

ANNUAL REPORT 2022-23



Northeastern University
Mechanical and Industrial Engineering

Northeastern University College of Engineering

With over 230 tenured/tenure-track faculty and 18 multidisciplinary research centers and institutes with funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research focused on discovering solutions to global challenges to benefit society. Northeastern's global university system—with engineering programs on campuses across the U.S. and in multiple countries—provides flexible academic offerings, innovative partnerships, and the ability to scale ideas, talent, and solutions.

About Northeastern

Founded in 1898, Northeastern is a global research university and the recognized leader in experiential lifelong learning. Our approach of integrating real-world experience with education, research, and innovation empowers our students, faculty, alumni, and partners to create worldwide impact.

Northeastern's personalized, experiential undergraduate and graduate programs lead to degrees through the doctorate in 10 colleges and schools across our 13 campuses worldwide. Learning emphasizes the intersection of data, technology, and human literacies, uniquely preparing graduates for careers of the future and lives of fulfillment and accomplishment.

Our research enterprise, with an R1 Carnegie classification, is solutions oriented and spans the world. Our faculty scholars and students work in teams that cross not just disciplines, but also sectors—aligned around solving today's highly interconnected global challenges and focused on transformative impact for humankind.



We are a leader in experiential education and interdisciplinary research, focused on Engineering for Society

DEAR COLLEAGUES, FRIENDS, AND STUDENTS,

At Northeastern University (NU), the Department of Mechanical and Industrial Engineering (MIE) is committed to nurturing our students for professional and technical excellence, advancing the frontiers of engineering through groundbreaking research, engaging in service activities that benefit our department, university, and the profession, and instilling in ourselves and our students the values of ethical behavior, professional responsibility, and careers that contribute to the betterment of society.

As we face critical challenges in the coming decade, including climate change, processing of big data, supply chains, urban transformation, sustainable manufacturing, healthcare optimization, and renewable energy sources, our department stands at the forefront. In line with our commitment to cutting-edge research, we have established 12 dynamic research themes as a means of facilitating collaborative discussions to drive innovation and shape our future research. Research themes range from Biomechanics, Biofluids, & Mechanobiology, and Data Analytics, AI, & Operations Research, to Intelligent & Additive Manufacturing, and Robotics & Control Systems. See the full list on page 4.

Our distinguished faculty members are at the heart of these endeavors, engaging in broad, trans- and inter-disciplinary work. Our department boasts 65 tenured/tenure-track faculty, among whom a remarkable 44% have received prestigious Young Faculty Awards, and an impressive 30% have been honored with CAREER awards from the National Science Foundation. In addition, we are proud to have 16 dedicated and equally accomplished teaching faculty in MIE who contribute significantly to our educational excellence and mission.

As of Fall 2022, our department has grown to accommodate an impressive student body of 3,633 individuals, making us the largest disciplinary academic department in the College of Engineering at Northeastern. To cater to our students' diverse career aspirations, our offerings include 24 graduate MS, PhD, and certificate programs, as well as undergraduate majors in mechanical engineering (ME) and industrial engineering (IE). Additionally, we offer combined majors such as ME and physics, IE and business, ME and design, and ME and history. Furthermore, we have expanded our reach across Northeastern's global university network, now offering programs in both Seattle and Vancouver. In Seattle, we have also introduced a new undergraduate summer aerospace program to enrich our students' educational experiences.

Our department thrives with a vibrant community of student groups, including AerospaceNU, BajaSAE, Electric Racing at NU, INFORMS (Institute for Operations Research and the Management Sciences), IISE (Institute of Industrial and Systems Engineers, NU Student Chapter), ASME (American Society of Mechanical Engineers, NU Student Chapter), NUToys, the ESS (Energy Systems Society), and DAESO (Data Analytics Engineering Student Organization) among others. To support and nurture our students' growth, we host key events such as cooperative education (co-op) mixers and job fairs, ME and IE Student Townhalls, and we have recently established the PhD Council to address the specific needs of our doctoral candidates.

This annual report is a testament to the exceptional academic and professional achievements of our faculty and students during the 2022-2023 academic year. We look forward to continuing our journey of excellence and innovation, shaping the future of engineering, and preparing our students to meet the challenges of our ever-evolving world.

Thank you for your continued support and dedication to the Department of Mechanical and Industrial Engineering at Northeastern.

Sincerely,

Marilyn Minus, PhD
Professor and Department Chair
Mechanical and Industrial Engineering
m.minus@northeastern.edu

For more details, visit our website at MIE.NORTHEASTERN.EDU.

