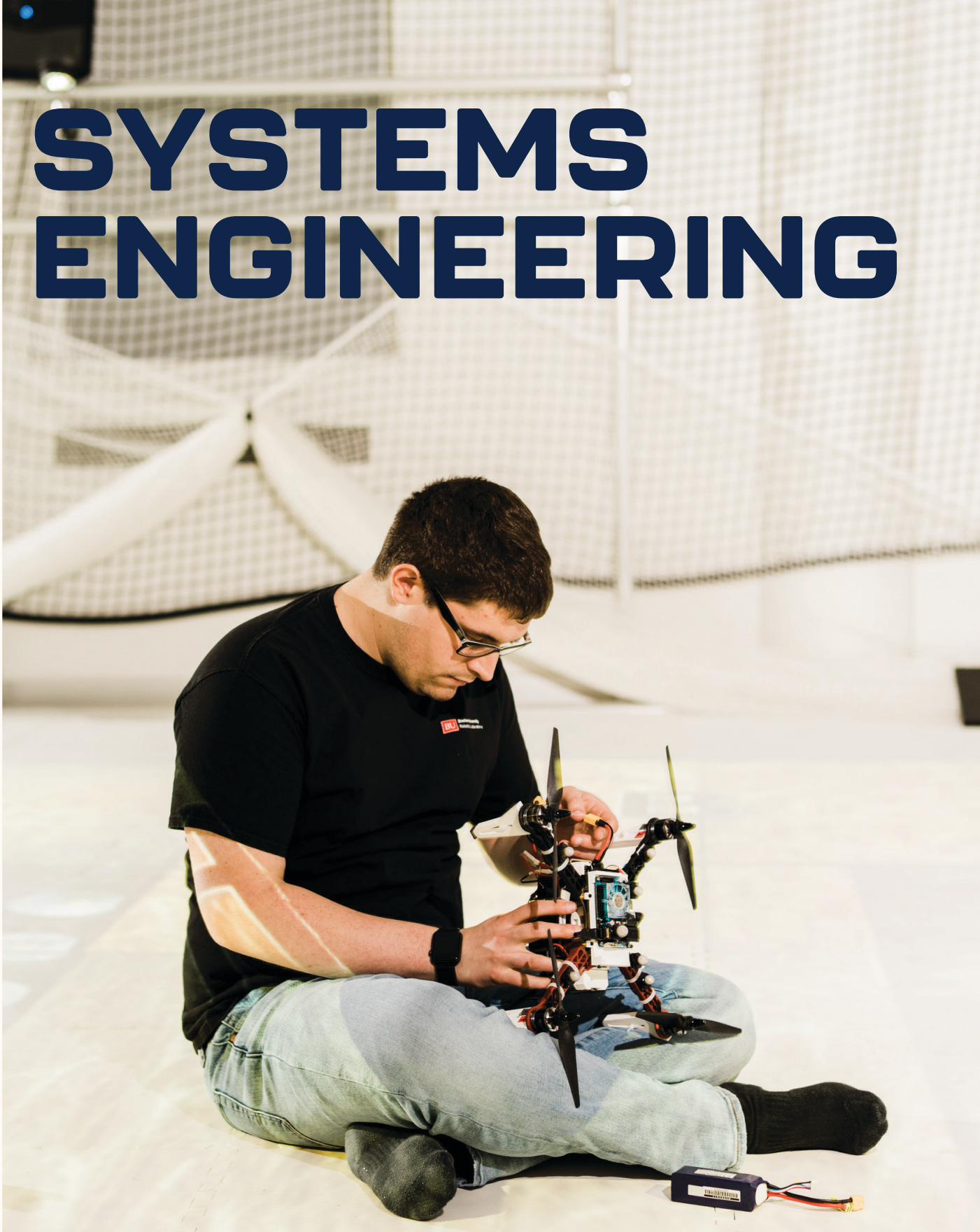
SYSTEMS ENGINEERING



impact report

2024-2025

BU College of Engineering
Systems Engineering

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A Message from the Division Head

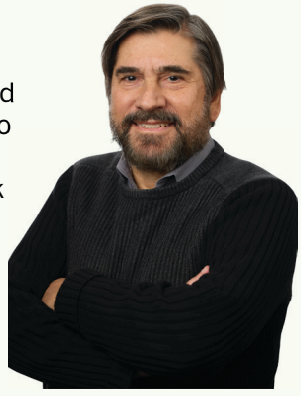
The 2024-25 impact report of the Division of Systems Engineering (SE) highlights the accomplishments of our faculty and students and summarizes research funding levels and world-class distinctions for its members. The Division's research activities continue to be in close collaboration with the Center for Information and Systems Engineering (CISE), focusing on a variety of projects that span the modeling, design, analysis, and optimization of human-made and physical systems within a broad array of applications. SE remains a centerpiece of the College of Engineering's convergent research themes across multiple disciplines within Boston University.

The Division currently consists of 20 appointed faculty members with primary appointments in the College of Engineering, the College of Arts and Sciences, the Questrom School of Business, and the Medical School, along with 13 affiliated members. Enrollment comprises 88 students in our PhD, MS, and MEng programs. There were 8 PhD degrees awarded, along with 1 MS, and 4 MEng degrees. Our students' activities include the CISE Graduate Student Workshop (CGSW), a unique annual event entirely organized and administered by students providing them the opportunity to share the results of their research and practice their communication skills.

The Division continues to provide full financial support to all admitted PhD students through fellowships, while our continuing PhD students remain fully-funded, normally from research grants received by participating and affiliated faculty. Total sponsor commitment for active grants was over $42M in support of research activities in our primary concentration areas: Automation, Robotics and Control; Communications and Networking; Computational Biology; Information Sciences; and Production, Service and Energy Systems. We continue to engage in exciting collaborative projects that involve faculty across Boston University, consistent with the College of Engineering's commitment to a convergent approach for tackling complex scientific and societal challenges in such cutting-edge research areas as smart cities, energy systems, healthcare, AI-enabled cyber-physical systems, safety-critical systems, robotics, and cybersecurity.

Our graduates are equipped with the unique skills to adapt their knowledge and expertise to different application domains with this flexibility placing them in high demand, including several with summer internships.

The first half of 2025 has brought upon us many challenges in terms of, among others, reduced research funding budgets, shifting federal agency priorities, and limitations imposed on our international student population. We are prepared to adhere to our fundamental professional academic values and serve our society through our educational and research missions. I take this opportunity to thank my colleagues, our students, and our dedicated staff who are helping us continue to grow.



