SUSTAINABLE, RESILIENT, and EQUITABLE STRUCTURES

A VISION FOR
ENGINEERING EDUCATION AND RESEARCH IN AN ERA OF GLOBAL OPPORTUNITY

Northeastern University
Civil and Environmental Engineering


It has
to be
us.

Message from the Chair

Northeastern University
Civil and Environmental Engineering

Vision

Creating sustainable and resilient urban environments for the world.

Mission

Advancing innovative civil and environmental solutions for society and creating globally-oriented engineering leaders by integrating experiential education and use-inspired interdisciplinary research.

It has to be us.

As civil and environmental engineers, those are the words we must live by in the face of grand societal challenges. For issues as diverse as decarbonization, urbanization, economic prosperity, homeland security, and public health, we stewards of the built and natural environment hold all the levers for change.

Structural engineering is a critical component of that change.

In keeping with our department mission, this document lays out our faculty's vision for structural engineering education and research in an era of global opportunity, and explores the work of our students and professors towards achieving that future.

We hope you will join us!

Jerome F. Hajjar, PhD, PE, NAE
CDM Smith Professor and Chair
Department of Civil and Environmental Engineering
Northeastern University
President, Structural Engineering Institute

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SUSTAINABLE, RESILIENT, and EQUITABLE STRUCTURES

ENGINEERING EDUCATION AND RESEARCH IN AN ERA OF GLOBAL OPPORTUNITY

At Northeastern University, we are passionate about transforming the structural engineering profession to meet the needs of today and tomorrow.

Structural engineers create innovative designs for a wide range of structures while ensuring life safety, economy, and beauty.

Our vision for the profession maintains the importance of these objectives while elevating three additional premier design objectives:

Sustainability, Resilience, and Equity.

Vision for the Profession

Sustainability, Resilience, and Equity Through Structural Engineering

As structural engineers, we design and create the world's structures, from the most majestic, to the core fabric of our communities. We innovate to create new types of structures to contribute to solutions of critical societal problems such as climate change and inequality. Combining physics, mechanics, materials science, mathematics, computer simulation, experimental methods, architecture, policy, and a wide range of engineering skills, we develop structural solutions to address the use of novel materials and to develop new sustainable and resilient design and construction strategies. In the modern economy, structural engineers are incorporating an increasing level of automation through the development of advanced sensors, data analytics, and robotics for construction, control, and structural health monitoring.

Our vision for the profession maintains the importance of life safety and efficient design while elevating three additional premier design objectives: sustainability, resilience, and equity.

Structures are critical to building a more sustainable, resilient, and equitable society. The construction and operation of the built environment contributes heavily to natural resource consumption and carbon emissions. Structures are the homes, offices, stores, utility infrastructure, roads, and bridges that are the foundation of our economy. They serve a vast multitude of purposes. They are inspiring symbols of beauty, form, and function. They are also robust assets, required to be hardened against natural and man-made disasters. Structural engineering education has traditionally focused primarily on safety, cost control, and function, but global challenges have opened an exciting avenue of study in this critical profession. Northeastern's curriculum respects this tradition, while openly embracing the future.

Sustainability

in Structural Engineering

We envision sustainability in structural engineering as achieving net zero embodied carbon while reducing greenhouse gas emissions, material use, pollution, and waste.

Our curriculum provides the next generation of structural engineers with the tools to incorporate the principles of sustainability into structural engineering.

This involves reimagining traditional building materials through novel engineering techniques; our students design high rises out of timber, study the importance of adaptive reuse of existing infrastructure, and explore ways to design buildings to be disassembled and their materials reused in new structures.

Our department takes an interdisciplinary approach to structural engineering, such as incorporating environmental engineering strategies for life-cycle assessment into structural design.

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Building a Carbon Negative Future with Steel and Cross Laminated Timber

Through a $3.1M grant from the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E), Northeastern Department of Civil and Environmental Engineering Chair and CDM Smith Professor Jerome Hajjar is leading a multi-institution team of researchers developing a new carbon sequestration technique using cross-laminated timber composite floor systems in bolted steel construction for building structures. The new structural method aims to decrease the use of steel while increasing the use of carbon-storing timber and design for deconstruction methods. The team envisions the research may enable widespread construction of carbon-negative multi-story buildings in the coming years.

The construction industry represents a major piece of the climate puzzle. Emissions from the mining, fabrication, and transportation of construction materials such as concrete, timber, and steel greatly contribute to society's annual carbon output. "There's huge, untapped potential in reimagining building materials and construction techniques as carbon sinks that support a cleaner atmosphere," said U.S. Secretary of Energy Jennifer M. Granholm in a press release from ARPA-E announcing the grant. "This is a unique opportunity for researchers to advance clean energy materials to tackle one of the hardest to decarbonize sectors that is responsible for roughly 10% of total annual emissions in the United States."

The new research builds on promising technology: cross-laminated timber (CLT). The research team estimates that traditional building materials contribute nearly half of a high-rise commercial building's embodied carbon emissions. Cross laminated timber can be partially substituted for some of these materials. Timber's origin as a photosynthetic lifeform means it serves as a "carbon sink," and CLT diaphragms can store about 50% of their weight in carbon until it decomposes or is otherwise destroyed. "We are exploring how timber may be incorporated into our design thinking in a way that complements other

emerging sustainable practices such as steel recycling and renewable energy-powered forging," says Hajjar.

The team will work to further understand the structural properties of CLT and develop new solutions for improving the design of CLT within steel building structures to move past traditional structural limitations of timber.
To achieve their carbon reduction and CLT design improvement goals, the team will utilize another innovative method Hajjar helped pioneer. Design for Deconstruction (DfD) is a method of steel framework design allowing deconstruction of the building at the end of its lifecycle in a manner that preserves the steel components for reuse. In this grant, the team will study combining DfD steel and CLT to create a new framework for buildings designed with greener, more reusable materials.

The grant team will include industry partners, colleagues from fellow academic institutions and Northeastern faculty, include Hajjar, Assistant Professor Michael Kane, Associate Professor Matthew Eckelman, Associate Professor Michelle Laboy, and Roux Institute Director of Engineering Research Professor Jack Lesko, and Research Associate Professor Nathan Post from the Roux Institute.

