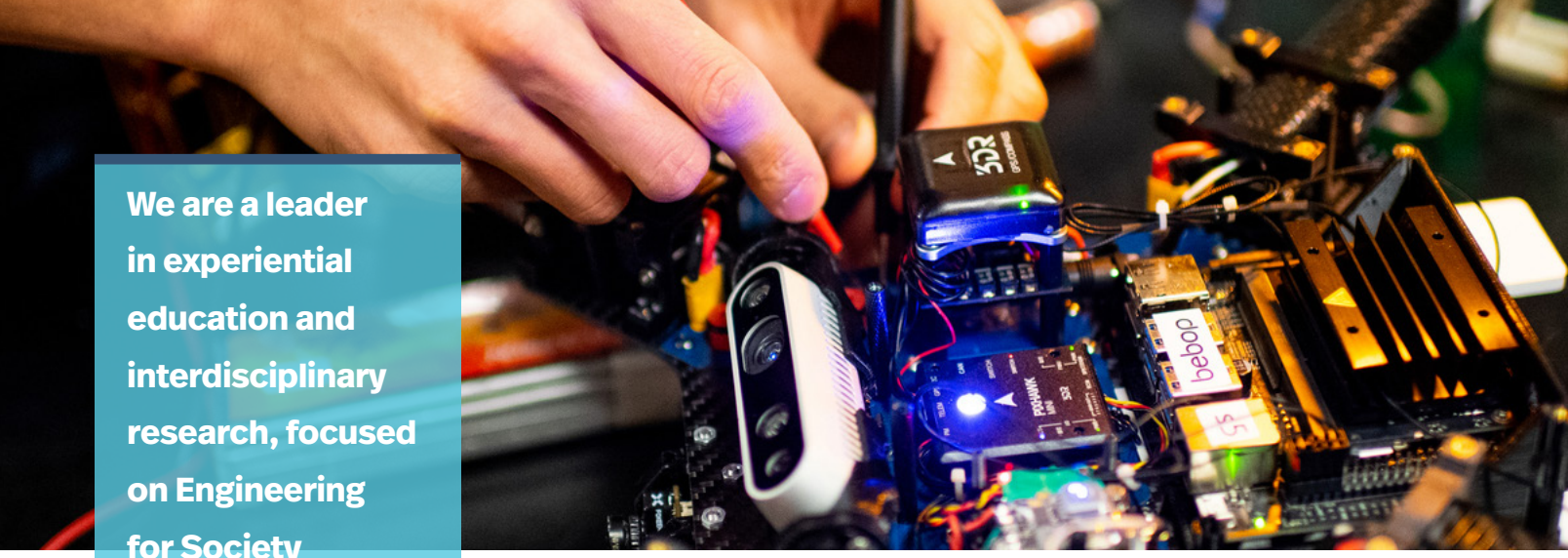
Northeastern University
College of Engineering

2020 | 2021

SCHOLARSHIP REPORT

MECHANICAL AND INDUSTRIAL ENGINEERING



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

DEAR COLLEAGUES, FRIENDS, AND STUDENTS,

This year we are once again reminded in mechanical and industrial engineering of the many opportunities and challenges that need to be addressed. At Northeastern University, the Department of Mechanical and Industrial Engineering (MIE) 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. Our faculty are also recognized global leaders in their fields, and the department continues to leverage these strengths to address societal needs through engineering in an evolving and complicated world.

Addressing engineering 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, the MIE 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. Our department is comprised of over 70 tenured/tenure-track and teaching faculty, where more than 30 percent of the MIE tenured/tenure-track faculty have received prestigious Young Investigator Awards. This speaks to the quality of our faculty and research.

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.

This past academic year the MIE department has also seen continual growth in our program offerings, with the addition of a combined BS degree in Mechanical Engineering and History, a minor in Aerospace, as well as an MS in Advanced and Intelligent Manufacturing. These new programs bring together our disciplinary concentrations of mechanics, materials, mechatronics, and industrial engineering. MIE is the largest disciplinary department within Northeastern's College of Engineering, with a total student enrollment of over 2,800 in fall of 2020. These new programs and degrees join our over 20 MIE programs at the BS, MS, and PhD levels.