Christos G. Cassandras
Division Head

Appointed Faculty

20
Faculty

5
Editors-in-Chief (IEEE)

15
NSF/PECASE Awardees

3
Presidents (IEEE)

39
Average H-Index

17
Fellows (IEEE)

97
Average i-10 Index

10K
Average Citations

2 SE at a Glance

Graduate Programs

88
Students Enrolled

8
PhD Degrees Awarded

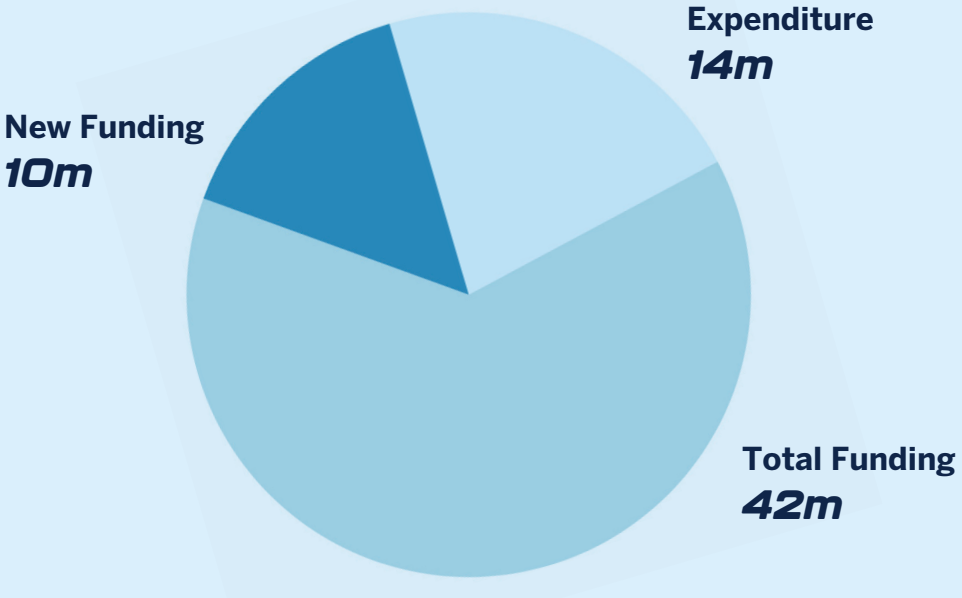
1
MS Degree Awarded

4
MEng Degrees Awarded

3
MEng Degrees with Specialization Awarded

1
MEng Degrees with Engineering Practice Awarded

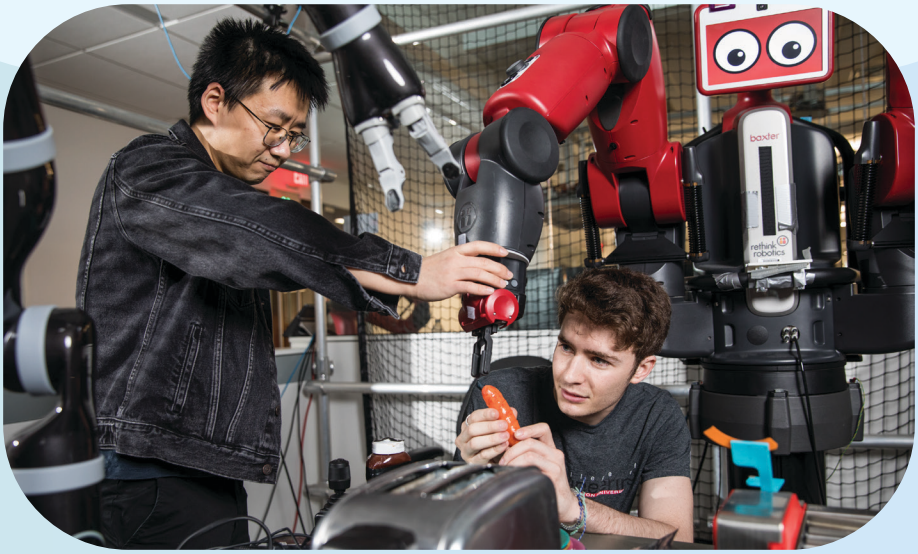
Research Funding



A Vibrant Academic Experience

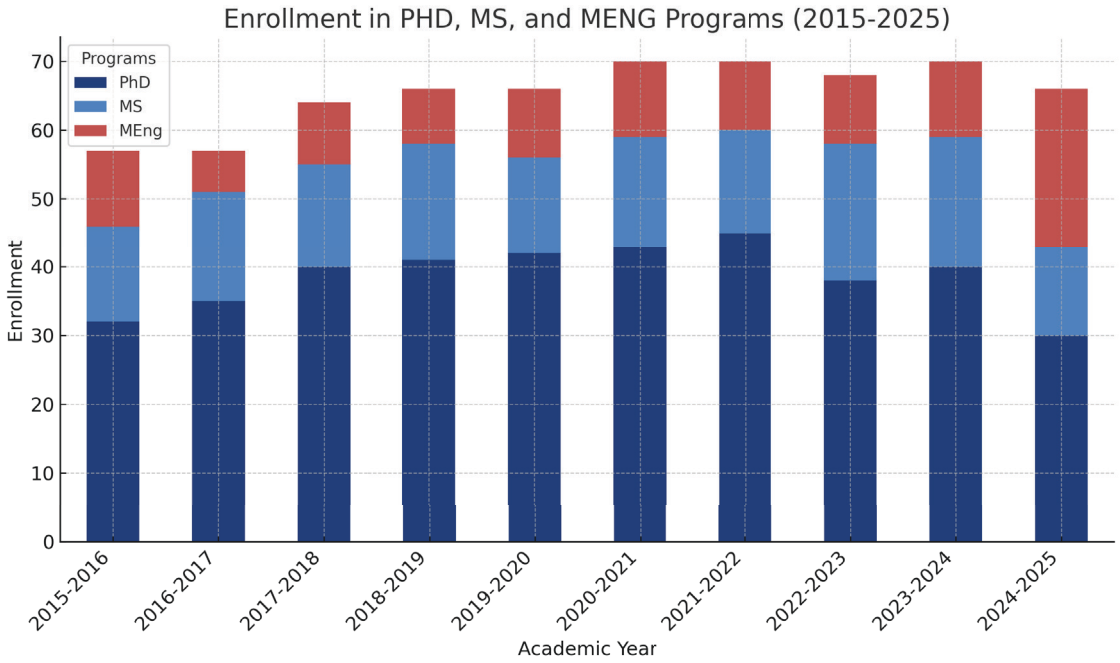
SYSTEMS ENGINEERING (SE) offers a unique interdisciplinary graduate program with select faculty from the College of Engineering departments of Biomedical Engineering, Electrical and Computer Engineering, and Mechanical Engineering; the College of Arts and Sciences departments of Computer Science, Earth & Environment, and Mathematics & Statistics; and the Questrom School of Business.