Eckelman, an expert in lifecycle assessment of materials and processes, will model how the new method of DfD + CLT will differ from current methods in their carbon emissions. Michael Kane, a structural engineer with expertise in automation, artificial intelligence, and building energy systems, will design AI methods that will inform the researchers about the differences in the mechanical properties of local timber feedstocks, further improving their understanding of the structural performance of the CLT diaphragms. The ability to source timber locally will further decrease a build's carbon emissions by limiting the material transport distance.

We believe that by combining Design for Deconstruction and Cross Laminated Timber, baseline emissions can be reduced by up to 70%

Laboy will research the design and modeling of whole buildings, including structural patterns and enclosure systems, that will be used by the Life Cycle Assessment experts, while Jack Lesko and Nathan Post will be supporting the development of the design standards for reclaimed structures based on service life reductions in properties and performance. "We believe that by combining Design for Deconstruction and Cross Laminated Timber, baseline emissions can be reduced by up to 70%, and the reusable nature of the building materials will mean the biogenic carbon potentially stays locked in for long enough to qualify as carbon negative," said Hajjar.

Resilience

in Structural Engineering

We envision resilience in structural engineering as designing built infrastructure to perform safely during a wide range of existing and emerging natural and manmade threats, and then rapidly return to full operation.

From earthquakes and hurricanes to terror attacks, structures must withstand a multitude of extreme conditions.

Our research and teaching about resilience imagines going beyond survivability into viability beyond the event, creating infrastructure that not only withstands collapse under extreme loads, but remains structurally sound without need of demolition following disaster.

These issues grow increasingly pressing as climate change necessitates that future structures withstand more extreme and compounding forces.

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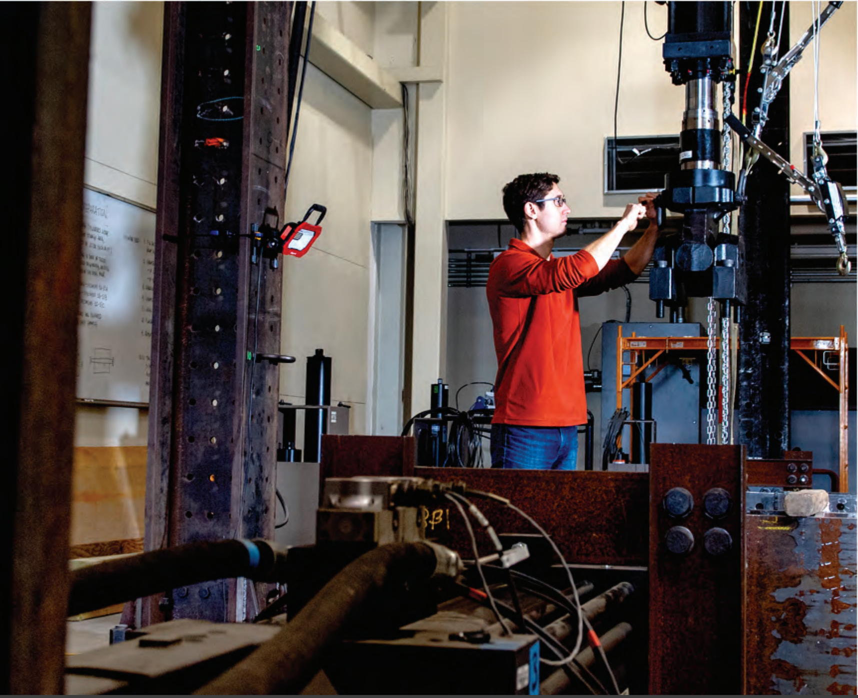
Resilience in Structural Engineering Dive Deeper



Wind and Waves: Making the US a Clean Energy Superpower

The eastern seaboard of the United States is a vast trove of untapped clean energy. In fact, there is enough wind energy potential of the East Coast to power the entire nation. At Northeastern, our faculty are advancing research on multiple fronts to help communities harness this renewable, clean resource.

Professor Andy Myers is an expert in offshore wind engineering, and through multiple grants, is exploring various structural design innovations with the goal of making the US an Offshore Wind Superpower. Through his research, he is developing a floating turbine platform that will self rotate to face whichever direction the wind is blowing. One advantage of this system would be a turbine that is smaller and easier to transport between manufacturing point and installation site. Currently, many turbines must be brought in from European manufacturers via boat.

Alongside research from Professor Hajjar, Myers and students are also exploring new welding techniques to improve structural stability and decrease materials use. The East Coast faces a unique challenge: frequent hurricanes.

Buildings in earthquake zones benefit from established structural guidelines for weathering seismic forces. Such guidelines do not currently exist for offshore wind turbines. Our faculty and PhD students are exploring what such guidelines could look like. As the US becomes more reliant on offshore wind, designing turbines that are resilient in the face of extreme wind loads will be critical.

Northeastern Faculty Leads Industry Initiative in New Department of Energy Offshore Wind Center of Excellence

The United States Department of Energy (DoE) announced the establishment of a new national center of excellence to accelerate the country's offshore wind industry. The center, the first of its kind on offshore wind, will be known as the ***Academic Center for Reliability and Resilience of Offshore Wind (ARROW)****. The $11.9M investment will be led by the University of Massachusetts Amherst and include a 40+ partner consortium of government, industry, and academic partners, including Northeastern University. The center was created to "accelerate reliable and equitable offshore wind energy deployment across the nation," and will accomplish these goals through three main programs. ARROW-Empower is aimed at educating over 1,000 postsecondary students on the offshore wind field. ARROW-Innovate will focus on the interdisciplinary technical research needed to grow the industry. Finally, ARROW-Engage will focus on ensuring community input, equitable distribution of benefits, and the growth of the industry's workforce.*

