



**ANNUAL
REPORT
2021-22**



**Northeastern University
Mechanical and Industrial Engineering**



With 215 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 University

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 comprehensive undergraduate and graduate programs lead to degrees through the doctorate in nine colleges and schools across our global system of campuses. Learning is personalized and experiential, with a curriculum that emphasizes the intersection of data, technology, and human literacies—uniquely preparing graduates for lives of fulfillment and accomplishment.

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

NORTHEASTERN



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

DEAR COLLEAGUES, FRIENDS, AND STUDENTS,

At Northeastern University, the Department of Mechanical and Industrial Engineering is educating our students for professional and technical excellence, to perform research to advance the science and practice of engineering, to engage in service activities that advance the department, the university and the profession, and to instill in ourselves and our students habits and attitudes that promote ethical behavior, professional responsibility, and careers that advance the well-being of society.

Addressing challenges, such as climate change, data science, supply chains, rethinking/reshaping cities, sustainable manufacturing, refining health and well-being, and identifying new energy resources, in the coming decade is profoundly important. To this end, our department has identified key collaborative research areas, including Socio-Technical Systems, Supply Chain Resiliency, Intelligent and Advanced Manufacturing, Computationally Intensive Research, AI, as well as Multi-Agent and Human-Centered Systems.

Faculty research efforts are broad, interdisciplinary, and current. Some of these research areas include the transformation and modernization of manufacturing to remain competitive globally, development of modeling tools for healthcare to help hospitals produce projections and consider possible shortage scenarios, origami-inspired engineering, prevention of opioid addiction, combating human trafficking, and the development of robots able to learn and adaptively execute autonomous behaviors.

We have 80 tenured/tenure-track and teaching faculty, where more than 30 percent of our tenured/tenure-track faculty have received prestigious young investigator awards. This speaks to the quality of our faculty and research. We are the largest disciplinary academic department in the College of Engineering at Northeastern with more than 3,100 students as of fall 2021. We also offer over 20 degrees at the BS, MS, and PhD levels, in addition to concentrations, minors, and graduate certificates to meet students' career goals.

This annual report highlights the exceptional academic and professional accomplishments of our faculty and students for the 2021-2022 academic year.

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](https://mie.northeastern.edu).

Quick Facts MECHANICAL AND INDUSTRIAL ENGINEERING

61 TENURED/
TENURE-TRACK
Faculty

26 Young Investigator Awards, including **19** National Science Foundation CAREER Awards
34% of faculty have received Young Investigator awards

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

1,562 Masters Students

Up **51%**
vs.
2016

26 Professional Society Fellowships

143 Doctoral Students

Up **16%**
vs.
2016

13 Undergraduate Academic Programs
BS and Minors

3,124 Total Student Enrollment
(Fall-2021)

\$37M External Research Awards
(2020-2022)

2 Federally Funded Research Centers

NSF/DHHS Healthcare Systems Engineering Institute

NSF Center for High-rate Nanomanufacturing



Army Research Office Young Investigator Award

Safa Jamali
Assistant Professor

Quick Facts COLLEGE OF ENGINEERING

With **215** 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.

5 Engineering Departments

116 YOUNG INVESTIGATOR Awards

Including **64** NSF CAREER Awards, and **18** DOD Young Investigator Awards

102 Professional Society Fellowships

2,897 Total Co-op Hires (2022)

2,200 Co-op Employer Partners (2020-2022)

TOTAL ENROLLMENT (Fall 2021)

8,542 54% Graduate
46% Undergraduate

Enrollment Growth
(2016 to 2021)

Up **48%** MS
31% PhD
11% BS

Our Newest Faculty



Tong Ma

Assistant Professor

PhD: University of Connecticut, 2018

Previously: Postdoctoral Research Associate, Pacific Northwest National Laboratory

Scholarship Focus: Nonlinear systems and control, modeling and control of partial differential equations described systems, stochastic control and optimization, statistical and machine learning estimation and forecasting



