is under unprecedented challenges, including climate change, threats to global health, and supply chain disruptions. We are working with our colleagues around the country and world to develop the most effective ways to educate the next generation of engineering leaders in this rapidly evolving landscape. We increasingly focus on hands-on, project-based lab experiences in addition to strong theoretical and analytical foundations. The gateway ECSE course, *Introduction to ECSE*, continues to use the personal instrumentation board ADAM 1000 to introduce incoming students to the ECSE field through hands-on labs, and prepares them with tools useful throughout their college career and beyond. Starting with this course, we are working on integrating engineering design throughout our curriculum. Our collective teaching approaches and experiences are shared in a living document of the "ECSE Best Practices in Teaching."

The ECSE program was founded in 1907, one of the earliest in the country. In the century since, our alumni have contributed to the transformation of society. Many alumni have responded to our calls for engagement and have shared their experiences with the next generation of students. We now have a robust alumni industry advisory program and alumni contact sheet as resources for ECSE students.

This year has seen several faculty departures through retirement and other opportunities, including Derya Malak, Manoj Shah, Partha Dutta, Mahmood Hameed, and Jeff Braunstein. We said goodbye to longtime ECSE technical staff members Jerry Dziuba and Steve Dombrowski, who were both with ECSE for over 40 years and passed away within weeks of each other. We also mourn the passing of longtime ECSE faculty emeriti Charlie Close and Frank Di Cesare, and ECSE administrative staff member Audrey Hayner.

We welcome James Dylan Rees as a lecturer, Prabhakar Neti as a professor of practice, and Bill Mnich and Jason Anthony as new technical staff. We are now embarking on a multi-year faculty hiring initiative focusing on next-generation computing, autonomy, security, and sustainability.

I look back at the past three-and-a-half years as the ECSE department head with gratitude and wonderment. I'm grateful to have had the opportunity to work and interact with the outstanding group of dedicated faculty and staff who strive to do their best in educating and helping our students in the face of unprecedented challenges and frustration. I'm amazed by the resilience of our students who continue to work hard and excel. I'm grateful to ECSE alumni who have volunteered to share their experiences with the next generation of students and help them prepare for the transition to the workplace. I'm happy that we are continuing the wonderful ECSE culture of scholarship, fellowship, and community. This is what drew me to Rensselaer 40 years ago as a doctoral student and has kept me motivated as a faculty member for the past 35 years. With the new Rensselaer administration and receding pandemic disruptions, let's work together to usher in the bright future of ECSE!

The CURENT Engineering Research Center

Rensselaer has been a partner in the NSF Engineering Research Center for Ultra-wide-area Resilient Electric Energy Transmission Networks, or CURENT, headquartered at the University of Tennessee, since its establishment in 2011. At Rensselaer, the center's efforts have been spearheaded by ECSE Professor and National Academy of Engineering member Joe Chow. Here, we summarize several research highlights from CURENT's research at Rensselaer, which focuses on the applications of synchrophasor measurement data for power system monitoring and control, and enabling dispatch and control of renewable resources to improve the economic and reliable operation of power systems with high levels of renewable penetration.

Research scientist Denis Osipov led a team to compete in the Oscillation Source Location Identification Contest organized by IEEE-NASPI (the North America SynchroPhasor Initiative) and won first place. From synchronized phasor measurements, system operators can be alerted to persistent oscillations in the range of 0.5 to 10 Hz arising from malfunctioning equipment, such as a governor valve on a steam/hydraulic turbine or an exciter/voltage regulator on a generator. Osipov developed a new Cross-Power Spectral Density (CPSD) method to locate and distinguish whether the oscillation source comes from active power or reactive power control. The Fourier transform is applied to the bus voltage magnitude and phase and line active and reactive power flow phasor measurements. The largest correlation component between the two signals is a reliable indicator of the direction of the oscillation source and whether the oscillation is due to active or reactive power. For example, the compass plot of the CPSD below (fig. 1) correctly indicates that the excitation system on the generator of Bus 2634 of the 240-bus reduced U.S. West Coast System is the location of the oscillatory source.

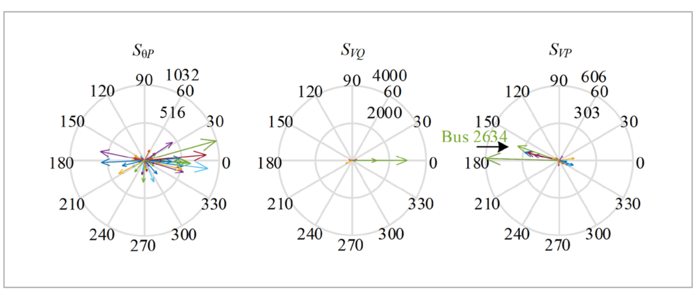


Figure 1: Detecting oscillation sources in power systems

The loss of a large generator or a large amount of load in a power grid will generally result in a frequency wave traveling from one end of the power system to the other, typically in a few seconds. It is important to learn how the frequency wave will speed up if converter-based renewable resources, which have negligible inertia, continue to replace retiring coal power-generating units. In collaboration with the University of Tennessee-Knoxville and Oklahoma State University, CURENT has developed disturbance propagation results on uniform one-dimensional and two-dimensional power systems with variable amounts of converter resources. Assuming that the converter resources are uniformly distributed, these "electromechanical waves" proceed at a speed proportional to $1/\sqrt{p}$, where p is the penetration ratio. However, grid-forming converters implemented with virtual synchronous generator control can slow down the wave propagation speed. The below figure (fig. 2) shows the wave propagation in a two-dimensional power grid. With snapshots at different time instants, the frequency rise due to load shedding moving through the system is clearly visible. Although the simulation was performed on an idealized system, these results have conceptual simplicity to offer guidelines for practical design of relays and protection devices.

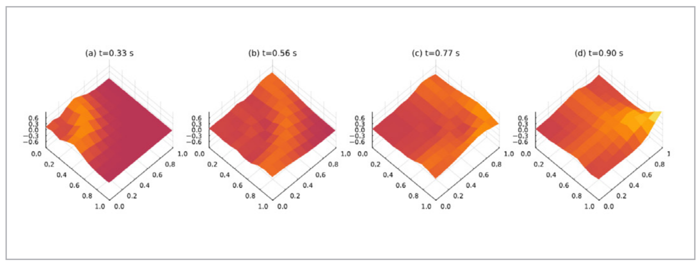


Figure 2: Wave propagation through a power grid

Traditional fast active power control systems are not commonly used since actuators are slow and the system frequency changes slowly due to the large amount of generator inertias. Converters backed by energy resources such as wind turbines and energy storage units can provide fast active power control, which can be very useful for improving the stability of the AC power grid. Even though the inertias of wind turbine generators are isolated from the AC power grid, the wind turbine blades can be controlled to provide sufficient frequency regulation, provided there is headroom left in the turbines. In case of faults near synchronous generators, a wind generator can temporarily curtail its power output for a few seconds to help decelerate the nearby synchronous generators and thus improve transient stability. An extension of the equal-area criterion applied to a single-machine infinite-bus system is shown on page 5 (fig. 3), as the decrease of the wind generator power increases the synchronizing torque. This adaptive Dynamic Power Reduction (aDPR) scheme, proposed by Stavros Konstantinopoulos (now at the Electric Power Research Institute), consists of three parts: (1) power reduction and ramping back up, (2) pausing the power recovery ramping when detecting that the synchronous generator is accelerating, and (3) using reactive power to damp generator back swing.

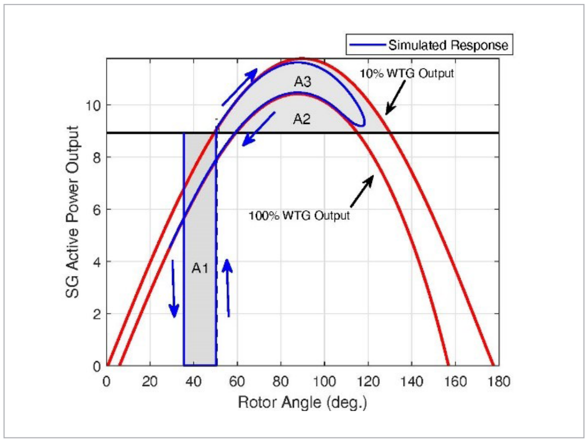


Figure 3: Adaptive dynamic power reduction

Another activity in support of renewable integration is an ARPA-E project on risk-adjusted unit commitment. Its objective is to allow renewable resources to include the risk of forecasted energy having shortfall in real time into its day-ahead market bids. The idea is based on debt securitization in financial markets. The bids by renewable resources are structured into three tranches: risk-free, mezzanine, and equity, with increasing price as shown below (fig. 4).