This annual scholarship report details the exceptional academic and professional accomplishments of our faculty and students for the 2020-2021 academic year.

For the latest highlights, please visit us at MIE.NORTHEASTERN.EDU.

Sincerely,

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

QUICK FACTS MECHANICAL AND INDUSTRIAL ENGINEERING

61
TENURED/ TENURE-TRACK Faculty

25
Professional Society Fellowships

2
Federally Funded Research Centers

- NSF/DHHS Healthcare Systems Engineering Institute
- NSF Center for High-rate Nanomanufacturing

23
Young Investigator Awards, including **18** National Science Foundation CAREER Awards

National Academy Member
Vinod Sahney, University Distinguished Professor

1291 **Masters Students**
Up 67% vs. 2015

153 **Doctoral Students**
Up 20% vs. 2015

23 **Graduate Academic Programs**
MS, PhD, Certificates

$34M **External Research Awards**
(2019-2021)

2021 NSF CAREER Award Recipient
Muhammad Noor E Alam,
Assistant Professor

2021 Honorary Member of the American Society of Mechanical Engineers
Hameed Metghalchi, Professor

QUICK FACTS COLLEGE OF ENGINEERING

With **200** tenured/tenure-track faculty and **17** multidisciplinary research centers and institutes with funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research, with a focus on discovering solutions to global challenges to benefit society.

5 **Engineering Departments**

104 **YOUNG INVESTIGATOR** Awards

Including **58** NSF CAREER Awards, and **18** DOD Young Investigator Awards

84 **Professional Society Fellowships**

949 **Graduate Students**
Placed on Co-op
(2020-2021)

TOTAL ENROLLMENT (Fall 2020)
7873
49.8% Graduate
50.2% Undergraduate

Enrollment Growth
(2015 to 2020)

52% MS
34% PhD
16% BS

New MS in Advanced and Intelligent Manufacturing

The Department of Mechanical and Industrial Engineering offers the Master of Science in Advanced and Intelligent Manufacturing to meet the growing demand for engineers, researchers, and scientists trained in advanced manufacturing and Industry 4.0 technologies.

The advent of the industrial internet of things, additive manufacturing (3D printing) of parts and electronics, advanced materials with unique properties, and efficient manufacturing processes transforms manufacturing operations into advanced manufacturing. Advanced manufacturing focuses on developing innovative technologies to create existing and new products by leveraging novel emerging materials, advanced processes, information, automation, computation, sensing, AI, and digitalization.

Through a curriculum focused on advanced, smart, and digital manufacturing, the MS in Advanced and Intelligent Manufacturing prepares students to be researchers for development of advanced manufacturing technologies, and leaders for managing advanced manufacturing enterprises.

RECENT FACULTY HIRES

JACK LESKO
Professor, Mechanical and Industrial Engineering, and Civil and Environmental Engineering, and Director of Engineering Research at the Roux Institute
PhD, Virginia Tech, 1994
Scholarship focus: Emerging interdisciplinary design involving lightweight polymeric multifunctional materials, structural design and reliability, with additional experience in distributed energy systems (storage, power transfer, packaging, and manufacturing), polymeric separation membranes, building energy efficiency design and construction, technology transfer

SHAHIN SHAHRAMPOUR
Assistant Professor, Mechanical and Industrial Engineering
PhD, University of Pennsylvania, 2015
Scholarship focus: Machine learning, optimization and control, distributed and sequential learning, with a focus on developing computationally efficient methods for data analytics

FRANCISCO LOTH
Professor, Mechanical and Industrial Engineering, and Bioengineering
PhD, Georgia Institute of Technology, 1993
Scholarship focus: Biological flows, experimental fluid mechanics, computational fluid mechanics, blood flow simulation, cerebrospinal fluid simulation, Chiari malformation, syringomyelia, medical image processing, magnetic resonance imaging

MAX SHEPHERD
Assistant Professor, Mechanical and Industrial Engineering, jointly appointed in Bouve College of Health Sciences
PhD, Northwestern University, 2019
Scholarship focus: Prosthetics and wearable robotics design and control, gait rehabilitation, preference optimization, and machine learning