Tucker Marion

Associate Professor

Jointly Appointed: Technological Entrepreneurship

PhD: Pennsylvania State University, 2007

Previously: Affiliated Faculty, Northeastern University College of Engineering and Associate Professor D'Amore-McKim School of Business; Director, Innovation Masters programs; Group (Department) Co-Chair, Entrepreneurship & Innovation Group

Scholarship Focus: New product development processes, IT and digital design tools, lean processes for startup and corporate ventures

Awards:

- Co-PI NSF EDSE Grant, 2021
- NASA IPA, 2020-2021



Peter Schindler

Assistant Professor

PhD: University of Vienna, 2015

Previously: Senior Scientist, Aionics Inc.

Scholarship Focus: Data-driven surface science for materials discovery in renewable energy and semiconductor applications

Awards: Austrian Science Fund, Erwin Schrödinger Fellow (FWF), 2017



Sze Zheng Yong

Associate Professor

PhD: Massachusetts Institute of Technology, 2016

Previously: Assistant Professor, Arizona State University

Scholarship Focus: Control, estimation, identification and analysis of autonomous, robotic and cyber-physical systems

Awards:

- NASA Early Career Faculty Award, 2020
- NSF CAREER, 2020
- DARPA Young Faculty Award, 2018



Juner Zhu

Assistant Professor

PhD: Massachusetts Institute of Technology, 2019

Previously: Research Scientist, Massachusetts Institute of Technology and Co-Director, MIT Industrial Battery Consortium

Scholarship Focus: Electro-chemo-mechanics in energy storage systems, applications of scientific machine learning, battery sustainability and safety

New Academic Programs and Campuses

BS in Mechanical Engineering and Bioengineering

MS in Data Analytics Engineering - Experiential 1 Year

MS in Engineering Management - Experiential 1 Year

MS in Data Analytics Engineering (2 year program) offered now in Boston, Seattle, and Vancouver, Canada

Faculty by Research Area

Biomechanics, Biofluids, & Mechanobiology

Rouzbeh Amini
Sandra Shefelbine
Hongwei Sun
Kai-tak Wan

Complex Fluids, Multiphase, & Multiscale Matter

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

Data Analytics, AI, & Operations Research

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

Energy Systems, Sustainability, & Environmental Protection

Yiannis Levendis
Laura Lewis
Hameed Metghalchi
Xiaoyu Tang
Mohammad Taslim
Yi Zheng
Juner Zhu

Engineering Education

Abe Zeid

Human-Technology Integration

Casper Hartevelt
Yingzi Lin
Tucker Marion
Jose Martinez-Lorenzo
Rifat Sipahi
Sze Zheng Yong

Intelligent Manufacturing

Muhammad Noor E. Alam
Ahmed Busnaina
Randall Erb
Xiaoning "Sarah" Jin
Sagar Kamarthi
Mohsen Moghaddam
Sinan Muftu
Ozan Ozdemir
Hongli "Julie" Zhu

Materials for the Future

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

Mechanics

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

Networks & Complex Systems

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

Resilient & Sustainable Service Systems

James Benneyan
Ozlem Ergun
Jacqueline Griffin
Surendra M. Gupta
Kayse Lee Maass

Robotics & Control Systems

Tong Ma
Max Shepherd
Rifat Sipahi
Seungmoon Song
John "Peter" Whitney
Sze Zheng Yong

Faculty Honors and Awards

SELECTED HIGHLIGHTS

Army Research Office Young Investigator Award for Colloidal Crystals

Safa Jamali, assistant professor, mechanical and industrial engineering (MIE), was awarded a grant from the Army Research Office Young Investigator Program for research on the synthetic creation of colloidal structures for new materials. Collaborators include **Randall Erb**, associate professor, MIE, and North Carolina State University.

The research looks at high-tech particulate systems (combinations of liquids and particles) called colloidal crystals, which can be directed into specific lattices within a gel-like material that is useful in optical computing, photonic sensors, and novel display technologies. Forming colloidal crystals into ordered structures currently requires techniques that are cost prohibitive.