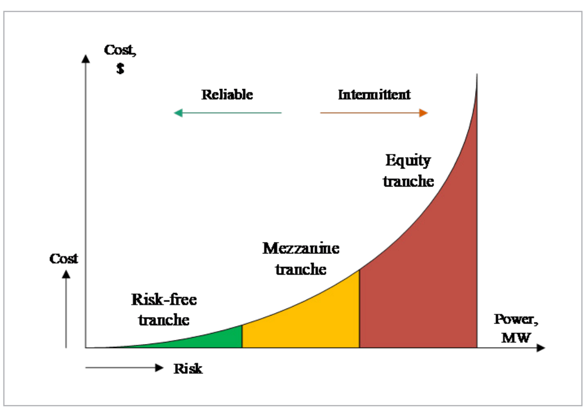
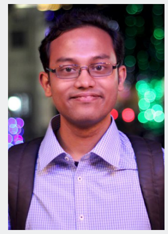


Figure 4: Pricing energy as a function of risk

Alumni Spotlight



Asif Chowdhury

SOC Design Engineer, Intel Corporation

I obtained my B.Sc. degree from the Bangladesh University of Engineering and Technology in electrical engineering in 2012 and then worked at the Samsung Research Institute in Bangladesh as a software engineer. In 2014, I joined Rensselaer as a graduate student in Professor Mona Hella's lab, and obtained my Ph.D. in 2020. During my doctoral studies, I was involved in multiple research projects involving systems and circuit-level design for optical wireless communication and time of flight/LiDAR systems. These included custom high-speed large-area silicon avalanche photodetectors, high-accuracy time-of-flight sensors, and a novel angle-sensitive occupancy sensor. All of this research was supported by the National Science Foundation Engineering Research Center for Lighting Enabled Systems and Applications. I also had the opportunity to work as a teaching assistant in courses like *LITEC*, *Introduction to Electronics*, and *Fields and Waves*.

After completing my Ph.D., I joined GlobalFoundries as a senior engineer to continue my research in the Silicon Photonics Department, leading a team to demonstrate a high-performance avalanche photodiode using monolithic silicon photonics technology and submitting several patents, one of which was recently issued. In January 2022, I joined Intel Corporation in Hillsboro, Oregon, as a system-on-chip design engineer, where I'm involved in the technology development of Intel's leading-edge Angstrom scale process nodes.

Maha Fadel

Wireless Software Engineer, MathWorks

I received my Ph.D. in electrical engineering from Rensselaer in 2020. Before joining Rensselaer, I received my bachelor's and master's degrees in electrical engineering from Cairo University and Nile University in Egypt, in 2013 and 2016, respectively. Between 2016 and 2020, I was a member of Professor Ali Tajer's Information Sciences Group. My research focused on interference management in wireless networks in the absence of channel state information at the transmitting nodes, via characterizing the information theoretic limits of novel superposition coding strategies. In 2019, I was one of the founding members of the ECSE Department's Graduate Student Council. I was awarded the Founders Award of Excellence and the Charles M. Close '62 Doctoral Prize by Rensselaer and the ECSE Department in 2019 and 2020. Upon graduating from Rensselaer, I joined MathWorks as a senior software quality engineer for the Communications Systems Toolbox. In 2022, I started a new role at MathWorks as a wireless software engineer, where I have been focusing on developing tools that facilitate the use of artificial intelligence in wireless communication systems applications within the family of the company's products.

Research Grants

Provably Efficient Reinforcement Learning via Neuro-symbolic Representations

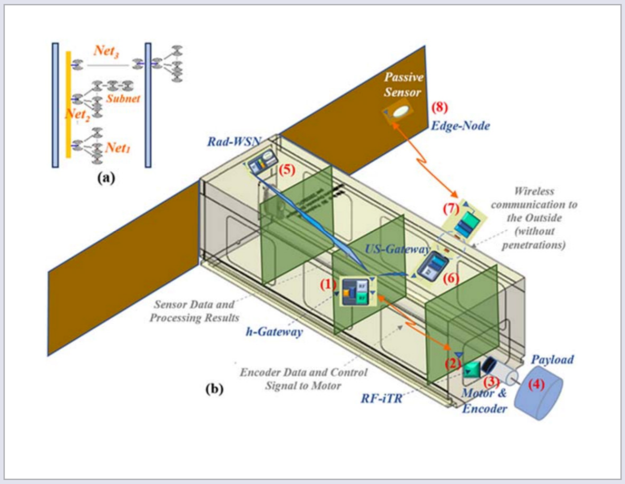
Meng Wang and Tianyi Chen (ECSE) with Miao Liu, Pin-Yu Chen, and Songtao Lu (IBM)

Humans excel at generalizing knowledge to different domains. While they are designed to mimic humans, most concurrent reinforcement learning (RL) algorithms require large amounts of data and cannot generalize to new tasks well. The data requirement and problem complexity increase tremendously when the task includes sequential logical subtasks. This project will establish the theoretical underpinning for sample-efficient RL that has provable generalization performance. The theoretical results apply to a broad class of RL applications such as text-based games (e.g., TextWorld), task-oriented dialog systems, and robotics. As a member of the IBM AI Horizons Network, the Rensselaer-IBM Artificial Intelligence Research Collaboration is dedicated to advancing the science of AI and enabling the use of AI and machine learning in research investigations, innovations, and applications of joint interest to both Rensselaer and IBM.

Research Grants

CUSTOmizable Intersystem Wireless Data/Energy Transfer (CUSTOS-WiT) System

Kyle Wilt (ECSE) in partnership with American GNC Corporation (Simi Valley, CA)



This Phase II Small Business Innovation Research (SBIR) grant will develop smart wireless sensor networks for spacecraft applications, initially targeted toward CubeSats. The Rensselaer focus is on providing the ability to connect the internal and external environments of the spacecraft using an "ultrasonic gateway," in which high-frequency vibrations are used to send both data and power across the spacecraft's outer skin to power and read the remote sensors. Ultrasonics are specifically used since traditional wireless techniques like Wi-Fi cannot readily pass through the metal and penetrating the skin increases the risk of failure. The smart wireless sensor network will enable significant reductions in spacecraft weight by eliminating the need for cable runs, sensing, and control modularity; easy incorporation of additional wireless nodes with minimal configuration; and non-intrusive sensing capabilities.

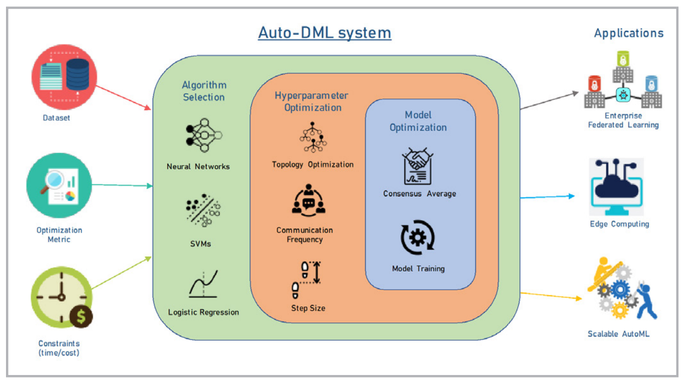
Artificial Intelligence Research Collaboration

The Artificial Intelligence Research Collaboration (AIRC) is a joint effort between Rensselaer and IBM researchers to advance the frontiers of AI research and develop the technologies needed for addressing a wide range of societal challenges, ranging from disease and the environment to automation and education. Since AIRC's inception, ECSE faculty members have been integral parts of this collaborative program, leading projects dedicated to advancing the science of AI. These efforts demonstrate the pivotal roles that ECSE research and education programs play in addressing modern-day engineering grand challenges. Some of the current projects are focused on designing the future generation of autonomous systems, developing human-interpretable machine learning (ML) frameworks, learning over large-scale networked platforms, and discovering causal relationships.