Quick Facts MECHANICAL AND INDUSTRIAL ENGINEERING

65 **TENURED/
TENURE-TRACK**
Faculty

29 **Young Investigator**
Awards, including ▶ **19** **National Science
Foundation**
CAREER Awards

34% of tenured/tenure-track faculty have received Young Investigator Awards

24 **Graduate Academic
Programs**
MS, PhD, Certificates
in **Boston, Seattle,**
and **Vancouver, Canada**

3,633 **Total
Student
Enrollment**
(Fall 2022)

31 **Professional
Society
Fellowships**

2,123 **Masters
Students**

Up **65%**
vs.
2017

13 **Undergraduate
Academic Programs**
BS and Minors

147 **Doctoral
Students**

\$37M **External
Research
Awards**
(2021-2023)

2 **Federally Funded
Research Centers**

NSF/DHHS Healthcare
Systems Engineering
Institute

NSF Center
for High-rate
Nanomanufacturing



**Office of Naval
Research
Young Investigator
Program Award**

Sze Zheng Yong
Associate Professor

Quick Facts COLLEGE OF ENGINEERING

With **238** tenured/tenure-track faculty and **18** multidisciplinary research centers and institutes with funding by eight federal agencies, the College is a leader in experiential education and interdisciplinary research focused on discovering solutions to global challenges to benefit society.

5 **Engineering
Departments**

3,333 **Total Co-op Hires**
(AY2023)

142 **YOUNG
INVESTIGATOR
Awards**

Including **72** NSF CAREER Awards, and **26** DOD Young Investigator Awards

3,057 **Co-op Employer
Partners** (AY2021-2023)

TOTAL ENROLLMENT (Fall 2022)

10,046 62% Graduate
38% Undergraduate

102 **Professional
Society
Fellowships**

**Graduate
Enrollment
Growth**

up **68%**
vs. 2017

Our Newest Faculty



Cynthia Hajal *Assistant Professor*

PhD: Massachusetts Institute of Technology, 2020

Previously: Postdoc, Dana-Farber Cancer Institute

Scholarship Focus: Tissue engineering, microfluidics, cancer research



Megan Hofmann *Assistant Professor*

Jointly Appointed: Khoury College of Computer Sciences

PhD: Carnegie Mellon University, 2022

Scholarship Focus: Accessibility and fabrication, digital fabrication in healthcare, automatic machine knitting



Hyeonyu Kim *Assistant Professor*

PhD: Massachusetts Institute of Technology, 2019

Previously: Instructor, Stanford University School of Medicine

Scholarship Focus: Cardiovascular system, tissue engineering, stem cell, organoids

Award: American Heart Association Career Development Award Fellow, 2023



Jeffrey Lipton *Assistant Professor*

PhD: Cornell University, 2015

Previously: Assistant Professor, University of Washington

Scholarship Focus: 3D printing, robotics

Award: NASA NIAC Fellow, 2021



Yasin Yazicioglu *Assistant Professor*

Jointly Appointed: Electrical and Computer Engineering

PhD: Georgia Institute of Technology, 2014

Previously: Research Assistant Professor, University of Minnesota

Scholarship Focus: Distributed control, optimization, and learning with applications to cyber-physical systems, networks, and robotics



Yoseob Yoon *Assistant Professor*

PhD: Massachusetts Institute of Technology, 2019

Previously: Postdoc, University of California, Berkeley

Scholarship Focus: Optoelectronic and mechanical properties of quantum materials, van der Waals heterostructures, engineering light-matter interactions, ultrafast optical and THz spectroscopy



Xubo Yue *Assistant Professor*

PhD: University of Michigan, Ann Arbor, 2023

Scholarship Focus: Federated data analytics, Bayesian optimization, continuous optimization, Gaussian processes, deep learning

Faculty by Research Theme

Biomechanics, Biofluids, and Mechanobiology

Rouzbeh Amini
Cynthia Hajal
Hyeon Yu Kim
Sandra Shefelbine
Hongwei Sun
Kai-tak Wan

Complex Fluids, Multiphase, and Multiscale Matter

Sara Hashmi
Carlos Hidrovo
Safa Jamali
Francis Loth
Hameed Metghalchi
Ozan Ozdemir
Hongwei Sun
Xiaoyu Tang
Mohammad Taslim
Moneesh Upmanyu
Kai-tak Wan

Data Analytics, AI, and Operations Research

Muhammad Noor E. Alam
Mehdi Behroozi
James Benneyan
Chun-an Chou
Nasser Fard
Jacqueline Griffin
Babak Heydari
Sagar Kamarthi
Emanuel Melachrinoudis
Mohsen Moghaddam
Shahin Shahrapour
Xubo Yue

Energy Systems, Sustainability, and Environmental Protection

Muhammad Noor E. Alam
Yiannis Levendis
Laura Lewis
Hameed Metghalchi
Xiaoyu Tang
Mohammad Taslim
Yi Zheng
Juner Zhu

Engineering Education

Ibrahim Zeid

Human-Technology Integration

Casper Hartevelde
Megan Hofmann
Yingzi Lin
Tucker Marion
Jose Martinez Lorenzo
Rifat Sipahi
Sze Zheng Yong