Jamali seeks to understand how particles behave under flow to form these colloidal structures more easily using divergent-convergent flow geometries and different frequencies, amplitudes, and applied deformations. This would be a much cheaper way to produce colloidal crystals in much larger quantities—a significant step forward in high throughput technology.

In the long run, he hopes to use physics-informed machine learning to design the specific protocols needed to create colloidal structures that can become materials for a range of high-tech applications.



Photo by Matthew Modono

IISE Fellow

Professor **Sagar Kamarthi**, mechanical and industrial engineering, was selected for the Institute of Industrial and Systems Engineers (IISE) Fellow Award. It 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.



U.S. Fulbright Scholar



Associate Professor **Carlos Hidrovo**, mechanical and industrial engineering, was selected as a Fulbright U.S. Scholar for 2022-2023 and will conduct research in Australia. U.S. Fulbright awards are prestigious and competitive fellowships that provide unique opportunities for scholars to teach and conduct research abroad. He will be mainly researching the implementation of two techniques: surface acoustic waves (SAWs) at the Royal Melbourne Institute of Technology

and micro magnetofluidics at Griffith University in Queensland, for controlling the generation of liquid droplets in gas-liquid droplet microfluidics. Successful implementation of these techniques might allow for the generation of submicrometer size droplets at generation rates of 1 MHz and with high uniformity (less than 5% deviation in size). This could represent a paradigm shift in the generation of highly uniform aerosols for applications in drug delivery (e.g., highly targeted nasal sprays), 3D printing, and the accurate detection of airborne targets (e.g., toxic gases and pathogens).

ASEE 2021 Ralph Coats Roe Award

Yiannis Levendis, College of Engineering Distinguished Professor, mechanical and industrial engineering, received the American Society of Engineering Education (ASEE) 2021 Ralph Coats Roe Award, which “recognizes an engineering educator who is an outstanding teacher and has made a notable contribution to the profession.”



\$2.1M DOE Grant for Novel Magnetic Materials to Address Supply Chains Issues and Enable Green Technology

Distinguished University and Cabot Professor **Laura Lewis**, chemical engineering, and mechanical and industrial engineering, has been awarded a \$2.1 million grant from the Department of Energy (DOE) to discover Nature’s rules for creation of competitive magnetic materials comprised of non-critical elements. The research is focused on developing new types of strong, permanent magnets that allow the wireless transmission of energy and are used in everything from wind turbines to electric vehicles to cell phones and computers.. These magnets typically contain metals that are very expensive and/or involve geopolitical issues that make refining and distribution of them difficult, and they are a limited resource. Leading this three-year grant, Lewis is collaborating with the University of Delaware, Northeastern University Physics department, and University of Warwick, UK. The team is working from computational, theoretical, and experimental viewpoints to find fundamental recipes to develop magnetic strength at the atomic level using temperature, pressure, and magnetic fields.



SPIE Senior Member

Associate Professor **Yongmin Liu**, mechanical and industrial engineering, jointly appointed in electrical and computer engineering, was selected as a senior member of the International Society for Optics and Photonics (SPIE). SPIE Senior Members are members of distinction honored for their professional experience, their active involvement with the optics community and SPIE, and/or significant performance that sets them apart from their peers.



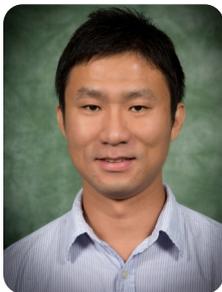
3M Non-Tenured Faculty Award

Associate Professor **Yi Zheng**, mechanical and industrial engineering, received the prestigious 3M Non-Tenured Faculty Award from 3M Corporation. This competitive award recognizes outstanding young faculty who were nominated by 3M researchers and selected based on their research, experience, and academic leadership.



Chair-Elect for INFORMS Data Mining

Assistant Professor **Chun-An Chou**, mechanical and industrial engineering, was nominated and voted as Chair-Elect of the INFORMS Section on Data Mining. The Data Mining Section is one of largest INFORMS communities in the fields of operations research, management science, and analytics.