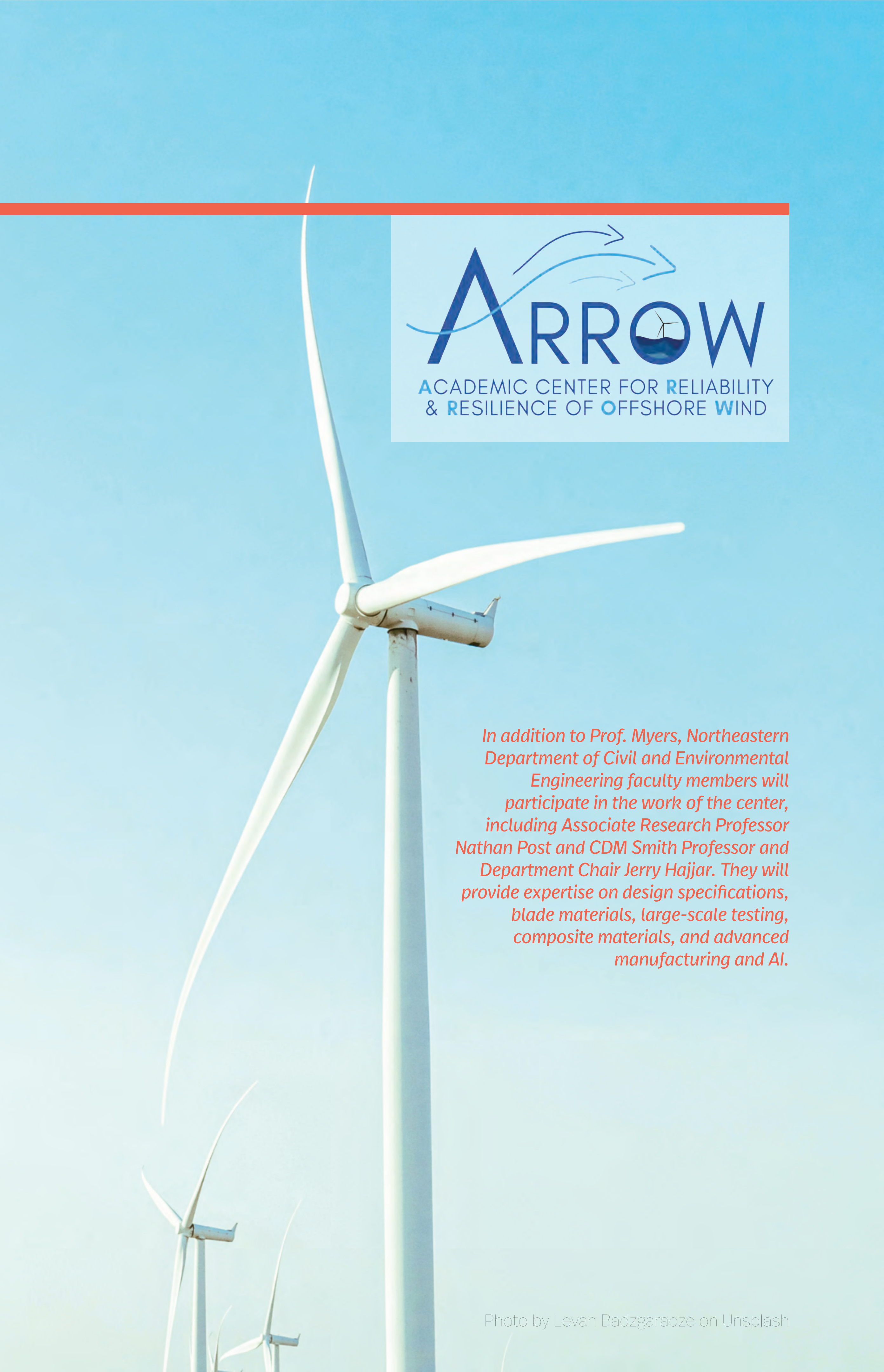
A Mighty Domestic Industry in the Making

The nascent US offshore wind industry has great potential, a bright future, and a lot of catching up to do, says Professor Andy Myers, the lead faculty member of Northeastern's portion of the project. "The US has set an ambitious 30GW goal of installed offshore wind capacity by 2030. There is a huge variety of technical expertise even within engineering and the sciences needed to succeed here; this industry is coming and there is a need for a professional workforce that understands the interdisciplinarity of the engineering, atmospheric science, policy, and community engagement challenges." The center aims to push growth in all these dimensions. "I'm really excited about how I saw this established in Europe during my sabbatical at Danish Technical University. They had all aspects of the wind energy industry within one department, which we don't have within the US, but this center is a step in the right direction." With committed federal and state support and enough potential wind energy available off the East Coast to meet the energy needs of the entire nation, offshore wind is a mighty domestic industry in the making.

Myers has focused much of his career on helping the US jumpstart offshore wind. In addition to his academic research, he has developed a national research agenda for offshore wind energy infrastructure with the Massachusetts Clean Energy Center, led and hosted conferences and workshops on the topic, such as Offshore Wind Tech Week in 2022 and the International Offshore Wind Technical Conference in 2023. He has worked closely with industry on a number of projects, including supporting the design and large-scale testing of a project recently named to Time Magazine's Best Inventions of 2023 list.

Academia-Industry Partnership

In his role as Industry Exchange Program Lead, Myers will leverage his expertise in structural engineering of offshore structures and experience working with the industry. "We focus heavily on industry partnership here at Northeastern," said Myers, pointing to the university's co-op program and use-inspired research focus. "Often in academia we are siloed into our specific areas of study, but the industry must pull together all these fields, from structural and mechanical engineering to policy, logistics, and atmospheric sciences, to be successful. I look forward to helping coordinate that as part of ARROW's mission." Myers will also serve as the Lead of the Infrastructure Thrust within the Innovate Initiative. "We are taking a full-cycle view of infrastructure: manufacturing, installation, operation, decommissioning. My specific research focuses on making sure the turbine support structures and foundations are reliable and resilient to stressors."