Intelligent and Additive Manufacturing

Muhammad Noor E. Alam
Ahmed Busnaina
Randall Erb
Xiaoning "Sarah" Jin
Sagar Kamarthi
Jeffrey Ian Lipton
Mohsen Moghaddam
Sinan Müftü
Ozan Ozdemir
Xiaoyu Tang
Xubo Yue
Hongli "Julie" Zhu

Materials for the Future

Ruobing Bai
Ahmed Busnaina
Randall Erb
Andrew Gouldstone
Safa Jamali
Yung Joon Jung
Laura Lewis
Jeffrey Ian Lipton
Yongmin Liu
David Luzzi
Marilyn Minus
Peter Schindler
Moneesh Upmanyu
Yoseob Yoon
Yi Zheng
Hongli "Julie" Zhu

Mechanics

Rouzbeh Amini
Ruobing Bai
Andrew Gouldstone
Yaning Li
Carol Livermore
Craig Maloney
Sinan Müftü
Hamid Nayeb-Hashemi
Juner Zhu

Networks and Complex Systems

Chun-an Chou
Ozlem Ergun
Babak Heydari
Laurent Lessard
Tong Ma
Kayse Lee Maass
Jose Martinez Lorenzo
Emanuel Melachrinoudis
Shahin Shahrapour
Wei Xie
Yasin Yazicioglu

Resilient and Sustainable Service Systems

Muhammad Noor E. Alam
James Benneyan
Ozlem Ergun
Jacqueline Griffin
Surendra M. Gupta
Kayse Lee Maass

Robotics and Control Systems

Jeffrey Ian Lipton
Tong Ma
Shahin Shahrapour
Max Shepherd
Rifat Sipahi
Seungmoon Song
John "Peter" Whitney
Yasin Yazicioglu
Sze Zheng Yong

Naval Research Young Investigator Program Award to Enable Naval Ships to Function Autonomously

With a \$750,000 Office of Naval Research Young Investigator Program Award, **Sze Zheng Yong**, associate professor of mechanical and industrial engineering, is developing algorithms for non-verbal communication between unmanned, autonomous Naval ships. The ultimate goal is to make it possible for unmanned vessels to carry out dangerous operations in conditions where GPS and other modes of communication are limited or unavailable.

“My work is inspired by the way human teams use body language to communicate nonverbally,” says Yong. “If humans can do it, we should be able to create a robotic system that can do something similar. My challenge is to make it possible for robots to express their intentions through their movements and motions, and for other robots in the team to infer this intent from those movements.”

Yong’s task is to create the complex algorithms needed for autonomous robots and Naval ships to design “information-bearing motions” for enhanced nonverbal communication. His work will enable other robot teammates to decode the information from these motions with limited or no communication. The goal is to make it possible for unmanned ships to function autonomously as teams and adapt to the unexpected when there is no central command. This is particularly significant in situations where GPS and other forms of communication are spotty or non-existent. It is also important to make these information-bearing movements subtle, so they are not easily intercepted and decoded by adversaries.

Yong’s innovation will help make it possible for unmanned ships to protect seaports, monitor enemy activity, transport cargo, conduct dangerous rescue operations, and disrupt enemy activity—all without endangering the lives of military personnel.

“I want to conduct research not just for the fun of it, but because I’m creating something useful,” he says.



Photo by Bella Martinez

Awarded Northeastern's First Highly Competitive NSF National Research Traineeship Award

*Multidisciplinary research
on effects of digital platforms
while increasing opportunity
for underrepresented
graduate students*

Photo by Alyssa Stone



It is critical that the developers of new platform technologies no longer simply be trained as engineers and computer scientists, and that policy makers and regulators must understand the ecosystems around digital platforms.

Northeastern is poised to contribute a significant body of research toward a greater understanding of the sweeping effects digital platforms such as Uber, Airbnb, and Venmo are having on society, while also training an underrepresented generation of students to solve problems across disciplines.

Ozlem Ergun, distinguished professor of mechanical and industrial engineering, was awarded a \$3 million grant from the National Science Foundation for the NSF's highly prestigious "national research traineeship" (NRT) program. The NRT provides support to students in "research-based master's and doctoral degree programs" who are working in "high priority interdisciplinary or convergent research areas."

The funds will support 28 PhD "traineeships" at Northeastern over the course of five years with the goal of helping students develop the "skills, knowledge and competencies" relevant to their respective careers, while also producing targeted research addressing real-world problems.

The award will also enable Northeastern to partner with Hampton University, an HBCU, and the University of Houston, a Hispanic-Serving Institution, to support student trainees across all three universities, and develop an engineering graduate degree program at the latter.

The award is the result of several years of collaboration among a large interdisciplinary team, including faculty from the College of Engineering, D'Amore McKim School of Business, Khoury College of Computer Sciences, the School of Law, Department of Economics and the School of Public Policy and Urban Affairs.