IEEE Fellow and Lifetime Achievement Award

Professor **Hanumant Singh**, electrical and computer engineering, jointly appointed in mechanical and industrial engineering, has been elevated to an IEEE Fellow for his development of localization and mapping techniques and autonomous systems for marine and polar applications. IEEE Fellow is the highest grade of membership and is recognized by the technical community as a prestigious honor and an important career achievement. Singh also received the Lifetime Achievement Award from the IEEE Oceanic Engineering Society for his work on Autonomous Underwater Vehicles.

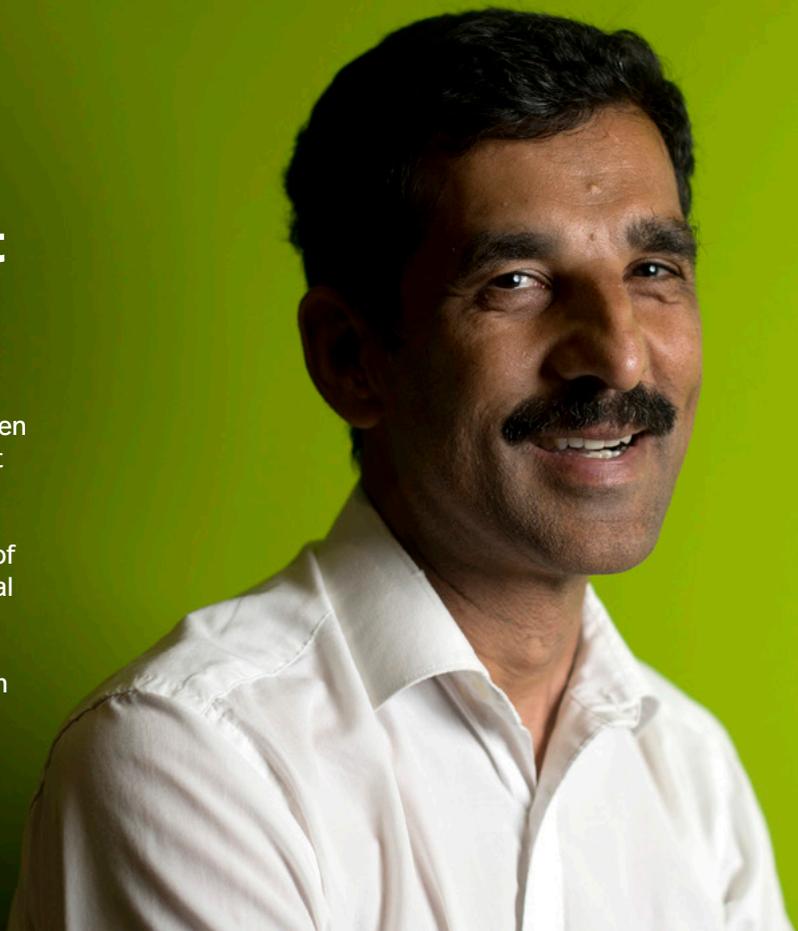
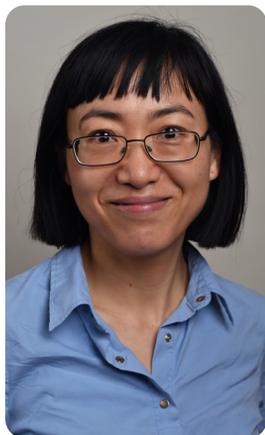


Photo by Matthew Mcdoono

\$2M NIIMBL Award for Stem Cell Research



Assistant Professor **Wei Xie**, mechanical and industrial engineering, received a \$2 million award from NIIMBL, the National Institute for Innovation in Manufacturing Biopharmaceuticals, for “Advanced Bioprocessing Sensor and Analytical Technologies for Induced Pluripotent Stem Cell Culture Online Monitoring and Automation.” To accelerate intensified, reliable, and scalable iPSC production in bioreactors, the project will refine sensor technology to detect spatial heterogeneity and support large-scale cell processing, as well as improve interpretable AI and machine-learning algorithms for bioprocessing control and automation.