ARROW

ACADEMIC CENTER FOR RELIABILITY & RESILIENCE OF OFFSHORE WIND

In addition to Prof. Myers, Northeastern Department of Civil and Environmental Engineering faculty members will participate in the work of the center, including Associate Research Professor Nathan Post and CDM Smith Professor and Department Chair Jerry Hajjar. They will provide expertise on design specifications, blade materials, large-scale testing, composite materials, and advanced manufacturing and AI.

Photo by Levan Badzgaradze on Unsplash

Equity
in Structural Engineering

Civil and environmental engineers design at the interface between the human and natural environment. We are conscious of how our decisions affect the trajectory of communities; setting them on course for their unique economic, environmental, and demographic realities for decades, even centuries, to come.

We evaluate everything we do for how our work affects the lives of people. As structural engineers, this means thinking about our projects within the context of the community for whom the project is built, calculating consequences beyond our clients, and understanding the perspectives of diverse stakeholders.

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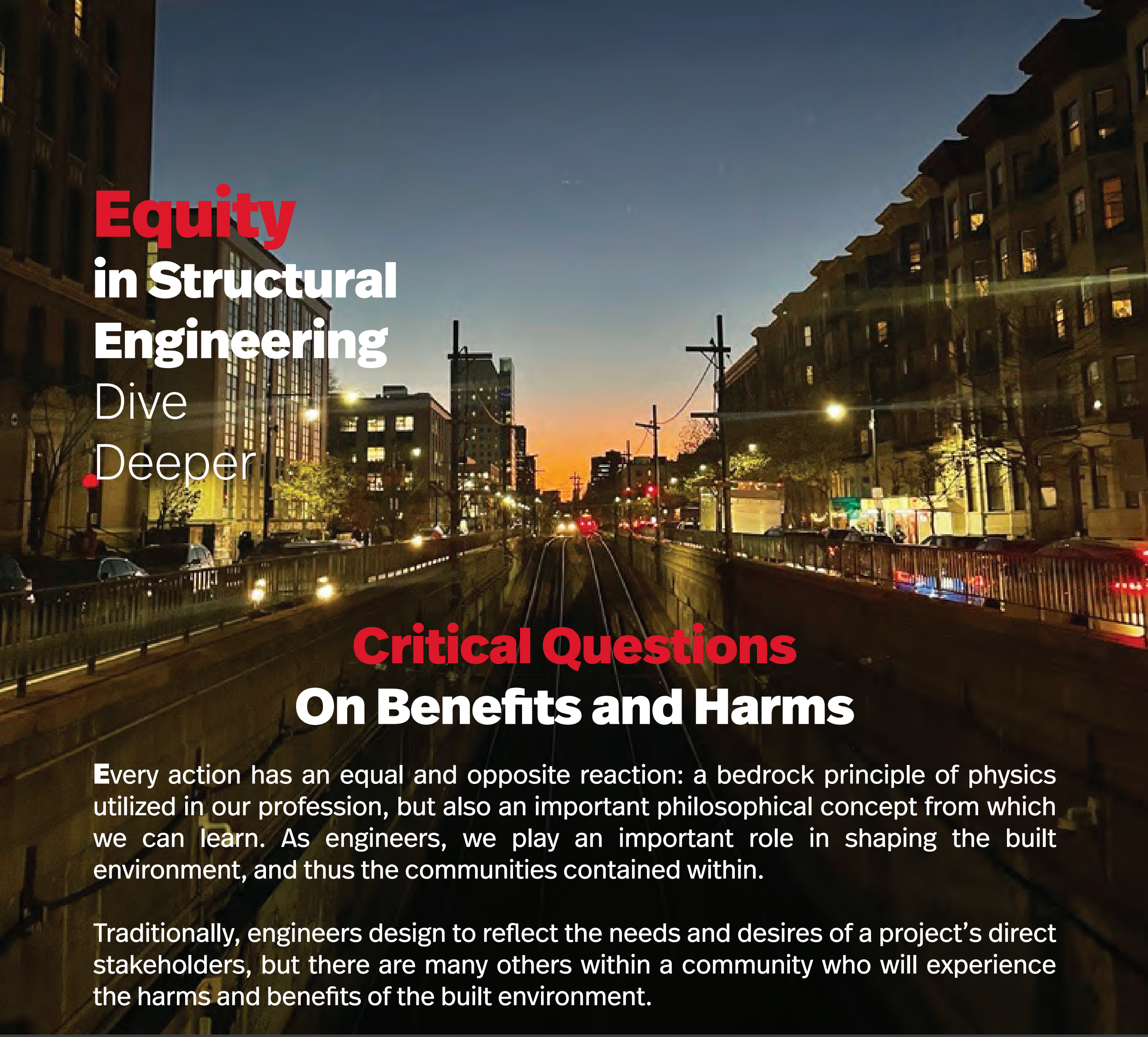


Equity in Structural Engineering

Dive Deeper

Critical Questions
On Benefits and Harms

Every action has an equal and opposite reaction: a bedrock principle of physics utilized in our profession, but also an important philosophical concept from which we can learn. As engineers, we play an important role in shaping the built environment, and thus the communities contained within.

Traditionally, engineers design to reflect the needs and desires of a project's direct stakeholders, but there are many others within a community who will experience the harms and benefits of the built environment.

Oftentimes, benefits and adverse impacts are not equitably or justly distributed. When they aren't, how is that distribution decided?

Who gets to decide? Which communities get highway connections and which get the traffic noise and pollution? Are our structural prototypes designed with commercial use preeminent, or are residential and community applications considered? Who gets the benefits of the built environment and who gets the harms?

This issue, and its historical implications, are front of mind as we train the next generation of engineers. Our curriculum blends critical questions of environmental and social justice with new ways of approaching the structural engineering industry.

Offshore Wind Tech Week

As part of ongoing efforts to bolster US dominance in this space, Northeastern's structures faculty envisioned a new, combined event featuring the industry's premier conferences and workshops on offshore wind.