Human-Interpretable Machine Learning: Professors Agung Julius, Qiang Ji, and Ali Tajer lead separate projects on making machine learning (ML) algorithms amenable to human interpretations. Interpretability is one of the key challenges that is limiting the mainstream adoption of ML algorithms. For domain experts, understanding why an ML algorithm makes an accurate prediction is as important as its accuracy (e.g., in medical diagnosis and autonomous driving). Professor Julius leads a project to design a framework for forming a temporal logic description of a system's behavior based on observed data. This framework combines the complementary strengths of deep learning and symbolic AI in learning the temporal logic description. Professor Ji's research involves designing a knowledge-augmented deep learning paradigm, whereby domain knowledge and observable data are combined in a synergistic manner. Such an approach, besides facilitating interpretability, enables better data efficiency and domain generalization. Professor Tajer's research aims to design analytical metrics for quantifying the interpretability of ML algorithms. Such metrics are critical for assessing the interplay between accuracy and interpretability in AI.

Reinforcement Learning: Professors Meng Wang, Tianyi Chen, and Santiago Paternain lead projects on the theoretical foundations of reinforcement learning (RL). Professors Wang and Chen are co-investigating the design of a technology that can train an RL algorithm on one task and readily generalize it to others. This is essential for reducing the need to constantly train RL algorithms for new tasks for which data acquisition is infeasible or costly. Professor Paternain's project tackles a related problem by leveraging the characteristics of the physical domain into the design of the RL algorithms, rendering them less data-hungry and more easily generalizable.

Distributed Learning: Professor Koushik Kar is investigating how to automate ML algorithms over large-scale distributed systems. Most modern technological platforms are rapidly evolving into interconnected platforms (e.g., wireless networks, power systems, cloud systems). Distributed learning and decision-making in such systems necessitate pushing a significant portion of computations to the edge units due to various privacy and regulatory constraints. This project investigates how to optimally distribute computation and learning across different computational resources in a network for various learning and optimization objectives.



Causal Discovery: Causal inference is a modern discipline that aims to find cause-effect relationships among components of large systems. It has widespread applications in various branches of science and technology, such as epidemiology, drug discovery, fault detection in networks, and social sciences. Professor Ali Tajer leads a project on designing algorithms that can uncover specific cause-effect relationships in large-scale systems (e.g., the impact of a particular substance on the efficacy of a drug that consists of a large number of substances). This research investigates the theoretical foundations of such algorithms and their applications to gene regulatory networks and fault detection in cloud systems.

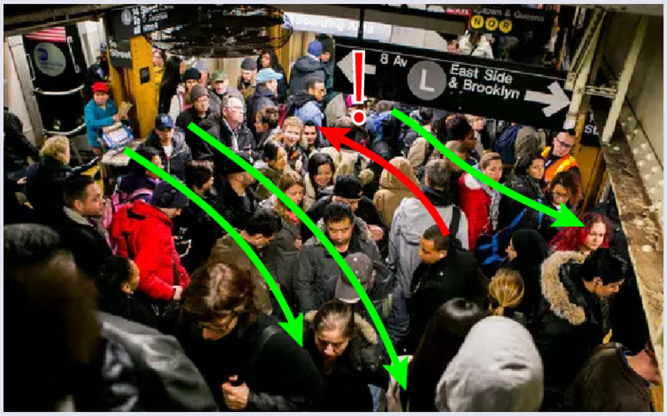
28 **TENURED/TENURE-TRACK FACULTY**

8 **LECTURERS, PROFESSORS OF PRACTICE**

11 **IEEE FELLOWS**

8 **NSF CAREER AWARD WINNERS**

$10 MILLION **ANNUAL RESEARCH EXPENDITURES**

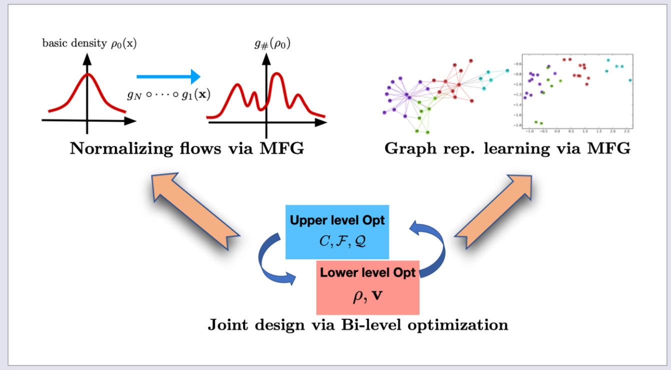


Detecting Anomalous Activity in Crowded Environments Using Long-Term Patterns of Life

Rich Radke (ECSE)

This project addresses the detection of real-time threats in video streams from crowded soft target environments such as shopping malls, sports arenas, or transit hubs. Video analysis is often the first line of defense in such environments due to the wide area of coverage, both at far and close range, provided by a spatially distributed network of cameras. Anomalous behavior or events in video may clearly signify a threat (e.g., a fight breaking out) or indicate something out of place that should be pursued via human intervention or another sensor modality (e.g., a line of people moving the wrong way through a crowd). We will use long-term video collected from many days and months of observation to determine what behavior is natural and expected for a given hour, day, and location. This model will allow the detection of anomalous behaviors in real time, even in the presence of dense crowds. The project is part of a new Department of Homeland Security multi-institutional Center of Excellence called SENTRY (Soft-target Engineering to Neutralize the Threat RealitY), headquartered at Northeastern University.

Research Grants



Representation Learning via Variational Mean Field Theory

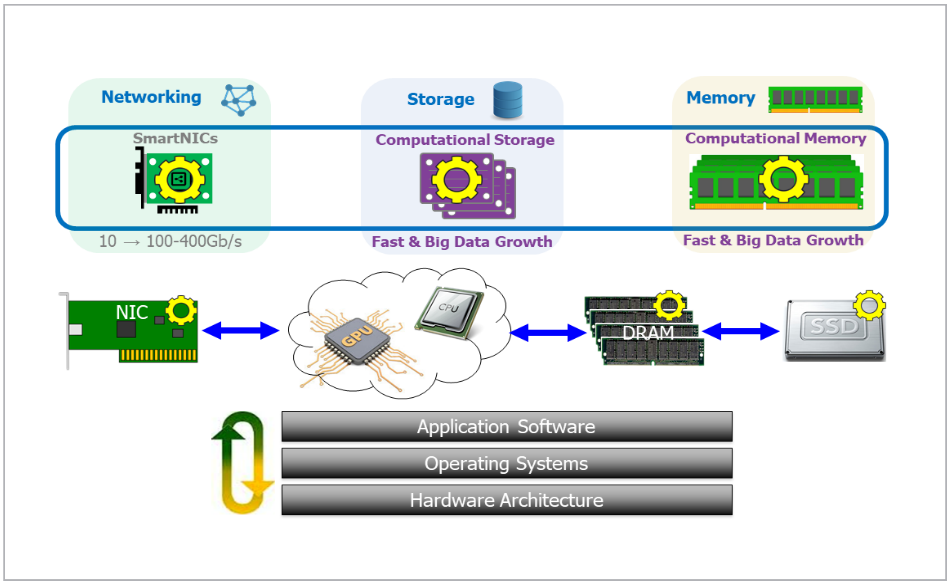
Rongjie Lai (Math) and Tianyi Chen (ECSE) with Jie Chen (IBM)

Deep learning has had tremendous success in many science and engineering applications. Representation learning, which extracts useful information from raw data needed for subsequent tasks (e.g., classification, regression, and reinforcement learning), is one of the most important directions of deep learning. Despite its empirical success, our theoretical understanding of representation learning is far from satisfactory. This project aims to provide a new understanding of representation learning using mean-field game (MFG) theory and bilevel optimization. The proposed research not only provides a theoretical understanding of generative models and graph representations, but also serves as a key step in transforming deep representation learning from a black-box approach to an explainable and trustworthy method. The Rensselaer researchers' collaboration with the MIT-IBM Watson AI Lab leverages complementary technical skills and industrial viewpoints, giving Rensselaer students a broader perspective.

Near-Data and Heterogeneous Computing

Over the course of 20 years in the ECSE Department, Professor Tong Zhang has conducted research in a variety of areas, including VLSI architectures for signal processing and error correction coding, memory fault tolerance, non-volatile memory circuits and architecture, data storage systems, and data structures and databases. Striving to solve problems that are not only intellectually interesting but also practically relevant, his research team has made notable contributions to the high-tech industry. This includes an error correction coding system that is used in all commercial hard-disk drives (HDDs) and solid-state drives (SSDs) sold today.