OZAN ÖZDEMIR
Assistant Professor, Mechanical and Industrial Engineering
PhD, South Dakota School of Mines and Technology, 2017
Scholarship focus: Advanced metal additive manufacturing, compressible flows, multiphase flows, heat and mass transfer, thermodynamics, and failure analysis

SEUNGMOON SONG
Assistant Professor, Mechanical and Industrial Engineering
PhD, Carnegie Mellon University, 2017
Scholarship focus: Modeling the neuromechanics of human movement and applying it to assistive devices and rehabilitation treatment

FACULTY BY RESEARCH AREAS

Biomechanics & Soft Matters – Solids and Fluids

Rouzbeh Amini
Andrew Gouldstone
Carlos Hidrovo
Safa Jamali
Yaning Li
Yingzi Lin
Carol Livermore
Jose Martinez Lorenzo
Sinan Müftü
Hamid Nayeb-Hashemi
Sandra Shefelbine
Mohammad E. Taslim
Kai-Tak Wan
John "Peter" Whitney

Energy Systems

Muhammad Noor E Alam
Ahmed Busnaina
Luca Caracoglia
Yung Joon Jung
Gregory Kowalski
Yiannis Levendis
Yongmin Liu
Carol Livermore
Bala Maheswaran
Hameed Metghalchi
Mohammad E. Taslim
Wei Xie
Yi Zheng
Hongli "Julie" Zhu

Healthcare Systems

Muhammad Noor E Alam
James Benneyan
Chun-An Chou
Jacqueline Griffin
Babak Heydari
Sagar Kamarthi
Yingzi Lin
Kayse Lee Maass
Vinod Sahney
Rifat Sipahi
Wei Xie

Impact Mechanics

George G. Adams
Michael Allshouse
Andrew Gouldstone
Carlos Hidrovo
Yaning Li
Yang "Emily" Liu
Carol Livermore
Craig Maloney
Jose Martinez Lorenzo
Sinan Müftü
Hamid Nayeb-Hashemi
Sandra Shefelbine
Kai-Tak Wan
John "Peter" Whitney
Ibrahim Zeid

Mechatronics and Systems – Control, Robotics, & Human Machines

Babak Heydari
Laurent Lessard
Yingzi Lin
Jose Martinez Lorenzo
Shahin Shahrampour
Rifat Sipahi
John "Peter" Whitney

Multifunctional Composites

Teiichi Ando
Ahmed Busnaina
Randall Erb
Andrew Gouldstone
Jacqueline Isaacs
Yung Joon Jung
Yaning Li
Yongmin Liu
Marilyn Minus
Sandra Shefelbine
Moneesh Upmanyu
Yi Zheng
Hongli "Julie" Zhu

Multi-phase Structured Matter

Michael Allshouse
Teiichi Ando
Randall Erb
Carlos Hidrovo
Safa Jamali
Yung Joon Jung
Yaning Li
Yang "Emily" Liu
Yongmin Liu
Carol Livermore
Craig Maloney
Hongwei Sun
Mohammad E. Taslim
Moneesh Upmanyu
Kai-Tak Wan
Yi Zheng

Resilient Systems

Muhammad Noor E Alam
James Bean
Mehdi Behroozi
James Benneyan
Thomas Cullinane
Ozlem Ergun
Nasser Fard
Jacqueline Griffin
Surendra M. Gupta
Babak Heydari
Jacqueline Isaacs
Xiaoning "Sarah" Jin
Sagar Kamarthi
Yingzi Lin
Kayse Lee Maass
Emanuel Melachrinoudis
Vinod Sahney
Shahin Shahrampour
Hao Sun
Wei Xie

Smart and Sustainable Manufacturing

Muhammad Noor E Alam
Ahmed Busnaina
Randall Erb
Babak Heydari
Jacqueline Isaacs
Yung Joon Jung
Sagar Kamarthi
Yongmin Liu
Carol Livermore
Marilyn Minus
Mohsen Moghaddam
Moneesh Upmanyu
Wei Xie
Yi Zheng
Hongli "Julie" Zhu

NSF CAREER Award for Causal Inference in Large-Scale Studies

Muhammad Noor E Alam, assistant professor, mechanical and industrial engineering

Assistant Professor **Muhammad Noor E Alam**, mechanical and industrial engineering, received a $500K National Science Foundation CAREER Award for developing "Robust Matching Algorithms for Causal Inference in Large Observational Studies." The research will utilize the power of Big Data to infer causality in large-scale observational studies.