Offshore Wind Tech Week is the unique combination of two multi-day events, the NOWRDC Symposium and IOWTC 2022. The National Offshore Wind Research & Development Consortium (NOWRDC), a non-profit that funds US offshore wind R&D activities, kicked off the week with a keynote speech from former US Rep. Joe Kennedy III. The week continued with the 4th International Offshore Wind Technical Conference (IOWTC 2022) from the American Society of Mechanical Engineers (ASME) with Prof. Myers serving as technical chair. The conference brought together international experts in academia, government, and industry for sessions on engineering, design, and project development.

"These events are critical to advancing offshore wind power, given both the ambitious installation goals set by governments and the engineering innovations needed to meet them," said Myers. "Interdisciplinary research in engineering and manufacturing, as well as developments in transmission and supply-chain logistics are needed to harness the enormous potential for renewable energy just offshore."

Ambitious Goals and Exciting Challenges

Myers and Hajjar have long advocated for the expansion of offshore wind on the East Coast, which has the potential capacity to power the entire US. “We need a large amount of research to achieve government goals of 30GW by 2030,” said Hajjar, explaining that this would constitute an increase over the current installed capacity by several orders. “Geography is critical here – how deep is the ocean at the installation site? Is it conducive to fixed-bottom turbines or are floating turbines necessary? The East Coast sees frequent hurricanes, and their powerful winds are a potential threat to the structural integrity of turbine towers.” Hajjar, whose research also covers earthquake engineering, has highlighted the need for expanded hurricane design guidelines for turbines similar to what has been developed over the past few decades for buildings in seismic zones.

“The Pacific states face their own challenges,” Myers pointed out, “Considering the ocean depth of the West Coast, floating turbines will be necessary. We need more research into the development of floating platforms that are cost-effective and buildable at the rates we need.” Floating platforms represent a fraction of installed capacity compared to fixed-bottom turbines. According to a White House press release, just 0.1 GW of floating turbines are installed worldwide, compared to 50 GW of fixed-bottom offshore wind. “There’s a lot of exciting puzzles to solve,” said Myers, whose PhD student Raditya Danu Riyanto presented at IOWTC on their research into a novel floating turbine which can reorient itself to the wind direction. “We will need to resolve not just structural engineering problems, but logistical and supply chain issues, such as how to deliver and install the massive components of turbine towers from the manufacturer to the point of deployment, and how to transmit the power back to homes and businesses.” “The offshore wind ecosystem is really critical right now, and Massachusetts is a leader in this space,” Hajjar said. “The Department of Civil and Environmental Engineering is committed to playing our part in this important and historic moment through research and academics in the field of structural sustainability.”

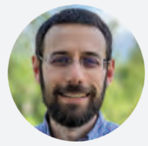
Meet Our Faculty

Our structures faculty have a wide range of expertise in the field of structural engineering and are supported in their teaching and research mission by an interdisciplinary mix of professors from within the department and beyond.

Structures Faculty

DIONISIO P. BERNAL
Professor

System identification; fault detection and fault localization; earthquake engineering; soil structure interaction; structural stability



NATHAN POST
Associate Research Professor

Climate resilience; composite materials, advanced manufacturing, uncertainty analysis and applied AI; wind engineering

LUCA CARACOGLIA
Professor

Structural dynamics; wind engineering; wind-induced vibration; fluid-structure interaction; linear and nonlinear cable dynamics; climate change

MEHRDAD SASANI
Professor

Progressive collapse of structures; earthquake engineering; structural integrity and reliability; building and community resilience

JEROME F. HAJJAR
CDM Smith Professor and Chair

Steel and composite steel/concrete structures; earthquake engineering; structural stability; large-scale testing; regional simulation

ELEONORA TRONCI
Assistant Professor

Wind engineering; applied machine learning and sensor techniques for structural health monitoring; coastal structural systems

MICHAEL KANE
Assistant Professor

Occupant-centric building controls; community resilience; model predictive control; hybrid systems

NANCY VARNEY
Associate Teaching Professor

Timber in structural systems; structural engineering design, sustainable and resilient engineering practices

JACK LESKO
Professor

Emerging interdisciplinary design using lightweight polymeric multifunctional materials; structural design and reliability; energy systems

SARA WADIA-FASCETTI
Professor

Condition assessment methodologies for infrastructure systems; life cycle analysis; structural and earthquake engineering uncertainty

ANDREW T. MYERS
Professor

Fixed and floating offshore wind structures; multi-scale experimental testing; computational simulation; probabilistic modeling

MING L. WANG
COE Distinguished Professor

Sensor technology for infrastructure; structural health monitoring for bridges; subsurface fault detection using air-coupled GPR systems

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Cross-disciplinary Faculty

These faculty, a mix of professors who enjoy their home in our department or as joint/affiliated appointments, provide vital expertise in various engineering, policy, and science fields needed to deliver a structures program with a focus on resilience, equity, and sustainability.

MATTHEW J. ECKELMAN
Associate Professor

Environmental engineering and sustainability; life cycle assessment; energy efficiency and emissions modeling; material and energy use in urban buildings and infrastructure

DAVID FANNON
Associate Professor

Sustainable and high performance building design; persistent architecture and resilience; human health, safety, and comfort in the built environment

STEPHEN FLYNN
Political Science

Critical infrastructure resilience; public policy; post-disaster infrastructure assessment; national security policy; societal resilience

MICHELLE LABOY
School of Architecture

Building and site systems integration; structures and landscape performance; building and urban resilience; green infrastructure; socio-ecological factors in design

ALI TOURAN
Professor

Risk assessment; construction cost/schedule uncertainty; project delivery systems; simulation; construction productivity