"The interdisciplinarity of this initiative will expand critically important analysis of the social justice implications of rapidly changing platforms," says Jennie Stephens, dean's professor of sustainability science & policy, who is helping to oversee the effort. "And by diversifying who is trained to be involved in the development and regulation of evolving platforms, this research training program is positioned to have big societal impact."

Landing an NRT award—considered by academics to be the gold standard for training grants—is a first for Northeastern. "They're highly competitive and very hard to get," says Ergun. She adds that program administrators hope that the associated training offered at the University of Houston and Hampton University would produce prospective students capable of pursuing postdoctoral work at any of the three universities.

"The NRT program addresses workforce development, emphasizing broad participation and institutional capacity building needs in graduate education," the foundation's website states. "The program encourages proposals that involve strategic collaborations with the private sector, non-governmental organizations, government agencies, national laboratories, field stations, teaching and learning centers, informal science centers, and academic partners."

"The focus of this proposal is to create a training program that addresses the needs of these digital platforms ultimately leading to profitability and competitiveness, and to better understand the changes these platforms are imposing on the society—be it in public services, the delivery of social services, resource allocation, even the future of work," Ergun adds.

Academic interest in the app-based platforms varies across disciplines. Ergun says she hopes the NRT funding will spur more collaboration between the social sciences and the STEM fields, where polarization on the topic is evident.

"While digital platforms have democratized provision and access to services and products with low entry and transaction costs, the larger impact on society is not fully understood," Northeastern's proposal reads. "It is critical that the developers of new platform technologies no longer simply be trained as engineers and computer scientists, and that policy makers and regulators must understand the ecosystems around digital platforms."



Photo by Adam Glanzman

Fellow of Optica and SPIE

Associate Professor **Yongmin Liu**, mechanical and industrial engineering, and electrical and computer engineering, was elected a Fellow Member of Optica for significant contributions to the fundamental and application of nanophotonics—plasmonics and photonic metamaterials in particular. He was also selected as a Fellow of the International Society for Optics and Photonics (SPIE). SPIE Fellows are members of distinction who have made significant scientific and technical contributions in the multidisciplinary fields of optics, photonics, and imaging.



Photo by Matthew Modono

IEEE Fellow

Distinguished University and Cabot Professor **Laura Lewis**, chemical engineering, and mechanical and industrial engineering, was elevated to an IEEE Fellow for contributions to the design of magneto-functional materials. This distinction is reserved for select IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation and is awarded to less than 0.1% of voting members annually.



Photo by Ruby Wallau

AIAA Associate Fellow

College of Engineering Distinguished Professor **Yiannis Levendis**, mechanical and industrial engineering, was selected as an American Institute of Aeronautics and Astronautics (AIAA) Associate Fellow for his technical contributions to fuel combustion physics, chemistry, and diagnostics, and for educating engineering students in the fields of gas turbine combustion and air pollution. Associate Fellows are individuals who have accomplished or directed important engineering or scientific work, have done original work of outstanding merit, or have otherwise made outstanding contributions to the arts, sciences, or technology of aeronautics or astronautics.



IISE Fellow

Professor Emeritus **Emanuel Melachrinoudis**, mechanical and industrial engineering, was named a Fellow of the Institute of Industrial and Systems Engineers (IISE). The Fellow award is the highest classification of membership in IISE and is in recognition of outstanding leaders of the profession that have made significant, nationally recognized contributions to industrial engineering.

American Society of Thermal and Fluids Engineers Early Career Researcher Award

Associate Professor **Yi Zheng**, mechanical and industrial engineering, was awarded the inaugural American Society of Thermal and Fluids Engineers Early Career Researcher Award for his significant contributions to the field of thermal and fluids engineering. Zheng was also presented a Certificate of Recognition signed by the Mayor of the City of Boston for recognition of his commitment and dedication to serving the Asian community and beyond. Additionally, Zheng was recognized by the Massachusetts House of Representatives for his “Outstanding Contributions to Sustainability and Clean Technology.”



Photo by Alyssa Stone

INFORMS Fellow

Ozlem Ergun, College of Engineering distinguished professor, mechanical and industrial engineering, was elected a Fellow of the Institute for Operations Research and the Management Sciences (INFORMS). This honor is reserved for few select members. In 2023, only twelve members were elected Fellows.