SE offers PhD, MS and MEng, MS and MEng with practice degrees and master's degree specializations, as well as an undergraduate minor, to students with interest in information, decision, and control sciences, and in all application areas encompassing the modeling, analysis, simulation, control, optimization, and management of complex systems. SE offers research opportunities through the Center for Information and Systems Engineering (CISE).



Our students

Population



Internships

Erhan Ozcan, Etsy

Alexander Wasilkoff, Southwest Power Pool (SPP)

Onur Okuducu, Brookhaven National Laboratory

Jingmei Yang, CVS Health

Yingqing Chen, Aptiv, Detroit, MI

Ehsan Sabouni, Gatik

Honors & Awards

IEEE Controls Systems Society Conference on Decision and Control 2024 Student Travel Award: Akua Kodie Dickson, advised by Andrew Sabelhaus

Outstanding Dissertation Award: Anni Li, advised by Christos Cassandras

PhD Societal Impact Award: Samad Amini, advised by Yannis Paschalidis

Graduate Student Fellow Award: Zijian Guo, advised by Wenchao Li

PhD Funding Sources

Funding Type	Fall 2024	Spring 2025	Summer 2025
Graduate Research Fellow	25	24	20
Internal Fellow	4	4	4
External Fellow	2	2	2
Intern/Corp/Other	1	1	4
Total	32	31	30

PhD Dissertations

Andres Chavez Armijos, advised by **Christos Cassandras**, "From Selfish to Social Optimal Planning for Cooperative Autonomous Vehicles in Transportation Systems"

Vittorio Giammarino, advised by **Ioannis Paschalidis,** "On the Use of Expert Data to Imitate Behavior and Accelerate Reinforcement Learning"

Zahra Zad, advised by **John Baillieul,** "Explainable and Sparse Predictive Models with Applications in Reproductive Health and Oncology"

Samad Amini, advised by **Ioannis Paschalidis, "**Transforming Dementia Diagnosis & Prognosis through AI"

Zili Wang, advised by **Roberto Tron**, "Learning-enabled Navigation and Nonlinear Control for Resource Constrained Robots"

Saeed Mohammadzadeh, advised by **Emma Lejeune**, "Advancing Deep Learning in Computational Mechanics and Biomechanics: Overcoming Challenges and Paving a Promising Future"

Anni Li, advised by **Christos Cassandras**, "Optimal Maneuvering for Safe and Cooperative Autonomous Vehicles in Mixed Traffic"

Jonas Hall, co-advised by **Sean Andersson** and **Christos Cassandras**, "Decomposing Persistent Monitoring Problems using Numerical Optimal Control"

Data Science Mentoring Circles Program

The Data Science Mentoring Circles Program connects BU PhD students from relevant fields with BU alumni now in DS jobs in industry. Each year interested students sign up and are assigned in small groups of 3-5 to a mentor. Several workshops are run each year and the students meet with their mentor approximately once a month. Students network, are advised on resume preparation, participate in mock interviews, and learn how to negotiate and evaluate offers. BU CS, ECE, Math & Stats, Biostats, CDS, CISE and SE participate.

Global Dual Degree

SE partners with Tsinghua University in Beijing for a dual master's degree program in Systems Engineering. Students are selected from the Department of Automation at Tsinghua University to enroll in BU's courses for two semesters. Afterwards, they return to Tsinghua University to complete the program. U.S. News & World Report ranks partner Tsinghua University as one of the top global engineering programs.

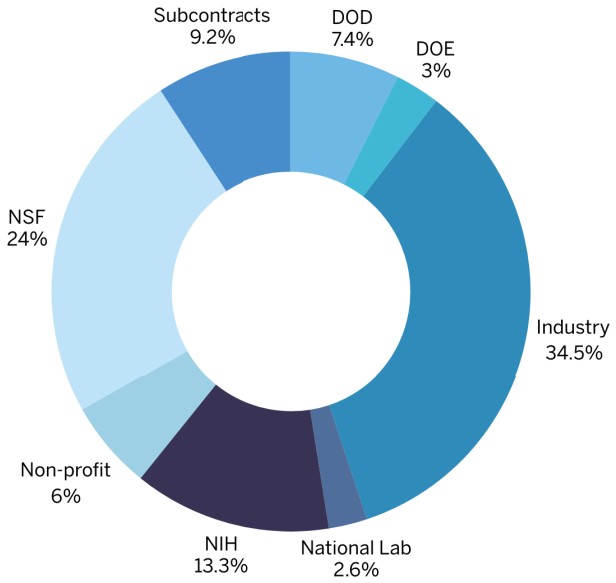
CISE Graduate Student Workshop (CGSW 11.0)

The CISE Graduate Student Workshop (CGSW) is an annual forum that provides students across the twelve departments/divisions the opportunity to share their original research in an engaging, collaborative environment. Organized by students, for students, the event encourages interdisciplinary sharing among affiliated students, faculty, and invited guest speakers.

CGSW 11.0 featured two plenary talks: Denis Daly, Senior Manager and Architect at Apple and Elli Ntakou (SE PhD, '17), Systems Resilience and Reliability Manager at Eversource Energy, The event concluded with an awards reception where Qinzi Zhang (first place), Karman Vakil (second place), and Abin Binoy George (third place) were recognized for best presentations.

4 Research that Matters

Systems Engineering research funding, **42M** in 2024-2025, is closely tied to the Center for Information & Systems Engineering (CISE), providing opportunities for interdisciplinary research in the study and design of intelligent systems with broad societal applications. CISE activities are designed to catalyze and support cross-disciplinary faculty research collaborations, advance scientific understanding and discovery, facilitate engagement with industry, and support a diverse community of faculty and students. In conjunction with this core mission, CISE spearheads a number of activities to project the College of Engineering's and BU's strength in convergent research themes, both internally and externally.



The Center for Information & Systems Engineering (CISE)

The Center for Information & Systems Engineering (CISE) is an interdisciplinary research center with the mission of deepening and broadening the study and design of intelligent systems with broad societal applications. CISE supports 54 faculty affiliates and over 100 students from diverse disciplines across the College of Engineering, College of Arts & Sciences, and the Questrom School of Business. CISE spearheads several activities, including a weekly seminar series, industry workshops and symposia, and developmental student events, to facilitate internal and external collaboration.