Select Areas of Faculty Expertise

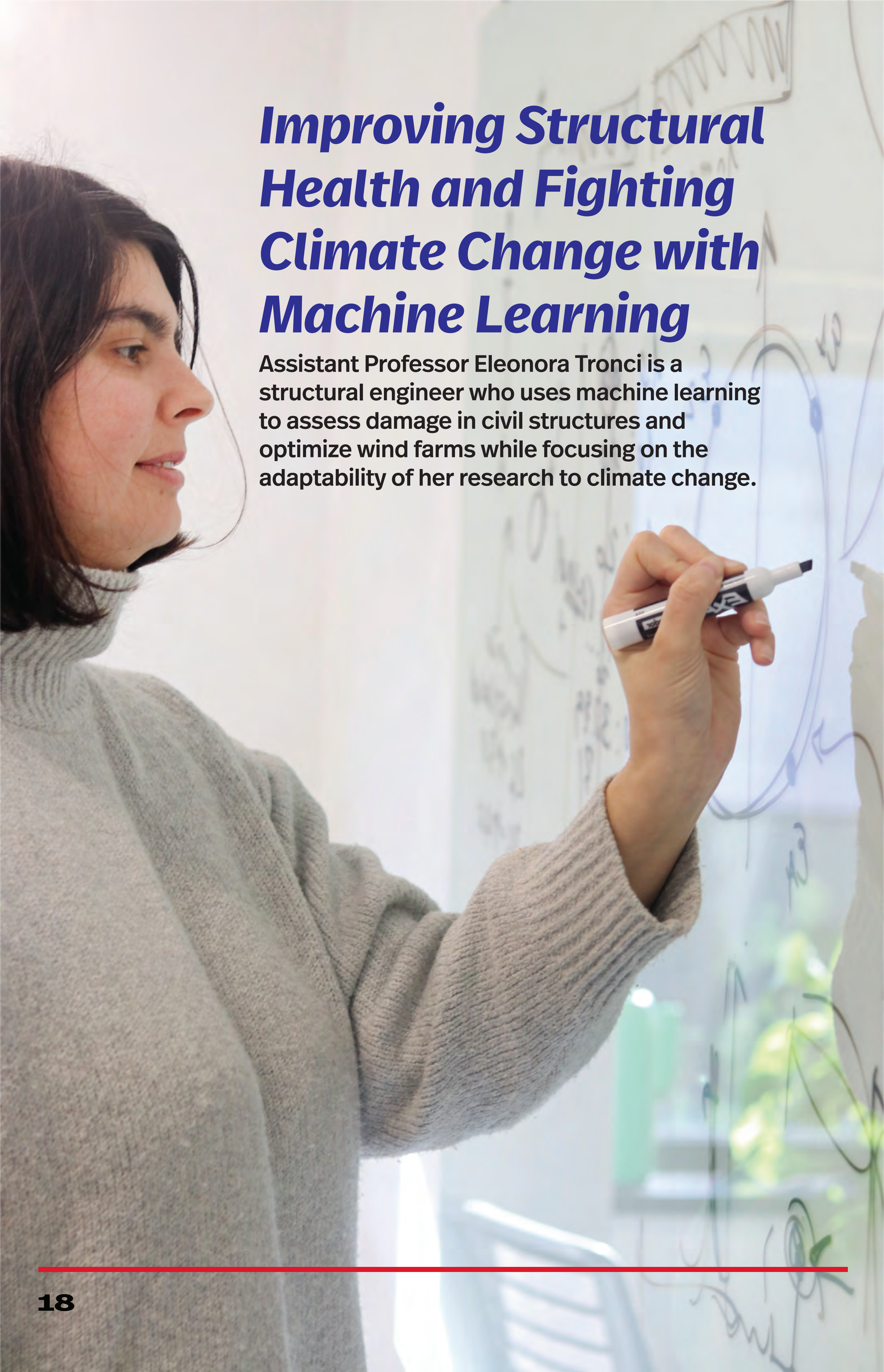
- Automation and controls
- Design of novel and sustainable infrastructure systems
- Dynamic and nonlinear infrastructure simulation
- Enhancing structural design and analysis with AI and ML tools
- Integration of structural systems and architectural design
- Large-scale structural testing
- Lifecycle assessment
- Natural hazard characterization
- Offshore and onshore wind energy structures
- Wind engineering
- Operational and embodied carbon analysis
- Progressive collapse
- Sensor development
- Steel and concrete integration
- Structural health monitoring

..and more

Northeastern University
Civil and Environmental Engineering

Improving Structural Health and Fighting Climate Change with Machine Learning

Assistant Professor Eleonora Tronci is a structural engineer who uses machine learning to assess damage in civil structures and optimize wind farms while focusing on the adaptability of her research to climate change.



With a focus on structural health monitoring, Tronci's educational background includes a PhD in Civil Engineering from Columbia University and a PhD in Structural Engineering from Sapienza University. Her research interests include applied machine learning for damage assessment in civil structures, multi-domain transfer learning and performance and structural assessment of offshore wind structures.

Prof. Tronci said that she has "always preferred the applied side of engineering." She is interested in managing existing structures and their structural condition, exploring how these findings could help design more resilient infrastructure and structural systems in the future.

Within multi-domain transfer learning, Tronci leverages intersectional knowledge to structural engineering. For example, she has studied the similarities in the characteristics of human voice recordings and the response of structural systems, investigating how this similarity can be leveraged to determine if a structure is damaged when monitoring data is lacking.

"Our voice has a specific frequency content based on vocal tract shape," she said. "When damage occurs in a structure, the frequency changes, like when your voice changes when you have a cold... The voice of a structure is in its vibration response."

Tronci praised the value of leveraging intersectional knowledge to a problem from a subject you might never have thought would apply.

Tronci is also interested in offshore wind, particularly how the information gathered by a wind farm can be optimized. She shared how just one wind turbine in a farm can be instrumented and leveraged to provide data about the whole farm, which minimizes costs for projects.

Moving forward, Tronci would like to focus on the adaptability of her research to climate change.

As the climate changes, environmental variables accounted for in structural design will also change, inevitably affecting the response and durability of infrastructure systems, lowering the usefulness of historical data. Additionally, changes in the wind dynamics will affect the wind farms power production and their remaining life.

"Years and years of data will be modified by climate change," she said.

Tronci thinks that students "bring a fresh point of view." She is part of the University's UPLIFT program for undergraduate researchers, and is always looking to work with new people interested in similar areas. She can also facilitate students wanting to study abroad who are interested in these same topics.

"My door is open," she said.