In many situations, particularly in the public health domain, it may be difficult or prohibitively expensive to design controlled studies to evaluate effective public policies. As large-scale data collection increases, the design of methods to infer causality between treatment and outcome by partitioning observations into appropriate sets has become an attractive alternative. Current methods underlying causal inference suffer from several fundamental challenges that may lead to sub-optimal policy selection. This project will develop tractable computational approaches to facilitate better policy decision making. As an important use case, the project will evaluate policies for improving treatment quality of Opioid Use Disorder (OUD) using large-scale U.S. healthcare data.

Using a modern optimization perspective, this project will advance existing methods for causal inference by developing a theoretical and computational framework that encompasses both inference and matching to identify causality from an observational study. The research objectives are to (1) establish a robust causal inference framework with matching methods to reduce uncertainty, (2) ensure covariate balance in high dimensional space, (3) develop optimal covariate balance techniques to reduce bias and model dependency by ensuring desired distributional properties, and (4) evaluate and advance U.S. healthcare policies based on this framework. To this end, a rigorous optimization framework will be employed to explicitly account for uncertainties in causal inference, maintain neighborhood structures of high dimensional data in low dimensions with matching requirements, and ensure optimal distributional properties of observational data. Efficient exact solution algorithms will be developed exploiting problem structure. Scalability will be addressed through algorithmic schemes with desirable convergence properties and data structure-based decomposition methods. These algorithms are expected to be useful to a wide variety of optimization problems such as quadratic assignment, convex-nonlinear feasibility, and binary feasibility.

The Institute for Experiential AI at Northeastern University

Pioneering a Human-Centric Artificial Intelligence Research and Applications Hub

Northeastern University has allocated $50 million to the new Institute for Experiential AI, a pioneering research hub that places human skills and intelligence at the forefront of artificial intelligence applications. Leading experts in computer science, engineering, ethics, humanities, law, public policy, health, security, and sustainability will collaborate to develop applied human-centric AI solutions that tackle the world's toughest challenges.

The Institute for Experiential AI is university-wide, based out of the Roux Institute at Northeastern—a graduate education and research campus in Portland, Maine, born from a $100 million investment in the university by David and Barbara Roux. Designed to educate generations of talent in the digital and life sciences sectors, the Roux Institute also acts as a driving force for sustained economic growth in Portland, the state of Maine, and northern New England.

"Northeastern has committed to building the top research institute in the world focused on experiential AI," says founding Executive Director **Usama Fayyad**. "No one has claimed this space yet and I'm excited for our chance to lead this field."

To accelerate research and advance practical applications of AI in several domains, the Institute for Experiential AI is recruiting 30 new research and teaching faculty, data scientists, and postdoctoral fellows. In addition, faculty from colleges within the university such as the College of Engineering and Khoury College of Computer Sciences will conduct and collaborate on multidisciplinary research as part of the institute.

The Institute for Experiential AI will partner with industry, government, and academia to educate the next generation of AI professionals and lead efforts to create ethical and responsible human-centric AI. The institute also plans to be a prominent contributor to the global AI ecosystem and a key driver of experiential AI in New England through targeted activities in the region.

Professor **Hameed Metghalchi**, mechanical and industrial engineering, was selected as an **Honorary Member of the American Society of Mechanical Engineers** "for distinguished services in promoting mechanical engineering through teaching, administrative and mentoring efforts; for contributions to the international community through research publications; and for sustained leadership in the Advanced Energy Systems Division of ASME's Energy Resources Board." Honorary Membership is awarded for a lifetime of service to engineering or related fields. In addition, Metghalchi was selected as an **Honorary Fellow of the International Society for Energy, Environment and Sustainability** for the Class of 2020, for pioneer research and education in thermodynamics and combustion for the last four decades improving thermal system efficiency and effectiveness while reducing pollutant formation.