CISE staff provide critical support for faculty in awards management, from proposal preparation and budget development to post-award administration and monthly PI reporting. In FY24-FY25, CISE's grant portfolio resulted in $18.6 million in research expenditures.

CISE hosts high-profile events to catalyze innovation, foster collaboration, and boost the visibility of Boston University. As part of its annual workshop series, CISE organized the "Learning to Trust Autonomy" workshop, bringing experts in autonomous systems to Boston University to address developments in robotics, as well as the technological and societal challenges to utilizing this technology outside of the testing environment. Additionally, CISE co-hosted the Green AI Summit, in collaboration with Harvard University's Green AI Institute. This event brought together distinguished speakers from government, industry, and academia to facilitate discussions surrounding sustainable artificial intelligence.

CISE activities are designed to advance research on critical societal challenges and foster interdisciplinary collaboration. In FY24-FY25, CISE programming featured innovative events, supported faculty and student research, and built community engagement.

BU RASTIC

CISE manages the $8.78M **Robotics and Autonomous Systems Teaching and Innovation Center (RASTIC)** grant awarded to Boston University for a new research and development center. The project will drive the development of new innovations with private sector partners in Massachusetts and increase student research opportunities in the robotics space. RASTIC will emphasize real-world prototyping projects to integrate new materials, functionality, and artificial intelligence into robotic devices, delivering tools that will allow students to design and launch their own research and development projects. The grant is in collaboration with Boston-based MassRobotics and six initial industry partners, including AETLabs, Ava Robotics, Boston Scientific, GreenSight, Intel, and Ubiros. RASTIC will become a 'neutral space' where companies can work directly with faculty and students, encouraging hands-on projects to design, prototype, and test new robotic devices. The facilities will include four distinct zones that will provide simulated and scaled settings to mimic the complex environments in which robotic devices and systems must operate.

Akua Dickson Researches Safe Autonomy, a Future Where Robots Help, Not Harm

Akua Dickson's (advised by Andrew Sabelhaus) Ph.D. research focuses on safe autonomy, a field where robots do autonomous tasks and help humans solve problems in a safe way.

Dickson works on mathematical functions that will ensure that robots act the way they are supposed to. She uses non-linear control and optimization to provide mathematical guarantees that robots act the way they are supposed to. A major aspect of her work is defining control barrier functions, which tell robots what the boundaries of safety are at any particular moment.

By constantly developing and refining these models for autonomous robots, Dickson hopes to increase people's trust in these technologies. Her earlier Ph.D. work focused on heavy-duty ground robots.

Now, she applies the same theory to soft robots that can perform more delicate tasks. The lack of rigidity and smaller amounts of force are inherently safer. She envisions applications ranging from autonomous soft robots performing delicate surgeries to fire-fighting robots that could keep humans out of danger. With such applications, she believes that safe autonomy will become even more popular in the next 10 years. She added that she feels like this field will be the next phase of the world.

"Having the opportunity to be one of the scientists at the forefront of these improvements and these technologies is exciting," Dickson said.

While she is still debating between academia and industry, she is currently leaning toward a research-focused role in industry. Her next steps are to continue advancing autonomous environmental contact for soft robot manipulators using control barrier functions.

by Chloe Cramutola

SE PhD Students Win TC Outstanding Student Paper Prize

A shared passion for intelligent transportation systems led Ph.D. students Ehsan Sabouni (advised by Christos Cassandras) and H M Sabbir Ahmad (co-advised by Christos Cassandras & Wenchao Li) to collaborate on "Optimal Control of Connected Automated Vehicles with Event-Triggered Control Barrier Functions: A Test Bed for Safe Optimal Merging." Their year-long project aimed to bridge the gap between theoretical control systems and real-world traffic safety applications. Their collaboration resulted in a novel paper that won the Smart Cities Technical Committee Outstanding Student Paper Prize in 2024.

The two started from scratch, implementing event-triggered Control Barrier Function (CBF)-based control on real hardware. Event-triggered control helps save resources by only acting when certain events happen. The CBF-based control defines the bounds of safety for any input.

The overall goal of their research was to implement a safe control system for traffic applications. By implementing theoretical models in autonomous robots, the students fine-tuned their theory and algorithms. One key aspect of the project was how the autonomous vehicles would behave at "conflict points," or areas where vehicles from different directions might intersect at the same time. Limited hardware and the cost of hardware constrained the testing of Sabouni and Ahmad's theories.

As for the future of their work, Ahmad and Sabouni said there is always space to grow and to improve their work in the lab so they can see it deployed on the street. Their goal is safety, which must adapt with changing autonomous and artificial intelligence systems.

by Chloe Cramutola

Transforming Data Centers into Grid-Responsive Powerhouses

As AI continues its explosive growth, so does its energy demand, pushing the U.S. electric grid toward its limits. With the rise of increasingly complex AI models and cloud-based applications, data centers are becoming power-hungry giants. Projected to use up to 9% of U.S. power by 2030, data centers increasingly strain the grid, threatening the resilience of everyday services like air conditioning, ATMs, and internet access.

Ayse Coskun, a professor of engineering (ECE, SE) and Center for Information & Systems Engineering (CISE) Director at Boston University, has pioneered transformative research at the forefront of a paradigm shift in how data centers should approach energy consumption. Her research, promoting data center energy flexibility, is increasingly critical to support grid stability and sustainability. Coskun is now extending her expertise to the commercial sector as the Chief Scientist at Emerald AI, a new company that aims to control the computational power demand from data centers running AI workloads, while ensuring performance guarantees.

Emerald AI is developing a software platform that interfaces with grid signals to dynamically orchestrate compute workloads, adjusting data center power use to meet both grid and performance requirements. With this capability, Emerald AI envisions a system of "AI Virtual Power Plants" that transform data centers from power-hungry liabilities into grid-stabilizing assets. As chief scientist, Coskun is working on Emerald's vision and technical scoping of the software, guiding the demos, prototypes, and products.

"Today, two massive infrastructures are colliding—data centers and the power grid," says Coskun. "The explosive growth in data center energy demand is outpacing what the grid can handle. Our platform sits at the interface, enabling power flexibility so data centers can come online faster; AI can scale more broadly; and the grid can grow more resilient, reliable, and affordable."