Graduate Degrees *of* Study

Structural Engineering, Data & Systems, and an Innovative Curriculum

Our structures faculty are designing a unique curriculum to match their ambitious and critical research initiatives. Anchored by rigorous instruction in bedrock practices of structural, architectural, mechanical, wind, earthquake, and geotechnical engineering, our curriculum also incorporates new and emerging AI/ML techniques, big data, sustainability practices, and sensing technology for structural applications.

Through a flexible curriculum, structures students may incorporate courses from our unique MS Sustainable Building Systems degree program to bolster their understanding of energy and material usage in the built environment.

MS Level - *may be completed in as little as two semesters when pursued full-time.*

- MS Civil Engineering, *Structures Concentration*
- MS Sustainable Building Systems

Doctoral Study

- PhD in Civil and Environmental Engineering, *Structures Concentration*
- PhD in Interdisciplinary Engineering

Degree Highlight

MS in **Sustainable Building Systems**

Integrating elements of architectural engineering and construction management while embracing the concepts of engineering sustainability related to energy and materials and their effects on the environment and health, this interdisciplinary program is jointly offered with the School of Architecture.

Our MS in Sustainable Building Systems teaches the design, construction, and operation of buildings to provide a comfortable, healthy, and productive environment while minimizing energy and environmental impact. Students develop leadership and decision-making skills to implement sustainable building practices in either the private or public sectors in the global market.

Upon graduation, students will have a theoretical background to the concepts behind the LEED (Leadership in Energy and Environmental Design) Green Associate examination.

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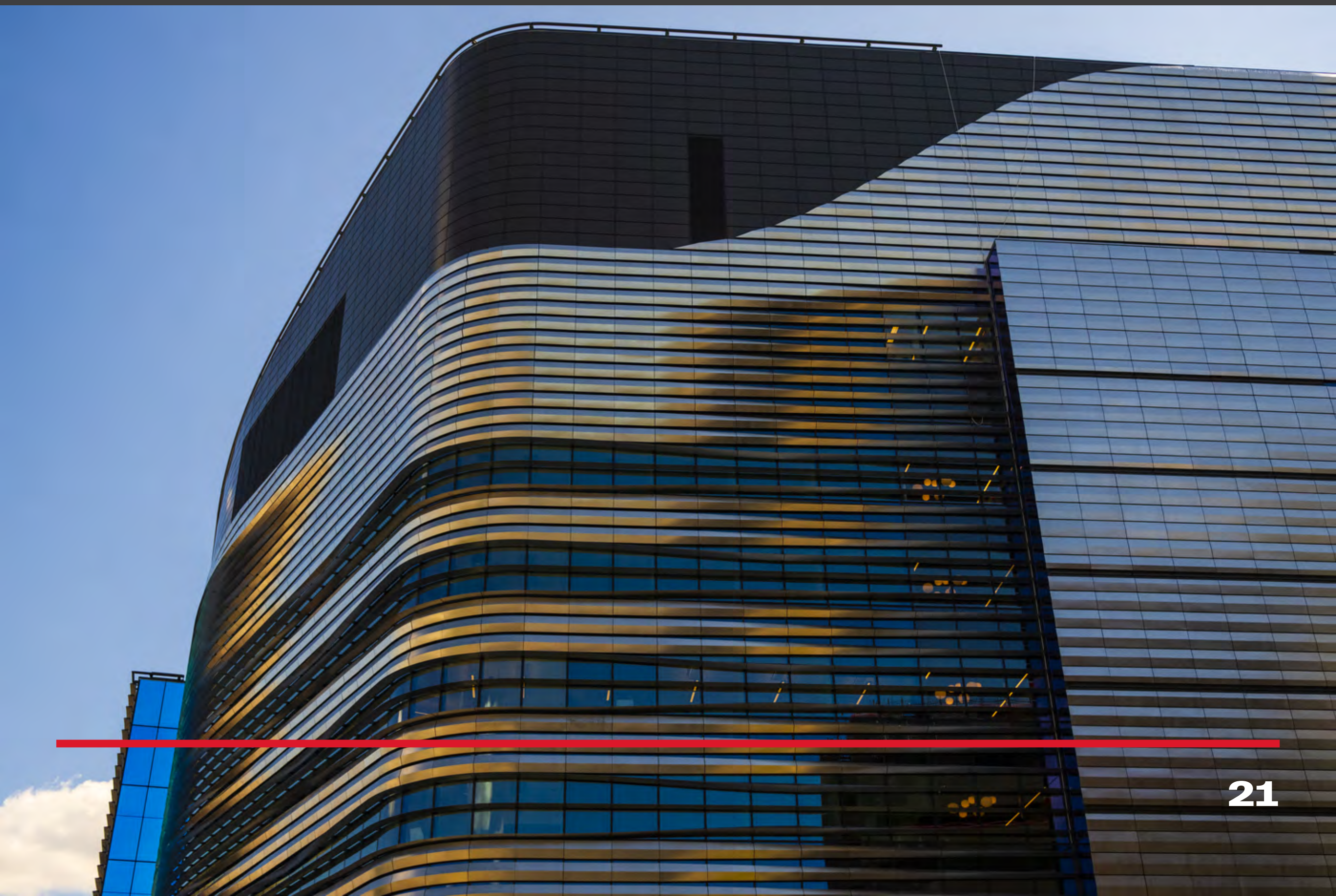


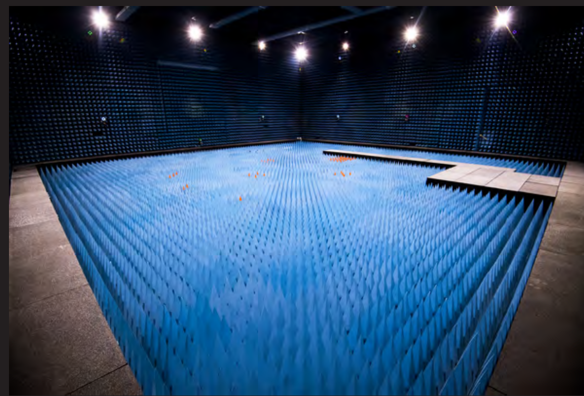
THE STReSS LAB

Our research, both computational and experimental, is supported by Northeastern's state-of-the-art laboratory for **Structural Testing of Resilient and Sustainable Systems (STReSS Lab)**, which enables experimental characterization of large-scale structural systems and components.