David Luzzi, senior vice provost for research and vice president of the Innovation Campus at Burlington, and professor of mechanical and industrial engineering, has been named a **Fellow of the National Academy of Inventors (NAI)**. The NAI Fellows Program highlights academic inventors who have demonstrated a spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society. Election to NAI Fellow is the highest professional distinction accorded solely to academic inventors.

Associate Professor **Yi Zheng**, mechanical and industrial engineering, **invented a sustainable material** that can be used to make buildings or other objects able to keep cool without relying on conventional cooling systems. The material is made of paper and is recyclable. Tests indicate that it can reduce a room's temperature by as much as 10 degrees Fahrenheit. The process for creating and testing the new material was described in the American Chemical Society journal ***Applied Materials & Interfaces***. Zheng was also selected to be a **NASA Glenn Faculty Fellow** in the area of "Harsh Environment Sensor Development" during summer 2021. As a NASA Glenn Faculty Fellow, he performed the sensor research towards developing minimally intrusive, multifunctional, miniaturized smart sensors, including microelectromechanical systems (MEMS) and MEMS type structures for use in harsh environments.

Professor **Ozlem Ergun**, mechanical and industrial engineering, is part of the UN World Food Programme team that won the **INFORMS 2021 Franz Edelman Award** for their project "Towards Zero Hunger with Analytics." The award recognizes and rewards outstanding examples of operations research, management science, and advanced analytics. Ergun was also **named a Franz Edelman Laureate** for authoring the Edelman finalist paper in *INFORMS Journal on Applied Analytics*. Laureates are recognized for their significant contribution to work that is selected as representative of the best applications of analytical decision making in the world.

Professor **Sagar Kamarthi**, mechanical and industrial engineering, was selected as the winner of the **2021 Data Analytics & Information Systems (DAIS) Data Analytics Teaching Award** from the DAIS division of the Institute of Industrial and Systems Engineers, which is a primer national society for industrial engineering. There is one winner annually.



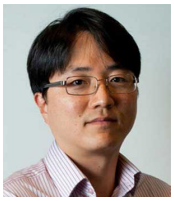
The Cold Spray Research Group received a **$999,464 grant from the National Institute of Standards and Technology (NIST)** to improve sensing approaches and create a suite of sensor technologies that will help optimize cold spray additive manufacturing. The mechanical and industrial engineering research team includes **Sinan Muftu**, professor and associate dean for faculty affairs; **Ozan Ozdemir**, assistant professor; and **Andrew Gouldstone**, professor and associate chair of experiential innovation.

Assistant Professor **Kayse Lee Maass**, mechanical and industrial engineering, in collaboration with Northeastern's College of Social Sciences and Humanities, is a co-principal investigator of a **$759K National Institute of Justice grant**, titled "Identification of Effective Strategies to Disrupt Recruitment of Victims in Human Trafficking: Qualitative Data, Systems Modeling, Survivors and Law Enforcement." Maass is also co-PI on a **$1 million National Science Foundation multi-university collaborative grant**, titled "Modeling Effective Network Disruptions for Human Trafficking."

Assistant Professor **Safa Jamali**, mechanical and industrial engineering, is leading a **$1.8 million DMREF (Designing Materials to Revolutionize and Engineer our Future) grant from the National Science Foundation** to create "Rheostructurally-Informed Neural Networks for Geopolymer Material Design." The award is in collaboration with the University of Delaware, Georgetown University, and the Air Force Research Laboratory. Geopolymers are inorganic and non-crystalline structural materials that can be obtained from natural soils via a chemical activation. They have great potential as additives to reduce cement consumption in construction and thus can help to reduce green-house gas emissions of cement manufacturing. They also promote the adoption of local soil resources for traditional and 3D printing-based construction. Important for human space exploration, geopolymers can be also formed from lunar and Martian soils with limited water, and thus are excellent candidates for space infrastructure such as landing pads and shelters. At present, however, processing of geopolymers into desirable structures remains far behind their laboratory scale performance due to the wide range of chemistries and characteristics of different indigenous geopolymers. The research combines experiments, microscopic simulations, and machine learning approaches to enable scientists and engineers to effectively design and control geopolymers properties and performances. In collaboration with the Air Force Research Laboratory, the team will educate and train future materials researchers with multi-tool skills that span experiments, simulations, and data-driven algorithms.