NSF Award for Intelligent Tutoring Systems for Advanced Manufacturing

Assistant Professor **Mohsen Moghaddam**, mechanical and industrial engineering, is leading a \$850,000 National Science Foundation grant for “Accelerating Skill Acquisition in Complex Psychomotor Tasks via an Intelligent Extended Reality Tutoring System.” The project builds upon the ongoing research at the intersection of AI and augmented, virtual, and mixed reality. It aims to foster

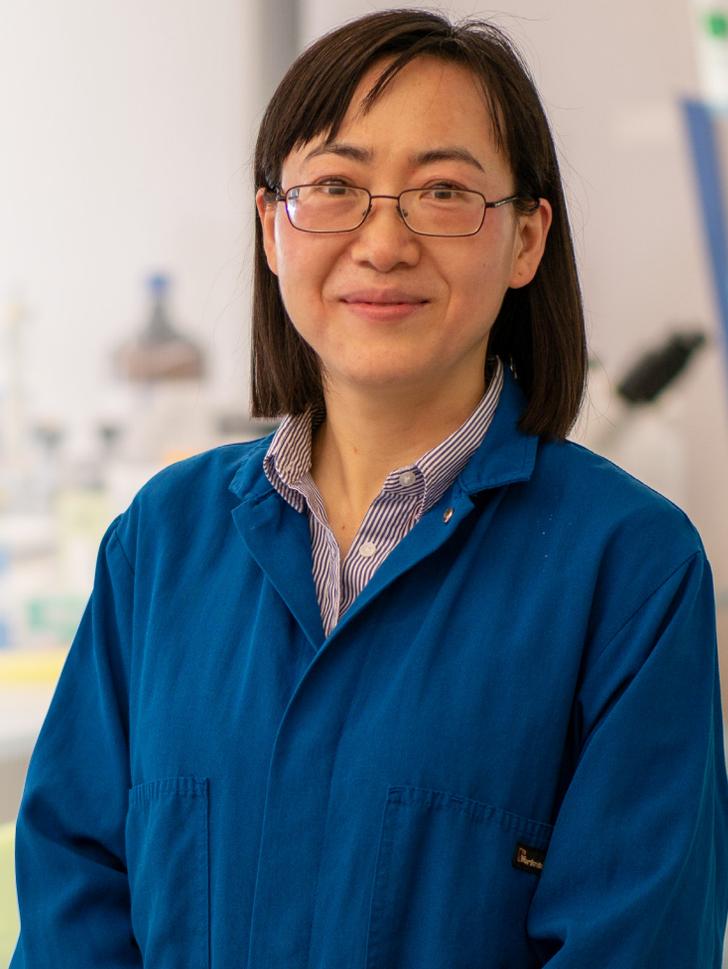
learning and adaptability in educational and workplace settings across a range of industries, including manufacturing, healthcare, construction, and defense, among others. Northeastern University co-PIs include Kemi Jona, assistant vice chancellor for digital innovation and enterprise learning; Casper Harteveld, associate professor of game design and associate dean of the College of Arts, Media, and Design (CAMD); and Mehmet Kosa, CAMD postdoctoral research associate.

Optical Metasurfaces Research

Research of Associate Professor **Yongmin Liu**, mechanical and industrial engineering, and electrical and computer engineering, on “Breaking the Limitation of Polarization Multiplexing in Optical Metasurfaces with Engineered Noise” was published in *Science*. The research details a new method of increasing the capacity of optical information systems to develop high-capacity optical displays, information encryption, and data storage.

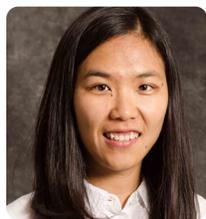
NIIMBL Grant for mRNA Vaccine Potency Assessment and Prediction

Assistant Professor **Wei Xie**, mechanical and industrial engineering, received an \$851,000 award from the National Institute for Innovation in Manufacturing Biopharmaceuticals for “Advanced FISH Assay and Mechanism Hybrid Surrogate to Improve mRNA Vaccine Potency Assessment and Prediction.” By swiftly assessing multivalent mRNA vaccines, Xie aims to improve the prediction of their potency and provide a quick quality screening technology.



Study of Micro-Level Social Interaction Parameters and the Effect on Pandemic Policy Success

The research of Associate Professor **Babak Heydari**, mechanical and industrial engineering, on “Micro-level Social Structures and the Success of COVID-19 National Policies” was published in the *Nature Computational Science* journal. The study shows that the micro-level structure of person-to-person interactions can be an important explanatory factor in the success of COVID-19 policy.



NSF Award to Improve Inkjet Printing with Advanced Materials

Assistant Professor **Xiaoyu Tang**, mechanical and industrial engineering, was awarded a \$625,000 National Science Foundation award for “Inkjet Printing Framework by Droplet Impact-induced Ink Release from Liquid Crystal Receiving Substrate.” The research investigates a new inkjet printing method to encapsulate ink in a liquid crystal substrate and eventually expand to a larger range of materials. If successful, it will enable printing of advanced materials, including organic electronics for sensors and wearable devices, and benefit healthcare and energy sectors.

Burning Iron Particles to Generate Clean Energy

Professors **Yiannis Levendis** and **Hameed Metghalchi**, and Associate Professor **Randall Erb**, all of mechanical and industrial engineering, were awarded a \$600,000 National Science Foundation grant for “A Study on Burning Iron Particles as Carbon-Free Circular Fuels with co-Generation of Value-Added Nanomaterials.” As renewable energy, mostly solar or wind, is not always available at the location or the time when demand is high, a cost-competitive and effective renewable energy carrier must be able to store available energy and transport energy to be used where and when it is needed. A promising energy carrier candidate is iron powder. This research is advancing the science of powdered iron as a “circular fuel” and is fully characterizing the products and any generated byproducts, while also identifying appropriate applications for the latter materials.