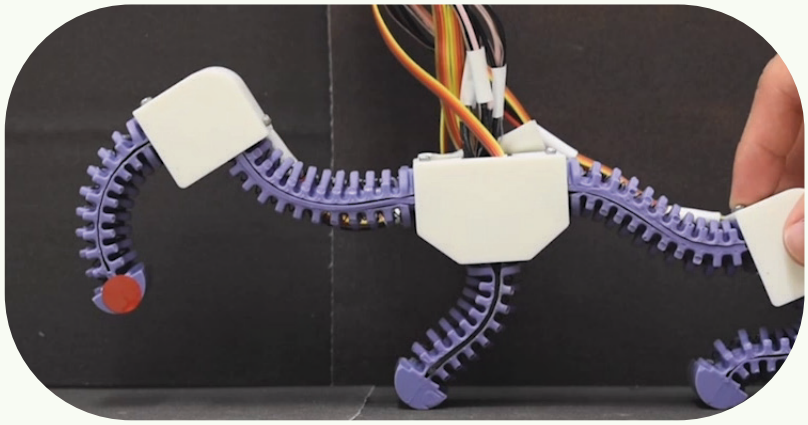
by Margaret Stanton

Just How Safe are Soft Robots?

When Sarah Alizadeh-Shabdiz thinks of robots, she pictures a bendy, wiggly piece of purple rubber. That's because Alizadeh-Shabdiz, a Boston University mechanical engineering major, spent her summer doing research in BU's Soft Robotics Control Lab. Working with Assistant Professor Andrew Sabelhaus (ME, SE), she studied novel ways to improve how soft robots are controlled, as well as the fundamental physics underlying how they interact with the environment.

Made from bendable, pliable materials, such as silicone rubber, soft robots are considered to be safer than the metal variety, but very little research has been done to quantify that. Among Alizadeh-Shabdiz's summer research projects was an experiment, funded by a grant from the Undergraduate Research Opportunities Program, designed to measure the force that one of the lab's soft robot limbs can exert on an object.

by Devin Hahn



BU Students Win Janetos Climate Action Prize for Uncovering Air Quality Gaps Between Old and New Campus Buildings

The buildings that make up Boston University's campuses are a mix of old architecture and brand-new construction. This means that the air quality in these buildings can vary significantly. Some structures, like the more recently built Boston University Photonics Center, have exceptional air quality—while others have room for improvement.

For the last two years, a team of Boston University students has been designing and testing indoor air quality monitors in order to better understand—and ultimately improve—ventilation in different buildings across the Charles River Campus. Healthier air has been shown to boost academic performance, so raising standards across campus could potentially help students with concentration and test results.

Now, in recognition of their work, they've won the 2025 Janetos Climate Action Prize, an annual award given to a student project that received funding from BU's Campus Climate Lab (CCL). It's awarded to the team whose work can most significantly advance BU's Climate Action Plan.

Because air quality is so important—but often not visible to the naked eye—it's important to "create tools such as ours to help assess and detect these deficiencies," said Celine Chen (ENG'25), during the group's presentation. "We hope to share our results with the overall BU community, and continue to develop, refine, and use the tools that we've created," she said.

The student researchers showcased their work at the annual Campus Climate Lab spring symposium. At the event, 10 CCL project teams shared overviews of their research with short lectures and poster presentations. The Janetos Prize was announced at the conclusion of the symposium. The winning team was represented by Chen and Primah Muwanga (CGS'24, CDS'27). Ellen Zheng (ENG'27) was studying abroad at the time of the symposium, but worked on the project remotely.

With funding from CCL, Chen, Muwanga, and Zheng—along with former students Marybel Boujaoude (ENG'24) and Yangyang Zhang (ENG'24)—designed and built 29 air quality sensors, which they used to gather approximately 30 million readings from classrooms this spring. The students deployed 21 of the sensors in two Charles River Campus buildings: an older building that houses the Engineering Product Innovation Center, and a relatively new one, the Photonics Center.

In their presentation, Chen and Muwanga detailed how their device showed the differences in air quality between the two. "Our research results have shown that there's inequitable access to clean indoor air when comparing an older building to a newer one," Chen said after the event. "We've seen that there's poor ventilation and high CO2 values in these older buildings, while the modern ones work perfectly fine." Although none of the levels were considered unsafe, a high amount of CO2 in a building can be problematic. "It can cause headaches and lack of attention, and we wouldn't want that in a student environment such as this," Muwanga said.

Their findings prompted the team to talk with BU Operations, which manages much of the University's infrastructure, to discuss ways to improve localized air filtration for particulates, increase airflow to classrooms where needed, and consider occupancy-based controls to save energy.

"Is indoor air at BU healthy and equitable? With continuous auditing, we can identify when air quality is below levels it should be at," Muwanga said. As the only nonengineer on the team, Muwanga—who is studying computing and data science—said the project showed her different ways that data could be used, especially for sustainability. She and Chen said that they would like to continue working on similar projects in the future.

"I did engineering because I was really passionate about innovation and how something so small could make such an impact," Chen said. "I think this project was perfect for that. I feel like it showed me that BU cares about sustainability and the impact of students. I really hope to find some way to do this in my career, as well."

"We're surprised that we won this award," said **Thomas Little,** a BU College of Engineering professor of electrical and computer engineering and the faculty advisor to the winning team. "It's exciting, and it suggests that we've achieved some impact that's definitely worth continuing with."

The other student teams studied ways to improve the handling of chemicals in labs, reduce BU's carbon output from green spaces, decarbonize major buildings, monitor urban air pollution, improve environmental justice, update waste management in art studios, utilize natural processes to solve environmental issues, and reduce microplastics from BU laundry rooms. A team also researched algae bioreactors, a potential way to produce carbon-negative, cost-effective energy.

CCL is led by the Institute for Global Sustainability, in collaboration with BU Sustainability and the Office of Research. Since its launch in 2020, CCL has awarded $410,000 to 49 projects involving more than 230 students, faculty, and staff. Last year's Janetos Prize went to a student group that developed air sensors to measure outdoor air pollution and map the quality of air in different neighborhoods in Boston.

Little and the indoor CO2 monitoring team hope to keep scaling up the sensor project, with an eventual goal of tracking air quality in every building on BU's campuses.

"As engineers, we are drawn to design projects, and innovating and developing technology that can enable other things," Little said. "And I think that we've accomplished that.

by Bailey Scott

The Future of Driving: Control Barrier Functions and the Internet of Vehicles

The National Highway Traffic and Safety Association reports that 94% of serious car crashes are due to human error. **Christos Cassandras,** Boston University Distinguished Professor of Electrical & Computer Engineering, Head of the Division of Systems Engineering, and a co-founder of the Center for Information & Systems Engineering (CISE), has made monumental contributions to the research of network of vehicles and using systems to eliminate human error on the roads.