As part of a collaborative team of researchers from multiple institutions, Professor **Nian Sun**, electrical and computer engineering, and Professor **Hongwei Sun**, mechanical and industrial engineering, were awarded **$660K in pledged funding as one of five third place winners of The Trinity Challenge** (TTC), for their project Disease Surveillance with Multi-modal Sensor Network & Data Analytics, which is a wastewater surveillance system designed to operate in remote areas with little access to health services. It is a wireless sensor network, with patented sensor technologies, that detects pathogens in air and water up to one week before cases present in humans. TTC is a competition to invent the most effective methods by using data, analytics, and digital tools to ensure that health emergencies similar to the COVID-19 pandemic don't upend societies in the future. Dame Sally Davies, master of Trinity College, Cambridge, and former chief medical advisor to the United Kingdom, in September 2020, brought together Northeastern University, Microsoft, Google, the Bill & Melinda Gates Foundation, and other industry leaders to participate in the challenge.

Faculty Highlights



Guardion, co-founded by Professor **Yung Joon Jung**, mechanical and industrial engineering, was a **winner of the NASA Science Mission Directorate Entrepreneurs Challenge**. Guardion uses nanotechnology to create highly sensitive, low-cost, networked detectors of radioactivity and nuclear radiation. The radiation sensor is at least an order of magnitude more sensitive than currently available options. It's also smaller and less expensive to build. A network of the sensors can be deployed in cities where they act as guards, sensing radiation-generated ions to preventatively detect the early presence of specific radiation from nuclear or radiological terrorism. They may also be given to first responders who are responsible for isolating an effected area. Having a network of sensitive detectors would allow first responders to instantaneously and remotely map the perimeter, which could save lives. The NASA Entrepreneurs Challenge sought to identify individuals and promising commercial companies working on technology that will advance the state-of-the-art in three broadly defined technology focus areas: Physics-based transfer learning and artificial intelligence, Advanced mass spectrometry, and Quantum sensors.

Assistant Professor **Mohsen Moghaddam**, mechanical and industrial engineering, is leading a **$614K National Science Foundation grant** with Northeastern's D'Amore-McKim School of Business and College of Arts, Media and Design, and in collaboration with University of Michigan – Ann Arbor, for the project "From User Reviews to User-Centered Generative Design: Automated Methods for Augmented Designer Performance." He is also leading a **$2 million National Science Foundation grant** in collaboration with other colleges at Northeastern for "Fostering Learning and Adaptability of Future Manufacturing Workers with Intelligent Extended Reality (IXR)."

Assistant Professor **Hongli Zhu**, mechanical and industrial engineering, and her PhD students **turned a sugarcane byproduct into a sustainable, compostable, and inexpensive material** that's durable enough to serve as tableware, and that biodegrades within 60 days. The material is made of sugarcane pulp, known in the industry as bagasse, and bamboo fibers to add strength. Since bagasse and bamboo fibers are made up of similar underlying chemicals (cellulose, hemicellulose, and lignin), the material doesn't require any additional processing to separate different components during the recycling and reusing processes, unlike some currently available options. The result is a completely natural and biodegradable material that is sufficiently durable to be molded into containers strong enough to hold food and liquids. She believes this is a practical approach to tackle plastic pollution. It is low cost, sustainable, and can upgrade the byproducts in the sugar industry to valuable and sustainable products everyone needs daily. Her research was **published in the journal *Matter***.