New Information Infrastructure for Pharmaceutical Supply Chains

Associate Professor **Jacqueline Griffin**, and College of Engineering (COE) Distinguished Professor **Ozlem Ergun**, mechanical and industrial engineering, as well as COE Distinguished Professor **David Kaeli**, electrical and computer engineering, and Northeastern’s Khoury College and College of Arts, Media, and Design faculty Stacy Marsella and Casper Hartevelde, respectively, were awarded a \$750K National Science Foundation grant for “Designing an Improved Information Infrastructure for Better Decision Making in Pharmaceutical Supply Chains.” They will develop secure mechanisms for sharing information; enhance the analytical structure to support decision-making; and improve understanding of the diversity of decision-making behaviors and how these behaviors are influenced by the available information. The grant is part of NSF’s Strengthening American Infrastructure program.





Using Background Checks to Find Trends in Gun Purchases

Professor **Rifat Sipahi**, mechanical and industrial engineering, and **Xu Wang**, PhD'25, published a paper in *AIP Chaos: An Interdisciplinary Journal of Nonlinear Science* that sheds light on national firearm acquisition trends across more than two decades of background check data. Researchers found that gun acquisitions across the country follow annual patterns that are highly synchronized state by state, with several variations tied to U.S. presidential terms.



First Silicon Nanowires that Operate as an Ultrawide-bandgap Semiconductor

The research of mechanical and industrial engineering professors **Yung Joon Jung** and **Moneesh Upmanyu** on “Catalyst-free Synthesis of sub 5nm Silicon Nanowire Arrays with Massive Lattice Contraction and Wide-Band Gap” has been published in *Nature Communications*. The researchers developed silicon nanowires that operate as an ultrawide-bandgap (UWBG) semiconductor—a first in the world of silicon, potentially revolutionizing the integration of etched silicon nanowires into UWBG device applications.



New Composite Materials to Resist Impact Vibrations

Associate Professor **Yaning Li**, mechanical and industrial engineering, in collaboration with the University at Buffalo, is leading a \$667K National Science Foundation grant for “Bio-Inspired Impact-Resistant Phononic Sutured Gabbions.”



Lab Spinout a Finalist in Massachusetts Innovation Network’s Competition

Planck Energies, which is a spinout company for the lab of Associate Professor **Yi Zheng**, mechanical and industrial engineering, was selected as a finalist for the Massachusetts Innovation Network’s innovation competition, The Eddies, in the Cleantech and Sustainability category. The Eddies (formerly known as NE Innovation Awards) is the oldest and longest running innovation competition in New England. Planck Energies, of which Zheng and **Andrew Caratenuto**, PhD'24, mechanical engineering, founded, is taking the world’s leading clean energy research and applying it to create valuable, consumer-focused products that can be used at commercial scale and in developing areas. Their products currently include a green roofing material that helps keep buildings cool without using any energy, and a solar desalination system that uses repurposed biomass materials to address global freshwater shortages.



Natural Biomass-based Solar-driven Water Desalinators

Research of Associate Professor **Yi Zheng**, mechanical and industrial engineering, has been featured on covers of two Royal Society of Chemistry journals – *Nanoscale* and *Journal of Chemistry Materials A*. Zheng’s Nano Energy Group has recently designed and demonstrated natural biomass-based solar-driven water desalinators. They are composed of forest waste (maple tree leaves) or ocean waste (chitosan and cuttlefish ink), continuously transporting water to the evaporation surface and effectively absorbing solar energy and converting it into heat.

Learn more about our accomplished faculty



Student Successes

SELECTED HIGHLIGHTS



Photo by Matthew Modomo

Robotics Team Advances to Finals of Global Competition

Northeastern's Robots team, advised by Assistant Professor **Peter Whitney**, mechanical and industrial engineering, advanced to the finals of the global Avatar XPrize competition, which aims to create an avatar system that can transport human presence to a remote location in real-time. They were one of 37 clubs out of 150 around the world to advance to the semifinal stage. As finalists they were one of 15 teams selected. The team built a mobile robot using a combination of originally designed hardware and re-engineered off-the-shelf robotic systems. The finalist teams equally shared a milestone prize purse of \$2 million and competed again in Fall 2022.