Professor Zhang's current research focuses on near-data computing, a key component in the heterogeneous computing paradigm. The slowdown of CMOS technology scaling has forced the industry to transform from traditional homogeneous computing toward heterogeneous and domain-specific computing. Aiming to make computations occur in the most efficient form and at the best location, heterogeneous computing is almost the only way to maintain the historical improvement of computing performance/efficiency in the post-Moore's Law era. This has led to significant current interest in near-data computing, i.e., equipping memory/storage devices with fixed or programmable computational capability so that the system can move certain data processing tasks closer to where data is physically located. Such computational memory and storage devices could complement CPUs and GPUs to form a truly heterogeneous and high-performing computing platform for data-intensive applications (e.g., data science and analytics, artificial intelligence, and machine learning). Recently, Professor Zhang's research team has been studying how to rethink the design and implementation of the computing infrastructure software stack (e.g., database, data management, and file system) upon the imminent arrival of computational memory/storage devices.



Since they represent a fundamental departure from traditional commodity memory/storage devices, computational memory/storage devices inevitably face many technical and non-technical obstacles toward their real-world success. To spearhead and accelerate the commercialization of computational storage drives, Professor Zhang cofounded ScaleFlux Inc. (San Jose, CA) together with his former Ph.D. students. ScaleFlux successfully launched the world's first computational storage drives being shipped worldwide and continues to lead the way in innovating and developing computational storage drives. Its pioneering endeavor helped near-data computing gain significant momentum in the industry. For example, industry-wide standardization efforts are currently being orchestrated by organizations like the SNIA (Storage Networking Industry Association) and NVMe (NVM express) consortia, and many well-established companies (e.g., Samsung, Intel, AMD/Xilinx, ARM, Western Digital) are rapidly ramping up their R&D activities on computational storage. The firsthand experience of developing revolutionary commercial products for future computing infrastructure has allowed Professor Zhang to bring valuable real-world aspects and insights into his classrooms and research at Rensselaer. His current research on near-data computing has been sponsored by the National Science Foundation.

3 **TECHNICAL STAFF**

4 **ADMINISTRATIVE STAFF**

The Computational Imaging Laboratory

The Computational Imaging Laboratory at Rensselaer, headed by Professor Birsen Yazici, focuses on developing theoretical and algorithmic foundations for computational imaging across a wide range of application domains, including radar and sonar remote sensing, and medical and optical imaging. Her lab's current research cross-fertilizes ideas from machine learning, optimization theory, integral geometry, and inverse scattering theory to innovate new imaging technologies. Members of the lab focus on developing provably good, computationally efficient algorithms and characterizing fundamental trade-offs between resources and performance gains.

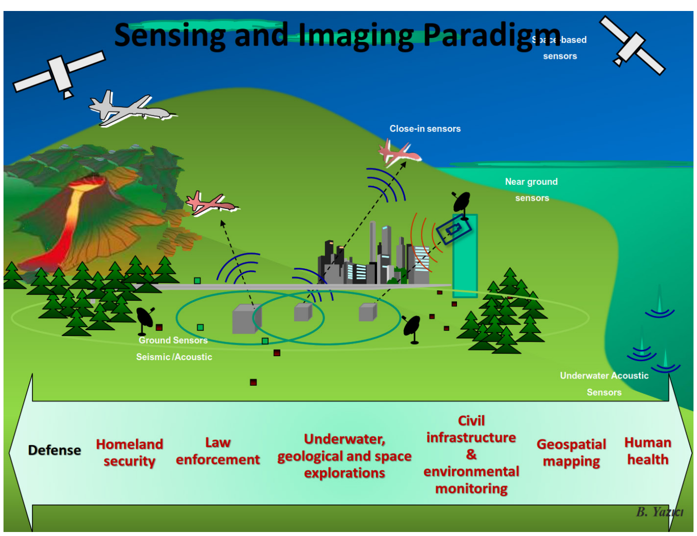
Sensor technology has improved dramatically in recent years. For example, radar, sonar, and optical sensors can be miniaturized and made more agile. They can be deployed on small uninhabited vehicles, change their illumination patterns, and work in active or passive modes, collecting vast amounts of data.

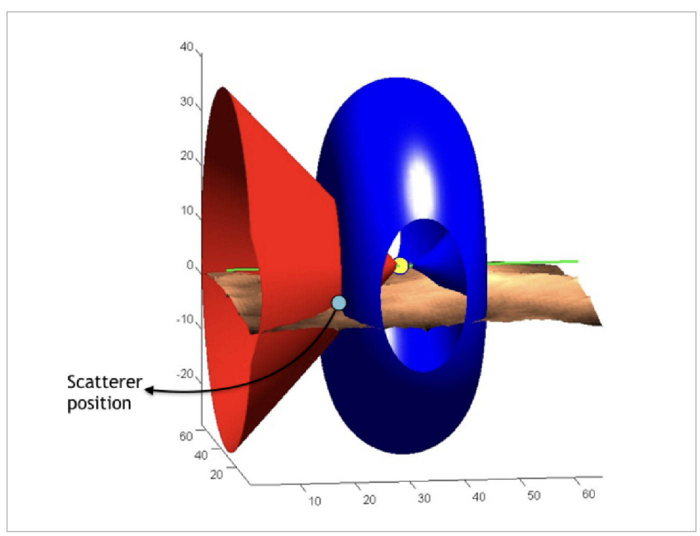
Professor Yazici's research takes advantage of agile distributed sensing capabilities and advanced data processing and modeling techniques to integrate sensing, image formation, and exploitation, resulting in innovative imaging systems and new applications. These new systems have inexpensive sensing hardware and provide better exploitation capability and richer information than conventional imaging systems. Current applications include passive and active interferometric imaging, super-resolution imaging, phaseless imaging, and imaging of dynamically changing environments.

Interferometric imaging is typically addressed using linear inversion methods under simplifying assumptions that limit the resolution and exploitation capabilities of the imaging system. Professor Yazici's lab developed a novel mathematical theory and computationally efficient algorithms for interferometric inversion based on non-convex optimization. Unlike previous approaches, the theory provides tools for engineers to design novel imaging systems with provable performance guarantees in complex environments.

Another area of great interest is the development of phaseless radar and sonar imaging systems. Conventional radar and sonar imaging systems fundamentally rely on phase information and expensive hardware for coherent imaging. Imaging with amplitude-only data is a paradigm shift in radar and sonar imaging. Professor Yazici's research group developed a novel deterministic mathematical theory based on non-convex optimization and accompanying algorithms that enables new, inexpensive hardware augmented with provably good, computationally efficient algorithms for the realization of phaseless radar and sonar systems.

In addition to optimization theory, the research group also exploits artificial neural networks for model-based learning and information exploitation. They design provably good deep networks to address ill-posed inverse problems. These networks take advantage of prior models learned from data, models derived from inverse scattering theory, and convex and non-convex optimization theory to provide design guidelines for provably good network architecture. Professor Yazici's research is currently funded by the Air Force Office of Scientific Research, National Science Foundation, Office of Naval Research, and Naval Research Laboratory.





Research Highlights

Nano/Bio Enhanced Devices

In 2007, the National Academy of Engineering released a report on the forefront of research at the nano/bio interface stating that "biology can provide tools for controlling material synthesis, physical properties, sensing, and mechanical properties at the molecular level. Harnessing biomolecular processes, such as self-assembly, catalytic activity, and molecular recognition can greatly enhance purely synthetic systems. Therefore, the integration of these fields is a natural evolution in engineering."