Distinguished University and Cabot Professor **Laura Lewis**, chemical engineering, jointly appointed in mechanical and industrial engineering, in collaboration with the University of Warwick, UK, was awarded a **$900K National Science Foundation - EPSRC grant** for "Multi-Driver Furnace Processing of Magneto-Functional Materials." This U.S. – U.K. collaborative project investigates new ideas and approaches to streamline the manufacture of advanced magnetic materials, while also minimizing the use of critical elements. This work is funded under the NSF-EPSRC "Manufacturing the Future" theme and features the development of a bilateral cohort of under-represented minority students who have an interest in conducting research at the intersection of manufacturing, energy and environment.

Learn more about our accomplished faculty

Student Highlights

Paola Kefallinos, E'23, mechanical engineering, was recently awarded the **Department of Defense Science, Mathematics, and Research for Transformation (SMART)** Scholarship. This award provides students with full tuition for up to five years, summer internships, a stipend, and full-time employment with the Department of Defense after graduation.

Diego Rivera, E'21, mechanical engineering, received the **National Science Foundation Graduate Research Fellowship**. The NSFGRF program recognizes and supports outstanding graduate students who are pursuing full-time research-based master's and doctoral degrees in science, technology, engineering, and mathematics (STEM) or in STEM education.

Gabrielle Whittle, E'21, mechanical engineering, was a first-place winner in the Undergraduate Student Award category of Northeastern's Women Who Empower **2021 Innovator Awards for Entrepreneurship** for her company Phoenix Footwear, which is developing a transformable high heel shoe. Her idea began in her third co-op as part of the Department of Mechanical and Industrial Engineering's aftermarket co-op initiative advised by Professor **Andrew Gouldstone**. She is working to have shoes adjusted to be high heels or flats, and also to have alternative, weight shifting sole designs that might alleviate some of the pain associated with wearing high heels.

A research paper, titled, "Flexural Bending Resonance of Acoustically Levitated Glycerol Droplet" by **Zilong Fang**, PhD'22, mechanical engineering, and professors **Kai-Tak Wan** and **Mohammad Taslim**, mechanical and industrial engineering, was selected as the **Editor's Choice** and published in the journal of *Physics of Fluids*.

Tyler Gogal, E'21, mechanical engineering, received a **Fulbright U.S. student award** to pursue a master's degree in Iceland, a leader in technologies such as carbon sequestration, alternative energy, and water purification. This will propel his overall goal to combine mechanical and environmental engineering expertise to address climate change and create innovations to make the planet more sustainable. The Fulbright U.S. Student Program is America's premier international exchange fellowship, with a mission to promote mutual understanding between the people of the United States and the people of other countries.

The Northeastern University team has been selected as a **finalist in NASA's 2021 RASC-AL Competition**, which stands for Revolutionary Aerospace Systems Concepts-Academic Linkage. They presented to NASA and aerospace industry leaders their "Venusian Atmospheric and Land Exploration: a Human-Assisted Low-Latency Approach (VALHALLA)" project at the virtual event.

Alex Bender, E'20, industrial engineering, was named as a **finalist of the 2020 INFORMS Undergraduate Operations Research Prize** for his paper titled "Estimating Effectiveness of Identifying Human Trafficking Victims: An Application of Data Envelopment Analysis on the Nepal–India Border." The research was completed in collaboration with Assistant Professor **Kayse Lee Maass** and researchers from Worcester Polytechnic Institute, John Jay College of Criminal Justice, and Love Justice International.

Ramin Mohammadi, PhD'20

INDUSTRIAL ENGINEERING

Advised by Sagar Kamarthi, Professor of Mechanical and Industrial Engineering

Ramin Mohammadi's dissertation for his PhD in Industrial Engineering at Northeastern University was in applied artificial intelligence techniques to healthcare problems to maximize patients' quality of life, while minimizing the potential financial burden for healthcare organizations. He used natural language processing methods to understand clinical notes to predict complications for patients who had undergone surgery. He built predictive models and automated decision support tools to help healthcare providers identify at-risk patients. For example, he developed a neural network model that prescribes a weekly activity target for individuals using their Fitbit activity data. The model combined both physical activity and behavioral data to come up with personalized activity targets.