Discovery of All-Ceramic Could Transform Design of Heat-Emitting Electronics

Associate Professor **Randall Erb**, mechanical and industrial engineering, and **Jason Bice**, PhD '22, mechanical engineering, published research on an all-ceramic that can be compression-molded into complex parts in *Advanced Materials*. The industry breakthrough could transform the design and construction of heat-emitting electronics, including cellphones and other radio components.



Photos by Matthew Madoono



Studying Axolotls to Understand How Limbs Develop and Regrow

Professor **Sandra Shefelbine**, mechanical and industrial engineering, and bioengineering, in collaboration with Biology Professor **James**

Monaghan, was awarded a \$625,000 National Science Foundation grant for “In Vivo Mechanotransduction During Limb Growth” to understand the mechanical signaling involved in limb growth. The researchers will use axolotls, a type of salamander that can regrow limbs, to study how cells sense and respond to mechanical forces. They believe that this research could lead to new insights into how limbs develop and regenerate.



Advancing Distributed Optimization for Non-Convex Problems

Assistant Professor **Shahin Shahrampour**, mechanical and industrial engineering, received a \$500,000 National Science Foundation grant,

in collaboration with Texas A&M University, to address “Consensus and Distributed Optimization in Non-Convex Environments with Applications to Networked Machine Learning.” The project will transform the understanding of consensus and coordination in non-convex environments and will include educational components to introduce distributed optimization as a practical tool for the next generation of engineers.

Exoskeletal Boot Improves Balance

Assistant Professor **Max Shepherd**, mechanical and industrial engineering, jointly appointed in physical therapy, movement, and rehabilitation sciences, published “Exoskeletons Need to React Faster than Physiological Responses to Improve Standing Balance” in *Science Robotics*—the research was featured on the front cover. His team developed a wearable ankle exoskeleton suit, ExoBoot, that can generate artificially fast torque before the onset of the user’s physiological reaction, improving standing balance by 9 percent.



Learn more about our accomplished faculty

Student Successes

SELECTED HIGHLIGHTS



Robotics Team Wins \$1 Million in Global Competition

Team Northeastern won \$1 million in third place at the ANA Avatar XPrize robotics global competition. The competition is aimed at developing human-operated robotic “avatar” systems that can complete tasks and replicate a person’s senses, actions, and presence to a remote location in real time. The student team is advised by Professor **Taskin Padir**, electrical and computer engineering, and director of the Institute for Experiential Robotics, and Assistant Professor **Peter Whitney**, mechanical and industrial engineering.



GEM PhD Engineering Fellowships

Eric Cardoza, E’23, mechanical engineering, and **Melanie Edmund**, E’23, industrial engineering, received the Graduate Education for Minorities (GEM) PhD Engineering Fellowship, which offers students opportunities and access to dozens of the top engineering and science firms and universities in the nation.



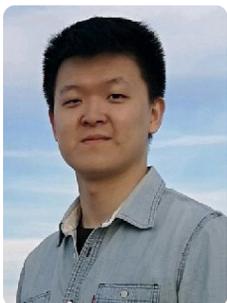
National Science Foundation Graduate Research Fellowship Program Award Recipients

The NSF GRFP recognizes and supports outstanding graduate students who have demonstrated the potential to be high-achieving scientists and engineers early in their careers. **Bjorn Kierulf**, E’22, mechanical engineering, received the award in 2023.



NU Motorsports Wins OktoBAJafest Competition

NU Motorsports, the **Baja SAE Northeastern team**, won the overall competition at OktoBAJafest, an exhibition race hosted by Clarkson University for student-built vehicles conforming to the rules of the Mini Baja series. The team also placed first in Endurance (with a 15+ lap lead) and third in the Hill Climb, Acceleration, and Design categories, with their new 2022 car. Baja designs, builds, and races an off-road vehicle every year; 15 universities participated in 2022 with 30 student-built vehicles.



Division Best Paper Award

Haonan Fan, PhD'24, mechanical engineering, received the 2023 Best Paper Award of the American Society of Mechanical Engineering Design Engineering Division for "DC Motor Velocity Control with Integral Retarded Controller Under Unintentional Delay" at the 2023 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference.