Coincidentally, 2007 was the same year Professor Shayla Sawyer's research program began. Her nano/bio enhanced device research endeavors to bridge the gap between novel hybrid materials and their use in new sensor systems to shift paradigms of how, where, and when hazards (biological, environmental, chemical, or nuclear) can be detected. Her group's most recent phase of next-generation hybrid devices is an outgrowth of early research funded by the Lighting Enabled Systems and Applications Center to detect concentrations of bacteria in a smart room using sensitive, ultraviolet, hybrid-material photodetectors. Seed funding from IBM, through the Jefferson Project, helped to evolve the research toward a bioelectronic solution. Now, Sawyer Lab researchers employ bacteria to do the work to fabricate nanomaterials and sense the environment. James Dylan Rees, now a lecturer in ECSE, investigated the use of dissimilatory metal- and/or sulfate-reducing bacteria in engineered sensors and systems by combining ideas from environmental engineering, electro-microbiology, semiconductor material fabrication, and semiconductor device development. Specifically, the bacterium *Shewanella Oneidensis* MR-1 has gained significant attention in the greater scientific community due to their recent results in the fabrication of high-mobility molybdenum disulfide nanomaterials (MoS2) at room temperature. In addition, transformative sensing research has been recently funded by the National Science Foundation to use *Shewanella Oneidensis* MR-1 and its extracellular electron transport as a modular bioelectronic interface. Through collaborations with synthetic biologists, water ecologists, and chemical engineers, the Sawyer Lab explores how communities of bacteria may be able to sense small molecule targets (such as phosphate or nitrates) with unprecedented sensitivity and selectivity. Implications for this bacteria-enabled research are far-reaching, from water quality sensing to in-situ soil sensing to infrastructure corrosion sensing to biomedical applications such as drug delivery and bacteria-driven diseases.

Student Spotlights

Ivan Hammel

Class of 2022 (B.S.)

Major: Computer and Systems Engineering

Work Experience: In 2020, I did a summer and fall co-op at Akcelita, an IT services and consulting company in San Juan, Puerto Rico. I developed a synthetic data generator for machine learning models, and implemented an in-browser 3D point cloud renderer. I also did a co-op at Western Digital in the spring and summer of 2021.

Projects/Research: I was a research support engineer in the Center for Earthquake Engineering Simulation at Rensselaer. I developed an automated computer vision system to detect and regulate droplet rate to saturate environmental models without human supervision.

On-campus Activities/Organizations: I was the president and treasurer of the Rensselaer student branch of the Institute of Electrical and Electronics Engineers, improving the organization's operations and structure. I've also been involved with the Society of Hispanic Professional Engineers (SHPE), working on the Career Fair and the MentorSHPE Committee.

My Future Plans: I'm starting with Google in Seattle in August 2022.

Fun Facts About Me: Only having learned how to play water polo in college, I scored twice on our own team at tournaments. My drink of choice when grinding through work is orange juice. I began collecting fountain pens over quarantine.

Amelia Peterson

Class of 2022 (Ph.D.)

Major: Computer and Systems Engineering

Work/Internship Experience: While I was an electrical engineering/computer and systems engineering student getting my bachelor's degree at Rensselaer, I did a summer internship at National Instruments, developing driver software for DC power devices. I then worked for a year as a verification engineer at IBM before returning to Rensselaer to pursue my Ph.D. under the supervision of Professor Shayla Sawyer. I'm looking forward to being a Lecturer in ECSE starting this fall.

Projects/Research: During my doctoral studies, I modeled the oxygen adsorption and photodesorption process on metal oxide surfaces to aid in designing high-speed, high-gain UV photodetectors for the application of biological fluorescence detection. I also worked with several professors and the administration on improving pedagogical practices across campus.

Fun Facts About Me: I enjoy drawing, painting, and digital art. I also volunteer as the electronic zone coordinator at the Tech Valley Center of Gravity, a makerspace in downtown Troy.

Autonomous Building Systems Control

Under the leadership of Professor Bob Karlicek, the Center for Lighting Enabled Systems and Applications (LESA) is exploring the development of autonomous building systems control under two separate Department of Energy (DOE) programs.

The first project, supported by a $2.3 million award from ARPA-E, addresses HVAC energy efficiency improvements. Significant energy use reductions can be achieved when a building accurately knows how its occupants are distributed. Here, LESA is using a novel Time-of-Flight (ToF) and color sensor platform along with machine learning and predictive occupant movement estimation algorithms to know where building occupants are without compromising occupant privacy (Fig. 1). The project consists of two parts: (1) algorithm development and validation using simple commercially available ToF/color sensors and controllers, and (2) the design and fabrication of new ASICs for the monolithic integration of ToF/color sensing and control to create devices with superior performance compared to current commercially available sensors. The improved sensor ASIC is being fabricated on the novel silicon optical bench platform at GlobalFoundries and will revolutionize occupancy sensing for the reduction of building energy consumption.

The researchers' preliminary modeling shows that when accurate occupancy data (number and location) is available for use by intelligent building HVAC control systems, HVAC energy use can be reduced by well over 30%, depending on the type of system used in the building. Precision control of building HVAC systems impacts both energy use and indoor air quality by enabling much better control of how fresh air that needs to be heated or cooled is introduced to the building.

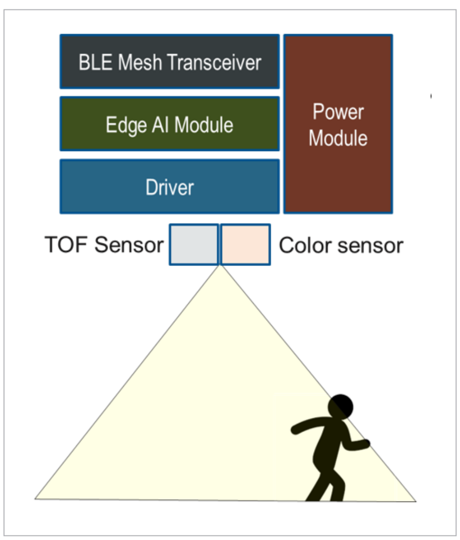


Figure 1: Novel occupant counting and tracking system using low-resolution depth (ToF) and color sensing and integrated intelligence. The individual sensor is compact (1/3 the size of a deck of cards) and forms a network with other sensors to localize building occupants.

In the process of developing the ToF occupancy sensing platform, the team determined that the sensor would also be extremely valuable for monitoring patients in health care facilities, primarily in detecting patient falls and observing movement patterns related to patient well-being. To realize this application, LESA spun out the Troy Sensor Company, and is currently seeking funding and investors to commercialize the use of this sensing platform in the health care field.

In the field of lighting control, LESA was awarded a second $2.7 million DOE project to explore how advanced digital LED lighting can maximize energy efficiency gains through the use of dynamic, beam-steerable lighting fixtures to tune the illumination in real time and in response to the system's estimate of where people are, what they are doing, and the type of lighting they most likely require. This project capitalizes on LESA's many years of research and development on energy-efficient LED lighting, tunable lighting for human circadian health, and advanced sensing platforms for lighting control. The goal is to create a digitally controlled lighting fixture that will automatically and optimally shape the lighting distribution (color, direction, intensity) for any estimated activity (reading, working, socializing, watching a lecture, and so on), all with little or no input from the room occupants. LESA is working with the Rensselaer Center

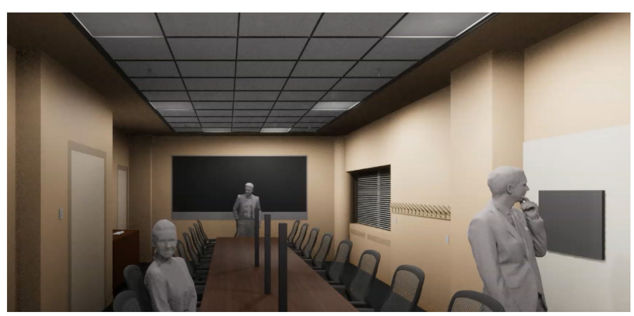


Figure 2: This image shows a digital twin of the LESA Smart Conference Room where virtual reality (VR) is used to demonstrate the use of digital control to tune light fixtures to highlight different scenes, here showing the illumination of an object on the wall for the person on the far right. The system tracks the position and gaze of occupants and automatically adjusts the light for the optimal illumination at the lowest possible energy consumption.

for Architecture Science and Ecology, the architecture design firm HKS, and LED manufacturer Lumileds to develop a system that automatically delivers the right light for any situation as needed.

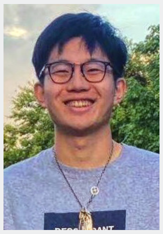
Starting with the lighting, the team designed specialized LEDs that can be digitally addressed to control beam direction and color and built them into a novel 2'x2' lighting fixture. Next, they designed a system of depth sensing cameras to estimate the location, pose, and gaze direction of each occupant in the space in order to estimate the type of activity they are engaged in. Finally, a specialized control system selects the appropriate lighting colors and directions that are optimized for both the occupants' activity and their circadian rhythms (by carefully controlling the blue light directed towards their eyes based on the time of day).