As part of the PhD program, Mohammadi worked as a data science intern at Partners Healthcare Connected for Health. He also developed a neural network model for combining data from multimodal sensors for machine learning at Philips Lighting (Signify). The company filed a patent for his work. Additionally, he worked as a deep learning engineer intern at Mitsubishi Electric Research Laboratories, where he developed a reinforcement learning model to improve the quality of HVAC systems.

Mohammadi presented his research at prestigious conferences and published seven journal papers. In addition, he actively contributed to several grant proposals. He received the 2020 Akira Yamamura Excellence in Research Award from the Department of Mechanical and Industrial Engineering (MIE) at Northeastern. He was also a finalist in the Boston Scientific Connected Patient Challenge III for his research on breast cancer.

In addition to being an active research, Mohammadi mentored fellow graduate students in their research. He also taught machine learning related topics as part of the Institute for Operations Research and the Management Sciences (INFORMS) workshop series and R programming as part of the Institute of Industrial and Systems Engineers (IISE) workshop series. Additionally, he built high-performance computing machines for Professor Sagar Karmarthi's research lab.

After receiving his PhD, Mohammadi joined Tausight as a machine learning engineer, where he leads a technical team focusing on data confidentiality, integrity, and the security of patients' protected health information. In addition, he is an MIE adjunct faculty member at Northeastern where he teaches graduate courses in machine learning and data visualization.

Qiyong Chen, PhD'20

MECHANICAL ENGINEERING

Advised by Sinan Müftü, Professor of Mechanical and Industrial Engineering

Qiyong Chen joined the Applied (Bio) Mechanics and Tribology Laboratory while pursuing his master's degree in the Department of Mechanical and Industrial Engineering at Northeastern University in 2014, and continued on to pursue his PhD after obtaining his MS in 2015.

Chen worked on two separate projects for his MS and PhD degrees. His MS thesis revolved around a medical procedure called radiofrequency (RF) ablation of hepatic tumors. In an effort to optimize pre-treatment planning, he integrated analytical solutions of the physical model and quadratic and nonlinear programing algorithms. With the same enthusiasm for mathematics and science, Chen shifted his research focus to the mechanics and material behavior of micron-scale metal particles in cold spray impacts during his PhD program. By leveraging finite element (FEM) simulations, the research work investigated various material responses such as adiabatic shear instability during supersonic impacts of Aluminum particles, which would otherwise be extremely difficult to observe and record with experimental measurements due to the ultra-high strain rates and extremely-short scale of the events. He also demonstrated an innovative approach to incorporate simulation results with artificial intelligence to drastically reduce the computational load of predicting particle impact results. Chen has published a total of six manuscripts, three as first author with several more in drafting and submission.

During his PhD program, Chen also completed an internship at Abaqus, the maker of a renowned finite element software company owned by Dassault Systèmes Simulia Corporation, and was ultimately recruited as a full-time employee after graduating. He is now applying his expertise in mechanics and simulation in the field of manufacturing and materials while working with colleagues and clients around the globe.

LVX
VERITAS
VIRTVS

Northeastern
College of Engineering

With over 195 tenured/tenure-track faculty, 17 multidisciplinary research centers and institutes, and funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research, with a focus 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 experience-powered lifelong learning. Our world-renowned experiential approach empowers our students, faculty, alumni, and partners to create impact far beyond the confines of discipline, degree, and campus.

Our locations—in Boston; the Massachusetts communities of Burlington and Nahant; Charlotte, North Carolina; London; Portland, Maine; San Francisco; Seattle; Silicon Valley; Toronto; and Vancouver—are nodes in our growing global university system. Through this network, we expand opportunities for flexible, student-centered learning and collaborative, solutions-focused research.

Northeastern's comprehensive array of undergraduate and graduate programs—in on-campus, online, and hybrid formats—lead to degrees through the doctorate in nine colleges and schools. Among these, we offer more than 140 multidisciplinary majors and degrees designed to prepare students for purposeful lives and careers.

DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING

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COVER IMAGE

Hongli Zhu, assistant professor of mechanical and industrial engineering, works in her lab on a bio-inspired ion-selective membrane using wood-derived nanofibers for flow batteries for large scale grid storage.