Cassandras specializes in the areas of discrete event and hybrid systems, cooperative control, stochastic optimization, distributed optimization in network systems, and computer simulation, with applications to computer and sensor networks, manufacturing systems, and transportation systems. His recent research featured in Automatica on ScienceDirect, Optimal control of connected automated vehicles with event/self-triggered control barrier functions, highlights how the use of Control Barrier Functions (CBF) enables Connected and Automated Vehicles (CAVs) in traffic network conflict areas, therefore limiting the number of human-error crashes.

Car crashes, whether caused by speeding, distractions or fatigue, are attributed to driver negligence or recklessness."If we can automate at least a fraction of vehicles and reduce this 94% to under 50%, that would be quite something," Cassandras said. "If you replace human drivers with computers, computers don't sleep, drink, or blink. They love data, whereas [humans] become overwhelmed by data." The CBF takes the wheel out of the driver's hands and interacts with other vehicles artificially, removing human contact on the roads.

Basic concepts of game theory and cooperation come into play when driving, according to Cassandras. Game theory shows that decisions between two or more decision-makers, in this case, drivers, show interdependence between the other's decisions and cooperation, or lack thereof. Drivers primarily compete with one another but occasionally cooperate, letting another driver merge, pass, or go in front of them.

"We selfishly try to find what's best for us to get to our destination, to change lanes, to go through that intersection, and so on," Cassandras said. With this new CAV technology, that competition would be erased and a "social optimum" would be created. The competition of who gets to go through an intersection or gets to merge first would no longer be in the hands of the driver. The decision of what is best would now belong to the computer in the car.

For Cassandras, the keyword is safety. "Nobody will buy your automated car or any other expensive, elaborate piece of technology unless there are some guarantees that it's going to behave safely," he said. While achieving complete passenger safety and keeping track of what is surrounding the vehicle may be challenging, it is still possible.

"If my car is behind yours, I don't want to move too close to you and risk hitting you. That's fairly easy to define and specify," Cassandras said. "It is extremely hard to ensure this at all times, not just now and for the next two minutes, but forever." The solution to this problem comes in the CBF. These functions are the constraints the vehicle operates under, including how close the vehicle can get to the vehicle in front or how fast the vehicle can move. "The [CBF] approach creates a mapping and transformation that says, 'This is what you want. This is how I can achieve it,'" he said. These functions provide the guidelines for how these constraints can be complied with on the road.

But, with these functions comes a sense of conservativeness. Cassandras said, "a perfect transportation system could be guaranteed if all vehicles drive five miles per hour, but that is clearly not what we want." Therefore, a tradeoff arises between safety and speed with the CBFs. "I want to guarantee safety but at the same time I want to drive as fast as possible. That's the state of the art. I'd like to be as efficient as possible without ever violating safety, but not at the price of being super conservative."

Finding this equilibrium between speed and safety is difficult to find but by using on-board calculations, it is possible. "You want all of these calculations begun on board in fractions of a second because that's typically how much time there is to decide what to do next."

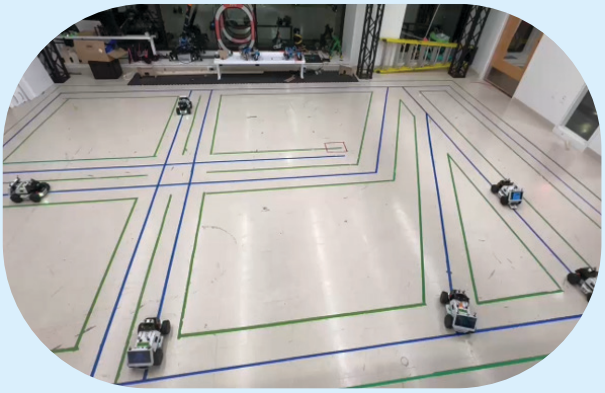
There are two schools of thought moving forward: pro or anti Internet of Vehicles (IoV). Similar to the internet cell phone use, the internet of vehicles would be used for vehicles to communicate with each other on the road. Conversely, vehicle companies may not want to be a part of that "internet" and choose to use their own technology instead.

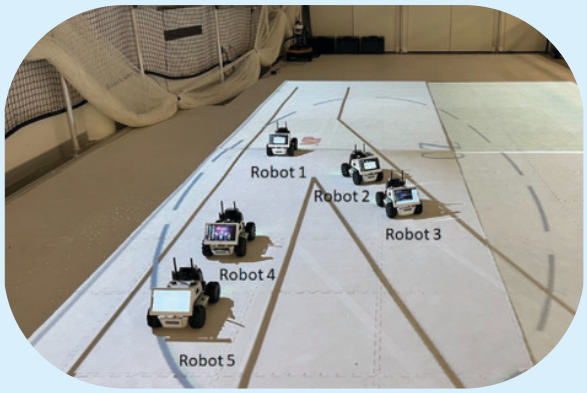
Companies may want to equip their cars with their own sensors to communicate within their network instead of the broader IoV community raising larger issues related to weather or navigating obstacles. The IoV's competitive advantage is left up to the consumers who decide whether or not to participate, creating a combination of autonomous and non-autonomous drivers on the road, "mixed traffic" as Cassandras referred to it.

Using a group of autonomous vehicles, a careless, distracted, or uncooperative driver can be mitigated—using a framework called 'games with coalitions'. "It goes into the whole idea of how we can have cooperation among agents, autonomous devices, and still get things done safely and efficiently without having to worry too much about it," Cassandras says. "If vehicles cooperate, they can sometimes neutralize the uncooperativeness of the human driver."

Cassandras' current and future grant projects include work with the National Science Foundation about delivering an online learning framework aimed at distributing travel demand in a given transportation network resulting in a socially-optimal mobility system that travelers are willing to accept. Additionally, Cassandras is working with Honda to explore and quantify benefits of using smart vehicles in highway traffic to improve flow currently sometimes subjected to high-variance unpredictable behavior causing 'phantom traffic jams'.

by Brendan Galvin





ANDERSSON LABORATORY
Sean Andersson
bu.edu/anderssonlab
The lab explores the dynamics in nanometer-scale systems with fundamental theory, applied mathematics, and physical experiments. The work applies to nanobioscience, nanotechnology, and robotics.

COLLABORATIVE AUTONOMY GROUP
Alyssa Pierson
sites.bu.edu/pierson/research/
Our research designs new capabilities for collaborative robotic teams by integrating trust, cooperation, and competition. By exploring the nuances in interaction we enable richer control policies with proven performance guarantees for fast and decentralized decision-making.

CONTROL OF DISCRETE EVENT SYSTEMS LABORATORY (CODES)
Christos Cassandras
christosgcassandras.org/codes
The lab conducts research on modeling, design, analysis, control and optimization of discrete events and hybrid systems with applications to cyber-physical systems.