Northeastern Electric Racing Team Places Second in Competition

The **Northeastern Electric Racing team** placed second in the all-electric vehicle category at the 2022 Formula Hybrid+Electric Competition, their first in-person competition after having spent the past five years building their first-ever vehicle and competing virtually the past two years. Northeastern Electric Racing is a student organization that designs and builds an all-electric formula-style race car to compete against other universities from around the world. They also won the inaugural Scrutineer's Award in Honor of Suzanne Royce for being the most prepared team and having the best engineering documentation.



INFORMS Receives Student Chapter Award

The **Northeastern University INFORMS student group** has been selected as a winner of the 2021 INFORMS Student Chapter Annual Award at the Magna cum laude level for the third year in a row.



Finalist in NASA BIG Idea Challenge

Students for the **Exploration and Development of Space student group**, advised by Assistant Professor **Alireza Ramezani**, electrical and computer engineering, was one of seven university teams selected as finalists in the 2022 NASA's BIG Idea Challenge. The team's project, titled "COBRA: Crater Observing Bio-inspired Rolling Articulator," is a snake-like design for their robot to allow it to traverse the extreme terrains on the moon's surface.

Student Spotlights

ASEE Student of the Year, Co-op and Experiential Division

Growing up, **Ruthie Nelson**, E'21, mechanical engineering, enjoyed working with her dad to fix the Chevy trucks owned by her family. That, along with her interest in STEM, led her to decide on an engineering major. "It's physics-based, so it would give a good basis for lots of things," Nelson says.

But Nelson didn't want to pursue an engineering degree at just any university. She believed Northeastern's co-op opportunities would give her an edge. "I knew that I would be challenged because the expectations would be higher than if I were to attend a more traditional school," she says.

Nelson took full advantage of Northeastern's experiential learning opportunities, completing three co-ops over four and a half years. Her first, at a power plant called Xcel Energy in her home state of Minnesota, gave her a good engineering foundation, and taught her about process optimization. "I got to be incredibly hands on," she says.

Nelson had a different experience working for GE Aviation in Lynn, Massachusetts, as part of the military technologies group. There, she gained experience in different types of engineering. "I got to work more on the product side of things," she says. "I even learned about the basics of jet engine design."



But Nelson credits her third co-op with giving her the strengths and abilities that helped her most with her post-Northeastern future. During her time at SparkCharge, a start-up in Somerville, Massachusetts, Nelson helped make portable chargers for electric vehicles. SparkCharge taught Nelson a lot about energy transportation, and gave her the opportunity to learn to code.

Ultimately, it was SparkCharge that gave Nelson the confidence to apply for her now-full-time-job at Tesla as a test equipment engineer. "I wouldn't have even thought I could apply to Tesla, without that co-op," she says. "I learned how to design parts and organize, but also I built confidence and learned that I can just trust myself and trust my instincts."

Nelson's success in the engineering program and various co-ops led to her recognition as one of several Students of the Year by the American Society of Engineering Education. Nelson received the award at ASEE's Conference for Industry and Education Collaboration in 2022. The accolade, part of the Cooperative and Experiential Education Division, honored not only her engineering strengths, but her attitude and willingness as a student learning from different co-ops.



Md Mahmudul Hasan, PhD'22

INDUSTRIAL ENGINEERING

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

As a PhD student of the Decision Analytics Lab at Northeastern, **Md Mahmudul Hasan** conducted data-driven research to address complex challenges in public health, contributing to healthcare decision-making, policy, and management. From a methodological standpoint, he leveraged management and data science techniques, particularly AI/machine learning, statistical modeling, and operations research techniques.