Best Master's Thesis Award at EuroSim Conference

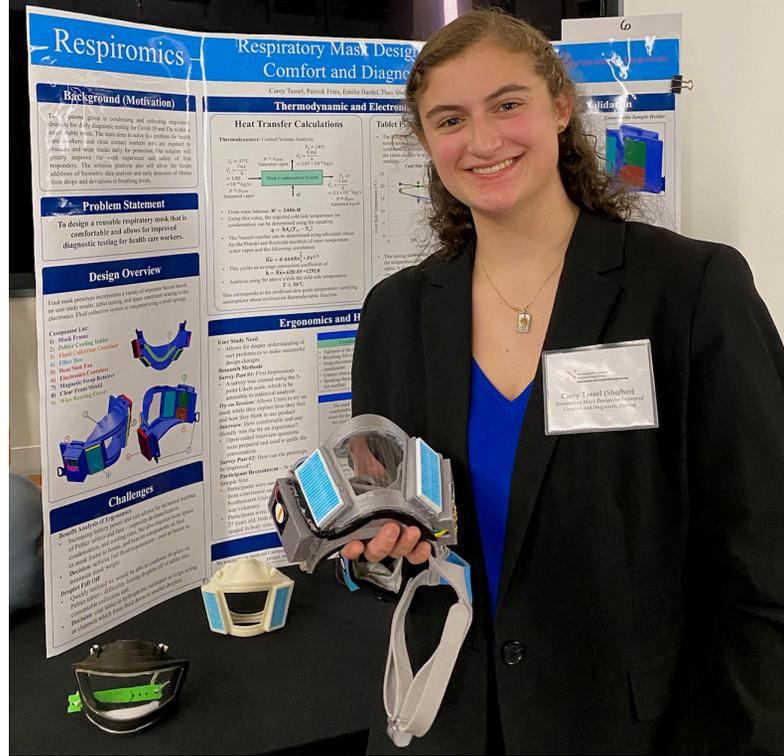
Sahil Belsare, MS'21, industrial engineering, received the Best Master's Thesis Award at the EuroSim Conference in Amsterdam for his innovative thesis on adaptive job shop scheduling using deep reinforcement learning. Belsare used a deep reinforcement learning approach to solve a stochastic flexible job scheduling problem, which was innovative at that time. He was advised by Associate Teaching Professor **Mohammad Dehghani**, mechanical and industrial engineering.



Trajectory to Engineering Leadership

Before starting college, **Carey Tassel**, E'22, MS'23, who recently graduated with a BS in mechanical engineering, and an MS in engineering management with the PlusOne program, has always had an underlying interest in the medical space. While in high school, Tassel participated in the Bioengineering Summer Immersion Program at Northeastern and discovered her talent for the problem-solving nature of engineering. She spent two weeks in a dorm at Northeastern exploring the Boston campus, talking with undergraduates, and learning directly from faculty through a research project and labs, while using the SolidWorks software for the first time. The experience with the Immersion Program as well as the appeal of the co-op program, and her familiarity with Boston made Northeastern her choice.

Once at Northeastern, Tassel selected mechanical engineering as her major, hoping to learn about medical devices and product design. "I wanted to solve problems and improve the lives of end users through design thinking," Tassel reflects on her experience in a graduate product design class, where her professor encouraged students to pick a problem in their life and design a solution. Her team designed a sliding lock for bathroom stalls that you could use with your foot, 3D printing, and building a prototype. She says, "I was excited to go to every class. I was excited not only for the content but also how our professor delivered it with personal anecdotes from his career as a product design consultant. I left ready for future co-ops where I would explore the product design cycle in industry."



Tassel's first co-op was at Ambri, an energy storage startup in Spring 2020. "It was a great experience. I got hands-on experiences with welding, electronics, and building battery test stations," she explains. Her second co-op was at the pharmaceutical company Lyndra Therapeutics. As part of the research and development team, Tassel was in the lab doing mechanical testing. A large project she worked on was a full redesign of a piece of test equipment. "I had a unique design perspective because I was on a team with scientists while working with engineers, so I was bridging two project goals into one product," she says. She feels that her second co-op helped her gain technical confidence with industry skills, so she was ready for the engineering design independence needed for the third co-op, which was at product design consulting firm Fikst Product Development. Tassel ultimately took a full-time position at Fikst after graduating in 2023 with her master's in engineering management.



The goal is to get a job that you love with the skills you have, and I look forward to keep learning as a full-time engineer."

Carey Tassel, E'22, Mechanical Engineering, MS'23, Engineering Management



Her senior design capstone project was also in product design. Tassel and her team designed a mask for COVID and flu that could collect condensed respiratory droplets as they were exhaled and store them for diagnostic testing. Working with a client at Harvard Medical School, her team integrated a fluid collection mechanism powered by electronic components into a wearable and reusable mask.

Strong connections with fellow students were also an important part of Tassel's experience and success. She names Sara Liebler, two years ahead of her, as a great mentor. "We met through the Society of Women Engineers (SWE) and worked together on the Executive Board. She supported me as a leader and helped me develop networking and professional skills. We even worked together at my second co-op with her as a technical mentor." Tassel later became president of SWE and mentored the future undergraduate leaders of the group.