DATA SCIENCE & MACHINE LEARNING LABORATORY
Venkatesh Saligrama
sites.bu.edu/data/
Projects related to vision and learning, decision and control machine learning, and structured signal processing.

DEPENDABLE COMPUTING LABORATORY
Wenchao Li
sites.bu.edu/depend/
The research spans dependable computing, particularly the development of computational proof methods and machine learning techniques to aid the construction of safe, reliable, and secure systems.

INFORMATION & DATA SCIENCES LABORATORY
C. Cassandras, D. Castañón, E. Dall'Anese, W. Karl, B. Kulis, W. Li, T. Little, P. Ishwar, B. Nazer, A. Olshevsky, I. Paschalidis, V. Saligrama, D. Starobinski, A. Trachtenberg
bu.edu/iss
The lab designs and synthesizes secure networked systems for optimum decision-making and control.

INTELLIGENT MECHATRONICS LABORATORY
J. Baillieul, S. Andersson, H. Wang
bu.edu/iml
Projects explore limited-bandwidth control problems, cooperative systems and control, symbolic control, and animal-inspired agile flight control.

LABORATORY OF NETWORKING & INFORMATION SYSTEMS
D. Starobinski, A.Trachtenberg
nislab.bu.edu
The lab offers a perspective on modern networking with emphasis on scalability, heterogeneity, and performance.

MULTI-DIMENSIONAL SIGNAL PROCESSING LABORATORY
W. Clem Karl
mdsp.bu.edu
The lab applies computational imaging to develop statistical models to extract information from diverse and vulnerable data sources.

Laboratories

MULTIMEDIA COMMUNICATIONS LABORATORY
Thomas Little
sites.bu.edu/mcl/
Projects focus on smart and connected systems, optical communications, and ubiquitous computing.

NETWORKS RESEARCH GROUP
A. Bestavros, M. Crovella, A. Matta
bu.edu/cs/nrg/
Research encompasses network measurement, architectures and protocols. Projects span from the design and implementation to the analysis of networked applications and systems.

NETWORK OPTIMIZATION & CONTROL LABORATORY
Ioannis Paschalidis
sites.bu.edu/paschalidis/
Research deals with fundamental problems in the fields of optimization, control, stochastic systems, and data science.

PERFORMANCE AND ENERGY-AWARE COMPUTING LABORATORY
Ayse Coskun
bu.edu/peaclab/
Energy-efficient computing, data center demand response, data center - power grid interactions, and applied machine learning for computer system optimization.

RELIABLE COMPUTING LABORATORY
Lev Levitin
bu.edu/reliable
Projects span from the design of computer chips to efficiency testing in hardware, software, signal processing, and networks.

ROBOTICS LABORATORY
S. Andersson, J. Baillieul, C. Cassandras, A. Pierson, A. Sabelhaus, R. Tron
sites.bu.edu/robotics
Research spans several areas of robotics, including motion planning, control, machine learning, and computer vision.

SOFT ROBOTICS CONTROL LAB
Andrew Sabelhaus
sites.bu.edu/srclab/
Combines the benefits of softer robots, like safer contact with the environment and humans, with algorithms and control systems that allow them to perform practical tasks, focusing on both robotic manipulation and locomotion.

SPIRA-LENBURG LABORATORY
Avrum Spira
bumc.bu.edu/compbiomed/labs/spira-lenburg
The lab utilizes post-genomic technologies and computational tools to improve the diagnosis, treatment, and prevention of lung disease.

VAJDA LABORATORY
Sandor Vajda
vajdalab.org
The lab focuses on the recognition of proteins and small molecules by protein receptors. The work applies to metabolic control, signal transduction, gene regulation, rational drug, and vaccine design.

VISUAL INFORMATION PROCESSING LABORATORY
J. Konrad, P. Ishwar
vip.bu.edu/
Projects relate to technology transfer in the broad areas of image, video, and multimedia processing. This visual information processing research applies to visual surveillance, 3D video, and human-computer interfaces.

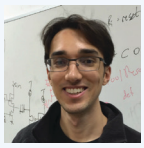
SEAN ANDERSSON
Professor of ME & SE
Chairperson of ME
Robotics, control theory, scanning probe microscopy, single molecule tracking
PhD, University of Maryland, 2003
NSF CAREER Award, 2009

JOHN BAILLIEUL
Distinguished Professor of Engineering
Professor of ME, ECE & SE
Robotics, control of mechanical systems, mathematical system theory, information-based control theory
PhD, Harvard University, 1975
IEEE, IFAC & SIAM Fellow

MICHAEL CARAMANIS
Professor of ME & SE
Mathematical programming, control and stochastic systems
PhD, Harvard University, 1976

CHRISTOS CASSANDRAS
Distinguished Professor of Engineering
Professor of ECE & SE
Head of the Division of SE
Discrete event/ hybrid systems, stochastic optimization, simulation, manufacturing systems, communication/ sensor networks, multi-agent systems
PhD, Harvard University, 1982; IEEE & IFAC Fellow; IEEE Control Systems Society President, 2012

DAVID CASTAÑÓN
Professor of ECE & SE
Stochastic control, estimation optimization, image understanding and parallel computation
PhD, Massachusetts Institute of Technology, 1976; IEEE Fellow; IEEE Control Systems Society President, 2008



ASHOK CUTKOSKY
Assistant Professor of ECE, CS & SE
Machine learning, stochastic optimization, online learning
PhD, Stanford University, 2018

EMILIANO DALL'ANESE
Associate Professor of ECE & SE
Optimization, control, online learning, network systems, energy
PhD, University of Padova, 2011

PRAKASH ISHWAR
Professor of ECE & SE
Statistical signal processing, machine learning, information theory, secure multi-party computation, visual information processing and analysis
PhD, University of Illinois Urbana, Champaign, 2002

BRIAN KULIS
Associate Professor of ECE & SE
Machine learning, statistics, large-scale data analysis
PhD, University of Texas at Austin, 2008

WENCHAO LI
Associate Professor of ECE & SE
AI safety, human cyber physical systems, formal methods, design automation
PhD, University of California, Berkeley, 2013

6 Appointed Faculty

ALEX OLSHEVSKY
Professor of ECE & SE
Control and algorithms for multi-agent systems, sensor networks, distributed optimization, control of large-scale systems
PhD, Massachusetts Institute of Technology, 2010

IOANNIS PASCHALIDIS
Distinguished Professor of Engineering
Professor of ECE, BME & SE
Director of the Hariri Institute
Systems and control, networking, applied probability, optimization, operations research, computational biology, medical informatics, bioinformatics
PhD, Massachusetts Institute of Technology, 1996; IEEE Fellow; IEEE Transactions on Control of Network Systems Founding Editor-in-Chief