Lumileds and LESA are working together to design, install, and test the lighting fixtures in our specially designed Smart Conference Room testbed. In order to develop the control algorithms, the entire room, including the sensing and lighting systems, has been digitally recreated in the Unity game engine. The team can evaluate candidate control algorithms using virtual reality (VR) headsets to provide an initial assessment of the lighting quality. The VR application also incorporates the depth-sensing cameras to locate virtual occupants as they move around and engage in various activities (Fig. 2). The system can be used to minimize energy consumption while providing high-quality, comfortable lighting distributions for the room's occupants. The full system will be built and tested with real test subjects in the final year of the project.

These projects are just two examples from LESA that are part of the recently formed Institute for Energy, the Built Environment, and Smart Systems' efforts in sentient, sustainable building research. This interdisciplinary research center addresses many topics, including the development of sustainable, smart buildings and urban systems that reduce global building carbon footprints while improving human well-being.

591 **UNDERGRADUATES**
16 **MASTER'S STUDENTS**
95 **DOCTORAL STUDENTS**

Student Spotlights



Zhengye Yang
Class of 2026 (Ph.D.)

Major: Electrical Engineering

Work/Internship Experience: I interned at Nokia Bell Labs as a test engineer when I was an undergrad. As a master's student at Columbia University, I worked on developing a system to provide real-time traffic information to vehicles to improve city traffic flow and reduce accidents. We also built a system that evaluated how well people were socially distancing during the pandemic.

Projects/Research: In my first year at Rensselaer, I worked with Professor Rich Radke on a project to analyze group meetings. Specifically, we are developing algorithms that try to understand the progress of a meeting and improve communication efficiency. Starting this summer, I will be working on a new research project involving anomaly detection in long-term video sequences.

Fun Facts About Me: I am a huge fan of vintage clothing and Native American crafts that are authentic and aged well. I spend my spare time researching amazing fabrics and leather manufacturing processes. I take good care of my boots and leather goods to relax myself.

Matthew Youngbar
Class of 2022 (B.S. and M.S.)

Major: Computer and Systems Engineering/ Computer Science

Minor: Electronic Arts

Work/Internship Experience: I worked for Genesys as a software engineer intern for two summers. Last summer, I worked with the Core UI team to develop reusable and accessible front-end web components, and the summer prior, I worked with the Edge Infrastructure team to improve cloud computing resource management services.

Projects/Research: I'm currently working with Professor Rich Radke on obtaining video data of public spaces for the preliminary steps of a computer vision research project. I have also worked on various projects for courses, including a web app that can be used for the coordination and communication of a college swim team.

On-campus Activities/Organizations: I have competed as a member of the Rensselaer swimming and diving team throughout my college career. I'm also co-president of the Student-Athlete Advisory Committee.

Future Plans: This summer, I'm going to work as a software engineering intern for Capital One in Boston, Massachusetts.

Fun Facts About Me: I love baking and taking care of my plants; I even made my own chocolate chip cookie recipe!

Research Highlights

Technology and Algorithms to Combat Circadian Rhythm Disruptions

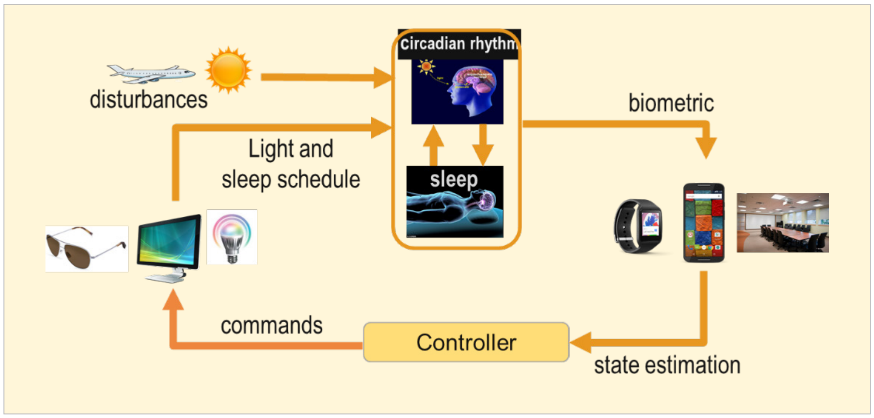
What does control theory have to do with light bulbs, jet lag, and alertness? Quite a lot, as it turns out. Jet lag is a phenomenon in which our bodies' internal clocks are misaligned with the local time (e.g., when we travel across several time zones). It has several symptoms, including decreased alertness. Our bodies' internal clocks, also called our circadian rhythms, are driven by many signals, primarily light exposure.

Research by ECSE Professors Agung Julius and John Wen uses control theory to formulate a closed-loop feedback control problem in which smart light bulbs can be used to eliminate jet lag and improve alertness. Closed-loop feedback control is the technology that allows smart autonomous systems, such as self-driving cars, to operate based on a simple principle — the loop of sensing, decision-making, and action.

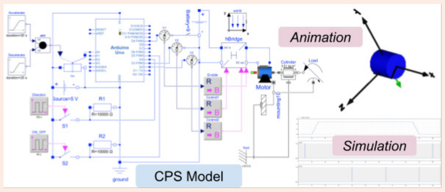
Our circadian rhythms are controlled by the master clock that resides in the suprachiasmatic nucleus in our brain. These rhythms are present in various biological processes, including sleep, hormone secretion, and neurobehavioral processes. Sensing the state of this biological clock is challenging because unlike engineering systems (e.g., cars that can be designed to include sensor instruments), this biological clock can only be measured indirectly (e.g., by using personal devices like smart watches). These watches can measure a few types of biometrics, most commonly actigraphy and heart rates. Professors Julius and Wen recently demonstrated the possibility of using actigraphy data for estimating circadian phase shifts with comparable accuracy to the clinical standard method that uses melatonin hormone assays. This opens the door for future wearable sensors that have more functionalities. Working toward this goal, Professor Julius is collaborating with ECSE Professor Mona Hella, an expert in microelectronics, to build the hardware and processing algorithms for such future sensors.

The decision-making part of the control loop involves optimizing the schedules of the possible actions and quantifying them optimally. For example, consider optimizing the individual lighting and sleep schedules for a group of travelers while maintaining a standard of comfort (e.g., avoiding sleep deprivation) and mental performance. This is done using techniques from optimal control theory applied to the individuals' circadian rhythm models. Recent publications by the researchers demonstrate how this technique can be applied to help trans-meridian travelers and rotating shift workers deal with their circadian disruption effectively and productively.

This research has been supported by state and federal agencies, including current active grants from the National Science Foundation and the Army Research Office.



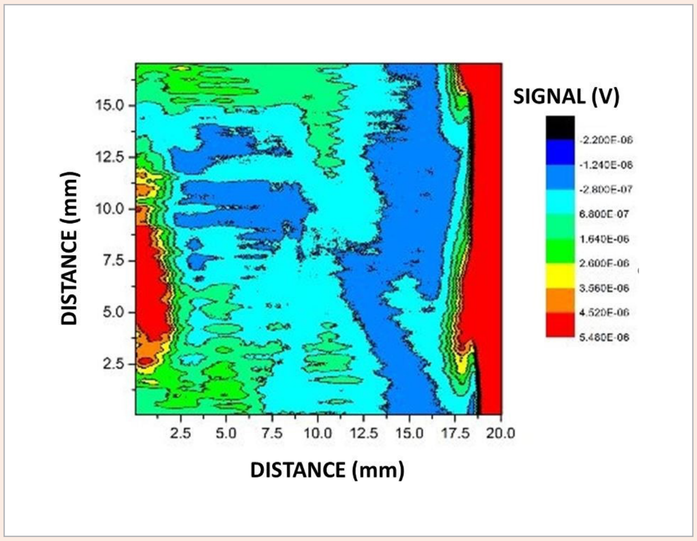
New Courses



Modeling and Simulation for Cyber-Physical Systems

ECSE-4170/6170 | Taught by Luigi Vanfretti

With computation and communication becoming more pervasive than ever, traditional physical systems (e.g., vehicles, industrial plants, and even power networks), are being transformed into complex systems-of-systems, referred to as cyber-physical systems. This course gives students a solid basis for modeling and simulating such systems using an object-oriented equation-based modeling language called Modelica with the goal of building system models with high reusability. The course has a hands-on approach to cover topics related to numerical simulation for cyber-physical systems, including continuous-time systems, discontinuous/discrete systems, and finite-state machines. Aspects of real-time simulation for embedded systems are introduced — allowing for the modeling and simulation of embedded systems to be carried out both virtually in simulation and physically using an Arduino kit.