Her final co-op and PlusOne master's degree in engineering management are leaving Tassel ready to manage subprojects and be a leader in the future. Tassel says that with the PlusOne program she found another passion in the business and managerial side of design engineering. "The goal is to get a job that you love with the skills you have, and I look forward to keep learning as a full-time engineer."



Members of the Society of Women Engineers at the SWE national conference.



Razan Al Lawati, PhD'23

INDUSTRIAL ENGINEERING

Advised by Md Noor E Alam,
Associate Professor of Mechanical and Industrial Engineering

Originally from Muscat, Oman, **Razan Al Lawati's** passion for problem-solving led her to complete an MS in interdisciplinary engineering at Purdue University and a second MS in operations research at Northeastern. She then pursued her PhD in industrial engineering at Northeastern under the supervision of Associate Professor Md Noor E Alam researching in the Decision Analytics Lab.

Al Lawati's current research focuses on using stochastic optimization in various ways to develop decision-making tools for systems that deal with uncertainty. In her work, she developed a novel framework in which decisions are updated as new information becomes available and studied the use of decomposition techniques to make large problems computationally tractable.

Al Lawati's entrepreneurial drive led her to found a solar consulting firm in Oman. Through this venture, she conducted feasibility studies and designed solar energy systems. She has also worked in enhanced oil recovery, where she researched and introduced new water treatment technologies. During this time, Al Lawati observed the difficulties associated with decision-making in the face of uncertainty with variable resource generators, prompting her to apply her PhD research to the renewable energy field. Her research findings have been applied to short-term market solutions for individual farms and long-term national, system-level solutions. Her in-depth understanding of the subject has enabled her to effectively mentor undergraduate students, facilitate workshops, and provide valuable assistance in manuscript editing and grant proposals. Al Lawati's research contributions in this field have been published in the *Journal of Applied Energy*.

Following graduation, Al Lawati plans to continue publishing papers related to her research to aid regulators, policymakers, and market designers in developing evidence-based decisions. She will also be collaborating with multidisciplinary teams on process improvement projects to bring life-changing impact to healthcare systems in the Middle East.

Xiaoyu (Criss) Zhang, PhD'23

MECHANICAL ENGINEERING

Advised by Laura Lewis, Distinguished University and Cabot Professor of Chemical Engineering and Mechanical Engineering

Xiaoyu (Criss) Zhang completed his PhD in mechanical engineering working with the Nanomagnetism research lab, focusing on experimental research to understand and tailor magnetofunctional materials. These materials are essential to modern society by allowing wireless interconversions between different types of energy to functionalize a variety of advanced technologies in automotive, aerospace, energy, and biomedical fields. Zhang's research applies novel materials processing approaches to alter local atomic environments and structures at scales from Ångstrom-level to microscale to tailor magnetofunctionality.

During his time at Northeastern, Zhang contributed to 14 peer-reviewed journal publications, including nine published contributions, with three as first-author, and five manuscripts in preparation. He has delivered 20 presentations at various national and international conferences. In 2022, he received the Department of Mechanical and Industrial Engineering's Ferretti & Yamamura Award for Excellence in Research. In addition, Zhang worked closely with six mechanical engineering professors on two core undergraduate courses, providing instructional guidance to over 1,000 undergraduate and graduate students in the department. His dedication to teaching earned him the Ferretti & Yamamura Award for Excellence in Teaching in 2019.



Zhang has a strong interest in international scientific collaboration and has been actively involved in the global magnetics community by participating in, volunteering, and hosting multiple professional events. In 2021, he led a successful \$10,000 seed-funding effort sponsored by the IEEE Magnetism Society, the premier global organization for magnetism professionals. As a "PI-in-training," this opportunity allowed him to collaborate with other PhD students from Ames National Laboratory and the Instituto de Ciencia de Materiales de Madrid in developing a more efficient processing pathway for advanced magnetic materials. In 2020 and 2021, he was one of the six organizers who represented North and South America in the inaugural Around-the-Clock Around-the-Globe Magnetism Conference. In 2022, he became the first student chair of a young scientists networking event at the annual Magnetism and Magnetic Materials Conference in Minneapolis.

After receiving his doctorate, Zhang is continuing research on magnetofunctional materials as a post-doctoral associate at Northeastern.

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COVER IMAGE

Wei Xie, assistant professor of mechanical and industrial engineering, received a \$851,000 award from NIIMBL, the National Institute for Innovation in Manufacturing Biopharmaceuticals. As COVID-19 variants continue to multiply, the mRNA vaccines used to blunt the spread and severity of the virus must be altered to maintain their effectiveness against new strains. These multivalent vaccines are engineered to provide protection against several strains of the virus at once. To improve quality control and quality assurance, and improve production, Xie and her team are investigating assay and machine learning methods to advance the scientific understanding of mRNA vaccine delivery, transfection, and translation process mechanisms. Scan the QR code to read the full article.

Photo by Bella Martinez/Northeastern University