JAMES PERKINS
Associate Professor of ME & SE
Real-time scheduling and control of manufacturing systems, supply chain management, resource pricing and congestion control in communications networks
PhD, University of Illinois, Urbana-Champaign, 1993

ALYSSA PIERSON
Assistant Professor of ME, SE & CS
Machine learning and optimization
PhD, Boston University, 2017
Faculty Early Career Development Program (CAREER) award, National Science Foundation (NSF); MassRobotics Rising Star in Robotics Medal, 2023; NSF CAREER Award, 2023

ANDREW SABELHAUS
Assistant Professor of ME & SE
Nonlinear control systems, soft robotics, robot locomotion, motion planning, safe human-robot interaction
PhD, University of California Berkeley, 2019, Intelligence Community Postdoctoral Research Fellowship (2020), NASA Space Technology Research Fellowship (2015)

VENKATESH SALIGRAMA
Professor of ECE & SE
Machine learning, computer vision, information theory, and statistical signal processing
PhD, Massachusetts Institute of Technology, 1997; IEEE Fellow

DAVID STAROBINSKI
Professor of ECE & SE
Wireless and vehicular networks; QOS and traffic engineering; network economics; cybersecurity
PhD, Technion, Israel Institute of Technology, 1999

ROBERTO TRON
Associate Professor of ME & SE
Intersection of automatic control, robotics and computer vision, with a particular emphasis on applications of Riemannian geometry and on distributed problems involving teams of multiple
agents
PhD, Johns Hopkins University, 2012
2021 Boston University College of Engineering Early Career Research Excellence Award

HUA WANG
Associate Professor of ME & SE
Associate Head of the Division of Systems Engineering
Control of nonlinear phenomena, intelligent systems and control, complex networks, cooperative control, robotics, applications in biological, energy and aerospace systems
PhD, University of Maryland at College Park, 1993

Affiliated Faculty

PANAGIOTIS ANDRIANESIS
Research Associate Professor SE
Electricity distribution network economics – aiming at developing, evaluating, and transferring to practice a robust framework for the future electricity distribution grid.
PhD, University of Thessaly, Greece
BU Institute for Sustainable Energy, Senior Fellow

AYSE COSKUN
Interim Associate Dean for Research and Faculty Development, Professor ECE, SE; Director, Center for Information and Systems Engineering
Energy-efficient computing, cloud computing, high performance computing, computer architecture, embedded systems
PhD, University of California, San Diego, 2009

MARK CROVELLA
Professor of ECE, CS & SE
Performance evaluation, focused on parallel and networked computer systems, detecting and understanding anomalies in IP networks, efficient network monitoring, network security
PhD, University of Rochester, 1994

W. CLEM KARL
Professor of ECE & BME & SE
Chairperson of ECE
Computational imaging, detection and estimation, inverse problems, biomedical signal and image
processing
PhD, Massachusetts Institute of Technology, 1991

LEV LEVITIN
Distinguished Professor of ECE & SE
Information theory, physics of communication and computing, complex and organized systems, quantum theory of measurement, reliable communication and computing, bioinformatics
PhD, Gorky University, 1969

THOMAS LITTLE
Professor of ECE & SE
Associate Dean of COE Educational Initiatives; Associate Director NSF Smart Lighting ERC
Computer networking, mobile computing, distributed systems, multimedia streaming and storage, visible light communications PhD, Syracuse University, 1991

ABRAHAM MATTA
Professor of CS
Chairperson of Computer Science
Design of network protocols and architectures based on a range of computer science principles, mathematical techniques, and performance evaluation tools
PhD, University of Maryland at College Park, 1995

BOBAK NAZER
Associate Professor of ECE & SE
Information theory, communications, signal processing, and neuroscience
PhD, University of California, Berkeley, 2009

AVRUM SPIRA
Alexander Graham Bell Professor of Healthcare Entrepreneurship,
Chief of the Division of Computational Biomedicine,
Director of Translational Bioinformatics Program
Lung cancer and COPD genomics, smoking and airway gene expression, bioinformatics
MD, McGill University, 1996

ARI TRACHTENBERG
Professor of ECE
Cyber security, algorithms, error-correcting codes
PhD, University of Illinois, 2000

SANDOR VAJDA
Professor of BME & Chemistry
Director of BMERC
Scientific computing, primarily optimization, computational chemistry and biology, including protein and peptide structure determination, protein engineering, and drug design
PhD, Hungarian Academy of Science, 1983

PIROOZ VAKILI
Research Associate Professor of ME & SE
Monte Carlo simulation, optimization, computational biology, computational finance
PhD, Harvard University, 1989

2024-2025 POST-DOCS

XIAOYU LUO
Security of cyber-physical systems; Control, optimization, and learning in multi-agent systems; Its implementation in practical applications, including traffic systems and multi-robot systems.
PhD, Shanghai Jiao Tong University in China, 2024

DAWEI ZHANG
Multi-agent systems and Cyber-Physical systems with applications in Robotics.
PhD, Boston University, Mechanical Engineering, 2024

VISITING RESEARCHERS

Yike Li
Yike Li, a PhD student at the University of Cagliari, Italy, working with Professor Alessandro Giua, joined the CODES lab and CISE for six months as a visiting scholar.

GRADUATE COMMITTEE

Hua Wang, Chair
Emiliano Dall'Anese
Ashok Cutkosky
Alyssa Pierson
Wenchao Li
Christos Cassandras
James R. Perkins (LEAP Reviewer)

ADMINISTRATIVE TEAM

CHRISTOS G. CASSANDRAS
Division Head

HUA WANG
Associate Division Head

ELIZABETH FLAGG, ED.M.
Division Director

LEA SABRA
Communications Manager

ALISON KRASNOR
Graduate Programs Manager

1M DEPARTMENT OF ENERGY GRANT:
MICHAEL CARAMANIS (SE, ME)
A New Risk Assessment and Management Paradigm (NEWRAMP) in Electricity Markets

.5M NSF AWARD:
MARK CROVELLA (SE, CS)
Collaborative Research: NETS: Medium: Large Scale Analysis of Configurations and Management Practices in the Domain Name System

1.5M AMERICAN LUNG ASSOCIATION GRANT:
AVRUM SPIRA (MED, SE)
Intercept Lung Cancer through Immune, Imaging & Molecular Evaluation-Intime

1.3M NASA AWARD:
ROBERTO TRON (SE, ME)
Safe, Low-Noise Operation of UAM in Urban Canyons Via Integration of Gust Outcomes and Trim Optimization

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