Physical Foundations of Solid-State Devices

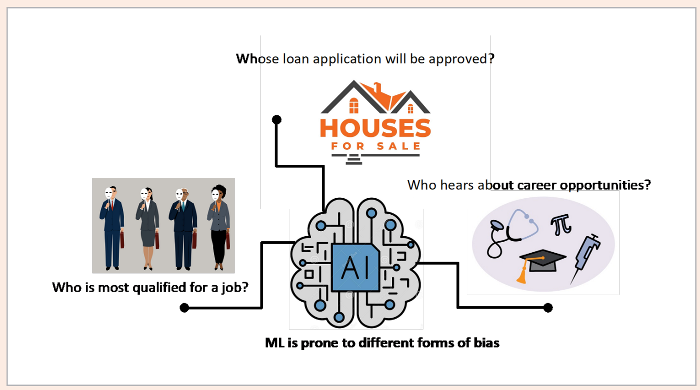
ECSE-4992/6220 | Taught by Michael Shur

The United States is planning to restore its eminence in advanced electronics. This effort will create tens of thousands of jobs for engineers who will work on advanced chips that operate completely differently from 20th-century transistors. The Beyond 5G Revolution has started, inspiring research on new materials and new devices that push technology to its quantum limits. This course addresses the physics foundations of advanced semiconductor devices required to understand modern integrated circuit technology, the technology behind quantum and ballistic transport, quantum computing and quantum communication, ballistic mobility, high field effects, polarization doping, and thin-film transistor physics.

Renewable Power Generation

ECSE-4141/ECSE-6141 | Taught by Jian Sun

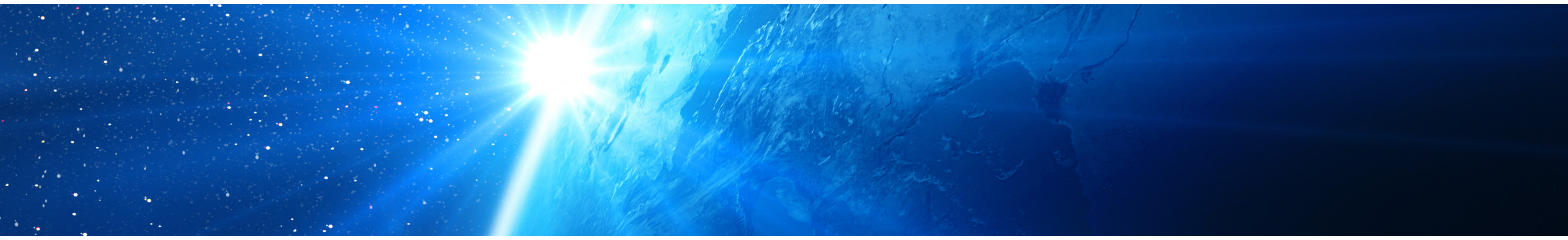
Renewable energy is essential for a decarbonized power sector. With the commitment by many governments to achieve carbon neutrality by 2050, renewables will replace most thermal power plants in the next 20 years. Developing such new power systems is a grand challenge for electrical engineers. This new cross-listed senior and graduate course teaches the fundamentals that students need to tackle this challenge, introducing students to electric power generation from renewable sources and its integration into the power grid. Topics include fundamentals of photovoltaic and wind energy, principles and control of solar and wind power plants, as well as operation and control of power systems with renewables.



Trustworthy Machine Learning

ECSE-4962/ECSE-6962 | Taught by Ali Tajer

Machine learning algorithms are increasingly deployed for decision-making in a wide range of social and technological arenas that directly impact the livelihood and well-being of citizens. Besides their accuracy, machine learning algorithms are also judged on the basis of their fairness, robustness, privacy, and transparency. This cross-listed senior- and graduate-level course starts by providing students with a basic understanding of these concepts and formalizing them mathematically in the context of machine learning. It then provides the algorithmic and mathematical tools for designing machine learning algorithms that can be inherently fair, robust, privacy-preserving, and transparent in decision-making.



Department News

Manoj R. Shah Elected to the National Academy of Engineering

Manoj R. Shah, former professor of practice at Rensselaer, has been elected to the National Academy of Engineering (NAE) for his "technical advancements in design, analysis, and applications of electric machines." As a professor of practice in ECSE at Rensselaer, Shah taught courses in electric power engineering, bringing theory and practice together. He continues his engagement with the ECSE department at Rensselaer as a senior research scientist. He is also engaged with General Electric, where he had a distinguished career.

Election to the NAE is among the highest professional honors bestowed upon an engineer. According to the Academy, membership recognizes those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering or developing/implementing innovative approaches to engineering education."

Shah is an internationally recognized expert in the area of advanced design and analysis of electric machines. He has co-authored 88 U.S. patents, 21 Institute of Electrical and Electronics Engineers (IEEE) journal papers, and over 25 conference papers. His research on topological and performance improvements in electric machines, novel electromagnetic devices/sensors, measurement and analysis techniques, and novel system configurations for subsea and aviation platforms has led to groundbreaking developments and discoveries with impact across the globe.

This includes the early application of computation using finite element analysis, referred to as the "2.5D" method, in electromagnetic design of electrical apparatus, which has now become standard. Shah's work in the '80s first laid the foundation at GE Power, and then permeated other institutions. This work not only helped with extraction of machine parameters and prediction of machine performance, but also enabled improved, robust, and cost-effective designs. The "2.5D" method led to improved design, power density, and thermal management in many generations of GE turbine generators. Some of the Permanent Magnet machine design concepts have been manufactured into products for electric vehicles, geothermal/oil and gas extraction technologies, aviation hybrid propulsion prototype development, and the RACER tool in GE Power's service offering. Electrical Multiphase Imbalance Separation Technique or eMIST is employed to monitor the health of GE wind turbine systems, thus making these systems operate more efficiently and reliably to prevent catastrophic failures.

"Dr. Shah has been recognized as an innovator in the area of advanced design and the analysis of electric machines," said Rensselaer Provost Prabhat Hajela. "His contributions to improving electric power systems and setting the bar for industry standards has had a global impact. Our Rensselaer community is proud of

- 31ST **IN 2022 U.S. NEWS & WORLD REPORT ELECTRICAL ENGINEERING UNDERGRADUATE PROGRAM RANKING**
- 42ND **(EE AND CSE) IN 2022 U.S. NEWS & WORLD REPORT GRADUATE RANKINGS**
- 24TH **IN 2022 TFE TIMES BEST MASTER'S OF COMPUTER ENGINEERING RANKING**

this fitting recognition of his contributions to the field. It truly embodies the spirit of innovation that the university advances in research and pedagogy."

"We are thrilled with Dr. Shah's election to the NAE," said Shekhar Garde, Dean of the School of Engineering at Rensselaer. "He is not only an outstanding scientist and engineer, but a fantastic teacher and mentor. As a professor of practice, Manoj brought immense real-world experience and wealth of knowledge of electric power systems to the classroom and helped our students bridge the gap between theory and practice, and we look forward to his continued engagement with Rensselaer."

Institute Professor and world-renowned expert in power grid control systems Joe Chow, who was elected to the NAE in 2017, envisions major opportunities for Shah's research in future power systems. "Dr. Shah's world-class research and design methods in electromagnetics are of paramount importance to future power systems which include large shares of renewable resources and future transportation systems, such as electric vehicles and electric aircrafts," he said.

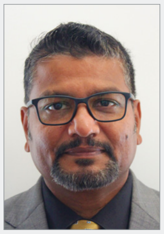
"Putting theoretical ideas to work in important practical applications has been a passion of mine throughout my career at GE," said Shah. "Being a teacher and mentor at Rensselaer presented a special opportunity for me to share my ideas with bright young minds and collaborate with outstanding faculty in the department. I look forward to my continued engagement with the next generation of students and faculty."