Hasan was also a member of Northeastern's Center for Health Policy and Healthcare Research. He collaborated on several interdisciplinary research projects, partly funded by the CDC in partnership with the Massachusetts Department of Public Health and Northeastern's Global Resilience Institute. The research addressed critical issues such as the opioid overdose epidemic. Hasan's research also focused on developing an intelligent multi-criteria decision-making framework for resilient supplier selection in logistics 4.0.

He presented his research at prestigious conferences and produced 13 publications. He received the John and Katharine Cipolla Merit Award-PhD from the Department of Mechanical and Industrial Engineering and the Outstanding Graduate Research Award from the College of Engineering. In addition to being an active and prolific researcher, Hasan mentored undergraduate and master's students, leading them in their projects and thesis activities and helping them participate in scholarly publications.

After defending his dissertation, Hasan worked as an Oak Ridge Institute for Science and Education postdoctoral fellow of drug safety and artificial intelligence methods in the U.S. Food and Drug Administration's Center for Drug Evaluation and Research. In this position, he utilized AI and natural language processing techniques to investigate how the interactions between opioids and other FDA-approved drugs cause adverse health events in the human population.

Hasan began a tenure-track faculty position at the University of Florida in July of 2022. He is jointly appointed between the Department of Information Systems and Operations Management at the university's College of Business and the Department of Pharmaceutical Outcomes and Policy at the College of Pharmacy.

Seyedeh Mahsa Sadeghian, PhD'22

MECHANICAL ENGINEERING

Advised by Sandra Shefelbine,
Professor of Mechanical and Industrial Engineering,
and Bioengineering

Mahsa Sadeghian completed her master's degree and PhD conducting research in the Multiscale Mechanics and Musculoskeletal Mechanobiology Lab at Northeastern. Her master's thesis used computational modeling to explore the mechanics of growing bone, focusing on stresses in the growth plate, a thin layer of cartilage responsible for growing bone length.

In her doctoral research she expanded on this work, incorporating mechanobiology, the tissue response to mechanical loading. As bone grows, it changes shape and material properties due to ossification. These biological processes are influenced by the mechanical environment of the tissue. By modeling the effect of loading conditions on growth and ossification, Sadeghian explored pathologies of the hip, particularly the proximal femur. She modeled femoroacetabular impingement, a hip condition that forms in elite adolescent athletes and leads to arthritis. Her work helped to uncover possible causes of the abnormal bone growth. She also modeled hip dysplasia, the condition in which the femur develops outside of the acetabular socket, and the effects of harness treatment.

Sadeghian published two papers and has two more in preparation. She was also a teaching assistant for the Mechanics of Materials Lab, changing the labs each year so that students had more hands-on experiences. In 2019, she completely redesigned the labs to include even more hands-on demonstrations and new equipment, and revised them yet again as take-home lab kits to accommodate the pandemic.

Her dedication to teaching earned her numerous awards, including the Alfred J. Ferretti Excellence in Teaching Award and the John and Katharine Cipolla Merit Award from the Department of Mechanical and Industrial Engineering, as well as the College of Engineering Outstanding Graduate Teaching Award. Sadeghian hopes to apply her modeling skills to orthopedic device design in the future.



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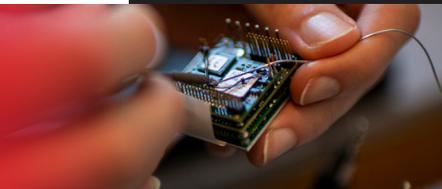
Letter from the Chair

1



Fast Facts

2



Faculty Honors & Research

5



Student Successes

10



COVER IMAGE

Desalination systems turn seawater into freshwater to address drinking water scarcity, but they rely on an expensive unsustainable filter, and the process requires electricity. Associate Professor **Yi Zheng**, mechanical and industrial engineering, designed a filter to be placed on seawater and activated by sunlight, and the filter was made of natural materials—manure, tree leaves, cuttlefish ink, crab and lobster shells, hornets nests, and office paper waste. See page 9.

Photo by Alyssa Stone/Northeastern University