Located on our Burlington, MA campus just north of Boston, the STReSS Lab is one of the most powerful facilities of its kind in the country. The 2,000 square-foot, reinforced concrete strong floor includes a grid of 416 tie-down anchors, each capable of withstanding 200,000 pounds of force.

Our Burlington campus is also home to both an indoor and outdoor drone cage, utilizable for autonomous robotic sensing.

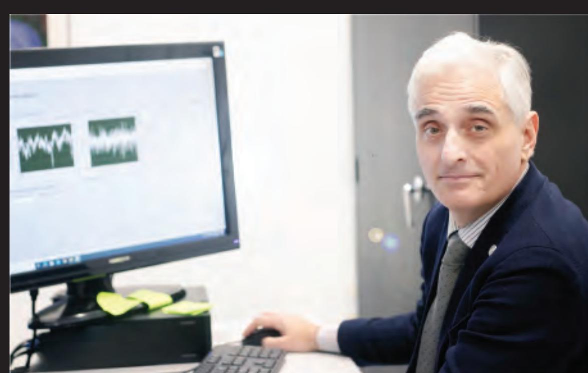
FACILITIES



Above: The Burlington Campus' outdoor and indoor drone cages utilizable for post-disaster infrastructure monitoring research.

Left: A student observes the bending of a piece of steel using one of a number materials testing equipment available in the Soil and Materials Teaching Laboratory.

Right: Professor Luca Caracoglia, an expert in structural dynamics and wind engineering, reviews the results of his recent test using the Boston Campus' wind tunnel system.



Left: One of the department's earthquake shaketables in between tests. This shaketable is located in our Infrastructure Engineering Lab, part of our newly renovated Innovation Studio.

Structures Students

Engineering Education in Action

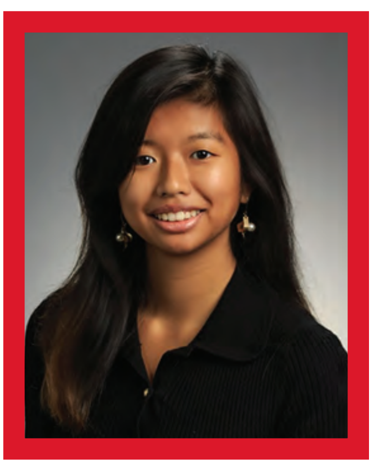
In this section you will find highlighted stories of a handful of structures students who have been through our program.

Nicholas Briggs, PhD program

Nicholas Briggs' research focus is highly experimental. Working from the STReSS Lab, he conducted full-scale testing of concrete-filled steel deck diaphragms to reveal their structural properties. His research was part of Prof. Hajjar's efforts to design new structural systems that reduce the use of construction materials, producing lighter, more sustainable, and cost-effective structures.

Yiming Jia, PhD program

Yiming Jia has been studying community resilience against natural hazards including flood, wind and earthquake hazards, using both probabilistic and machine-learning based models. For wind and flood hazards, he has developed models that would account for their compounding effects. Jia has also worked on accounting for and modeling non-stationarity of flood hazards. Furthermore, he's developing a machine-learning based project to estimate building damage in communities due to flooding.



Carrie Tam, BS and MS program

Tam pursued both her BS and MS at Northeastern, where she founded the university's chapter of Solar Decathlon, leading a 30-student effort to compete in the Department of Energy's student competition to design a highly sustainable affordable housing complex. She took advantage of our focus on experiential education, where she sought out a position as a research assistant in Dr. Hajjar's lab, studying ways to build more resilient structural systems.

Myra Forester, PhD program

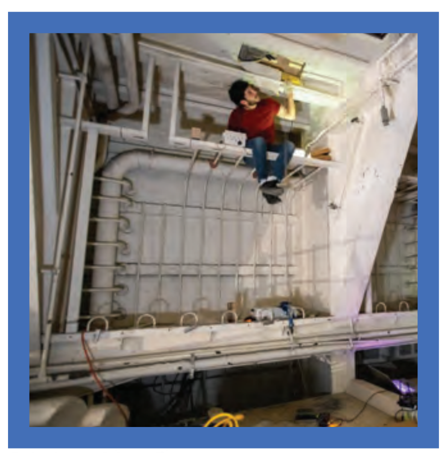
Earthquakes are a major hazard structural engineers must consider when designing in many parts of the world. Forester is creating machine-learning based models to estimate correlated ground motion severities at different sites. She is also developing automated processes for designing reinforced concrete structures that will be used to evaluate community resilience.

Baiyu Chen, BS, MS, and PhD program
A Triple Husky, Baiyu Chen has extensive experience working in the lab throughout her college career. When she arrived at Northeastern, she chose to study civil engineering due to a fascination with the use of timber in designing high-rise structures. Since her undergraduate days, she has worked in the lab studying cross-laminated timber, investigating with her advisor novel ways to integrate the material into steel diaphragms. The research has the potential to reduce carbon-intensive materials use and make buildings more sustainable.

Briana Pasache, MS program
Pasache works on characterizing and quantifying building limit states for evaluating earthquake resilience of communities. This includes the potential effects of inspection outcomes after an earthquake event. She has also been developing an experiment to better quantify noticeable permanent interstory drifts.

Lei Zhang, PhD program
Zhang is a PhD student advised by Prof. Luca Caracoglia. Zhang's research focuses on the response of super-tall cable braced buildings to wind forces. Super-tall buildings continue to proliferate in cities worldwide. This new generation of skyscraper will face unique structural challenges and requires timely research.

Matthew Chellali, BS and MS program
Chellali completed various hands-on projects while an undergraduate and master's student, including a project with his faculty advisor on research with the Department of Defense. He traveled to San Diego to conduct tests aboard a navy vessel. Northeastern was tasked with creating an interface that allows for live hull damage assessment of a navy ship using a sensor network.



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Get in touch

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