Shah is an elected fellow of the IEEE, a member of the Technical Advisory Board for the Future Electric Machine Manufacturing Hub at the University of Sheffield, United Kingdom, and a Short Course Instructor on Electric Machines at the SAE Hybrid Vehicle Academy.

He has received several awards, including the IEEE Gerald Kliman Award, the IEEE Nikola Tesla Award, the GE Coolidge Fellowship Award, the GE Asian and Pacific American Forum Regional Technical Achievement Award, and the GE Most Outstanding Technical Contribution and Individual Achievement Award.

The newly elected class of NAE members will be formally inducted during a ceremony at the NAE's annual meeting on Oct. 2, 2022.

New Faculty Spotlight



Prabhakar Neti

Professor of Practice, ECSE

ECSE welcomes new Professor of Practice Prabhakar Neti. Professor Neti received his Ph.D. in electrical and computer engineering from the University of Victoria in Victoria, BC, Canada. He has served as a faculty member at different technical institutions in India. Between 2007 and 2008, he was a postdoctoral fellow in the Department of Electrical and Computer Engineering at the University of Manitoba in Winnipeg, MB, Canada. Between 2008 and 2018, he worked as a senior engineer at the GE Global Research Center in Niskayuna, New York, where he received the prestigious Hull Award in 2013. He has more than 25 issued patents and many patent filings in the United States and worldwide, and has several years of startup experience. Professor Neti has over 25 Institute of Electrical and Electronics Engineers (IEEE) publications, and he has been a senior member of IEEE since 2009. His research interests include electrical energy systems, electric machines, condition monitoring, and online asset management of electrical equipment.

In Memoriam

ECSE Mourns the Passing of Three Longtime Staff Members

It is with tremendous sadness that ECSE mourns the passing of three longtime staff members: **Steve Dombrowski**, **Jerry Dziuba**, and **Audrey Hayner**, who will be remembered fondly by current members of ECSE and our alumni. There was an outpouring of grief and remembrance of Jerry, Steve, and Audrey from our ECSE family.

Steve Dombrowski was with Rensselaer and ECSE for 42 years. He was instrumental in creating and maintaining an outstanding laboratory learning environment for students and faculty. During the pandemic, Steve was critical to the successful deployment of an initiative to outfit all incoming ECSE students with ADAM 1000 Active Learning Modules and accessory boards to enable them to conduct labs and learn remotely. Steve was also the longtime adviser for the Rensselaer Amateur Radio Club W2SZ.

Professor Joe Chow: "Steve was instrumental in developing the computer labs on the sixth floor, back in the days when I was the acting department head. I taught in those labs often, and Steve would always make sure that everything was right. He helped with my summer camp programs for the last eight years. In those rooms, you can still see all the circuit boards and other things Steve built for the computer courses."

Professor Luigi Vanfretti: "I am so sad; he was so kind to me and such a great person to work with. He was such an encyclopedia of knowledge and a craftsman like no other I've met. I will miss him; it was so nice to have coffee with him and learn about all the different things he set up for teaching. He taught me so much about how to develop my own labs, and he took care of maintenance and distributing hardware to the students, even keeping track of the returns."

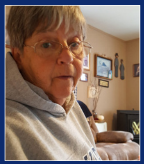
Senior Student Services Administrator Rama Hamarneh: "Steve was a smiling face every morning, he went out of his way to see how you were doing, and always stopped to hear about your day. He went above and beyond for his fellow staff members, making sure we felt supported. He will be dearly missed."

Jerry Dziuba, ECSE lab and classroom manager, was with Rensselaer for 47 years. He was dedicated, capable, helpful, and generous — a true pillar of ECSE. In 2021, ECSE named its annual Graduate Student Service Award in Jerry's honor.

Professor Mona Hella: "Jerry was a very special person. He loved what he was doing and took care of everything. Without him, I would never have survived at Rensselaer. He took care of the lab and teaching facilities, picked up the mail, asked for quotes, and fixed anything that could be fixed. I never had to tell him what to do; he just did what he believed was right, and it was always the right thing to do. My students loved him. He was resourceful and always excited about what they do and ready to help. He will always be remembered. Anytime I pass by the fourth floor or by the Mercer Lab, I will always see Jerry with my heart."

Professor Dylan Rees: "Jerry was there to help when I was a young graduate student doing real hands-on engineering work in my power systems lab, and he was there to help when I was a brand new lecturer working through the logistics of teaching labs during a pandemic. He was a cornerstone of the department and will be deeply missed."

Former Professor Don Millard: "Jerry was kind, thoughtful, and exceptionally competent, providing insightful and practical perspectives that were key to the achievement of ECSE's initiatives. I am critically aware of how terribly understated and modest he was, yet how incredibly significant his efforts were to the success of the department, the Institute, and — most of all — the education and preparation of a vast number of engineering students throughout the years."



Audrey Hayner worked for over 40 years as an administrative assistant in the ECSE Department, retiring in 2015. Audrey provided ample support to generations of ECSE faculty and students, even helping many of our current faculty when they were graduate students at Rensselaer.

Professor Hussein Abouzeid: "As a junior faculty, Audrey was among those seasoned individuals who I always sought out for guidance for all sorts of administrative issues that were needed to get my lab and research operations started, and for support with administrative matters. I counted on her and I feared her at the same time, because I knew I would get excellent support as well as stern comments if I was overdue or messed up. I always enjoyed stopping by her office and talking about various aspects of my job; she always had something simple yet smart and helpful to say."

Professor Paul Schoch: "I worked with Audrey since she started here and I was a student. She worked with the Plasma Lab group — Bob Hickok, Bill Jennings, Ken Connor, Tom Crowley, and me — for decades. I know her family, she was at my wedding, and she held my kids when they were infants. This is another painful loss for me and the ECSE community."

Professor Mona Hella: "Audrey was my best friend. She took care of everything. At the time when she was helping us with purchasing, if I sent her a request, she would send me an email two seconds later saying it was done. She knew where everything was and what forms to fill out. Having her around meant a lot to me. My early years at Rensselaer felt very special because of people like her and Jerry: those who showed up before everyone else and took care of everything so it would all be 'right.'"

2021-2022 ECSE Awards

Faculty Awards

Tianyi Chen: NSF Career Award

Manoj R. Shah: Elected to the National Academy of Engineering

Michael Shur: Elected Fellow of the Institute of Physics, selected as a Sigma Xi Distinguished Lecturer

Winners in the International Oscillation Source Location Contest (co-organized by the Institute of Electrical and Electronics Engineers and the North American SynchroPhasor Initiative):

Professor Joe H. Chow
Ph.D. student Stavros Konstantinopoulos
Postdoctoral Research Associate Denis Osipov

Student Awards

School of Engineering's Belsky Award for Computational Sciences and Engineering

Lisha Chen
Burak Varici

Analog Devices Inc. (ADI) Outstanding Student Designer Award

Ahmed Elmenshawi
Xing Tong

Baliga Award

Anmol Dwivedi
Anindita Ghosh

Vertical Flight Foundation Scholarship

Neelanga Thelasingha

Grainger Power Engineering Award

Brennan M. Loder
Allan H. Nesathurai
Alyssa J. Noble

2022 Commencement Awards

The Ricketts Prize:

Rahul Jain
Zach Orris

The Harold N. Trevett Award:

Maxwell de Feijter
Allan H. Nesathurai

The Henry J. Nolte Memorial Prize:

James Lewin
Brennan M. Loder

The Wynant James Williams Prize:

Sandor Magyar
Charles Pike

The Allen B. Dumont Prize:

Sarthak Chatterjee
Muhammad Waleed Mansha

The Charles M. Close '62 Doctoral Prize:

Amelia Peterson

The Jerry Dziuba Graduate Service Award:

Lauren Brady
Burak Varici

Dr. Alirenza Seyedi '99 Teaching Assistant Award:

Anindita Ghosh

4.0 GPA Award:

Zachary L. Orris
Connor John Wooding

ECSE Graduates and Students Enjoy Outstanding Placements in 2021-2022

Graduates and students of the ECSE program enjoyed another year of outstanding industry placements during 2021-2022 for post-graduation employment, as well as co-ops and internships. Marquee corporate names appearing on this year's placement list include Amazon, Boeing, Cisco, General Motors, Google, Lockheed Martin, and many other recruiters representing an impressively broad range of industries and economic sectors.

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