

Mechanical Engineering

FROM THE CHAIR / Fall 2024

Dear friends and colleagues,

As we embark on a new academic year, we are thrilled to welcome new students to our vibrant campus, including a record number of McCormick undergraduates. It is with immense pleasure that we share the latest news from the Department of Mechanical Engineering at Northwestern University.

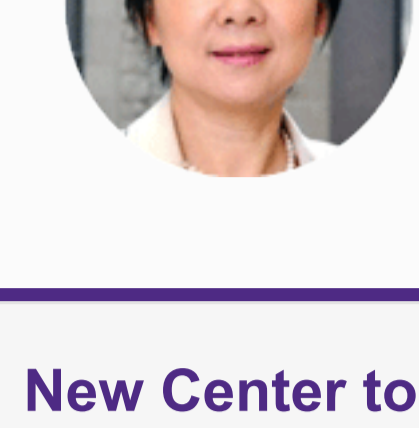
We are especially proud to announce the establishment of a groundbreaking Engineering Research Center (ERC) named Human Augmentation via Dexterity (HAND). Led by esteemed ME faculty members Ed Colgate (center director) and Kevin Lynch (research director), HAND is one of four new ERCs to receive funding from the National Science Foundation (NSF). This is a historic moment for Northwestern, as it marks the first time we are serving as the lead institution for a funded NSF ERC, with up to \$52 million in funding over 10 years.

Adding to our excitement, the ME department has achieved an incredible milestone by securing two Gen-4 ERCs within two years: the HAND ERC, led by Northwestern, and the Hybrid Autonomous Manufacturing: Moving from Evolution to Revolution (HAMMER) ERC, led by Ohio State University, with ME faculty member Jian Cao serving as the research director. One-third of our faculty and many graduate and undergraduate students engage in NSF ERC-sponsored research, which is a testament to the exceptional quality, leadership, and societal relevance of our work.

As you explore the latest updates on cutting-edge research from various groups — Ryan Truby, Cheng Sun, Brenna Argall, Todd Murphey, and me — you will see a clear trend: the growing integration of artificial intelligence (AI) and machine learning (ML) to enhance mechanical and material systems. Our strengths in these areas have positioned us at the forefront of the new research frontier of Embodied AI, which propels AI beyond the digital world to physical systems that navigate, manipulate, explore, learn, and perform useful work in the real world. This strategic priority synergizes our national leadership in robotics, manufacturing, and mechanics. We are also excited to announce three new tenure-track faculty positions associated with Embodied AI. Please see the position announcements for more details.

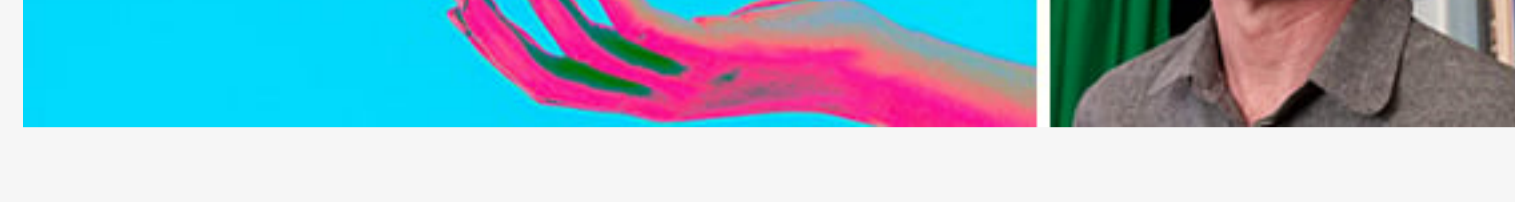
We are delighted to share the national and international recognition received by our faculty, students, and alumni. This year, we celebrated a record number of PhD students winning prestigious NSF and NDSEG fellowships. The remarkable achievements of our alumni continue to inspire us and reinforce our reputation as a top source of talent.

As we begin this new academic year, we remain committed to enhancing our students' learning experiences in ME. We will continue to organize events that encourage undergraduate research participation and foster connections with our alumni and industry partners through the Alumni and Industry Seminar Series. Stay connected with us by following our LinkedIn page and checking the latest news on our department website.



Wei Chen
Wilson-Cook Professor in Engineering Design
Professor and Chair
Department of Mechanical Engineering
McCormick School of Engineering

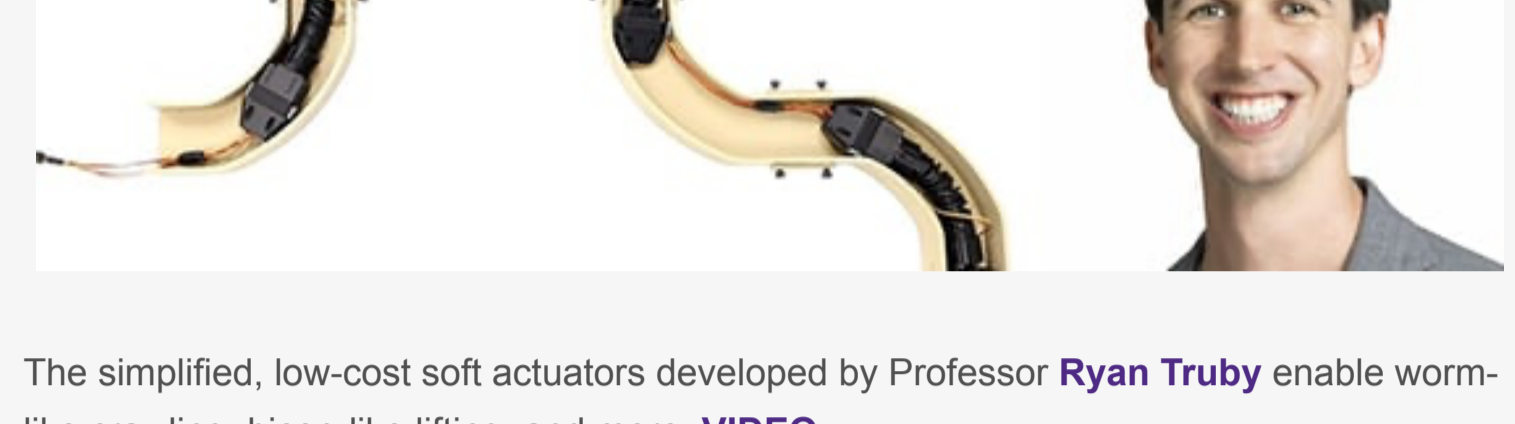
New Center to Improve Robot Dexterity Selected to Receive up to \$52 Million



Called Human Augmentation via Dexterity, the new center directed by Professor J. Edward Colgate will develop dexterous robot hands with the ability to assist humans with manufacturing, caregiving, handling precious or dangerous materials, and more. VIDEO

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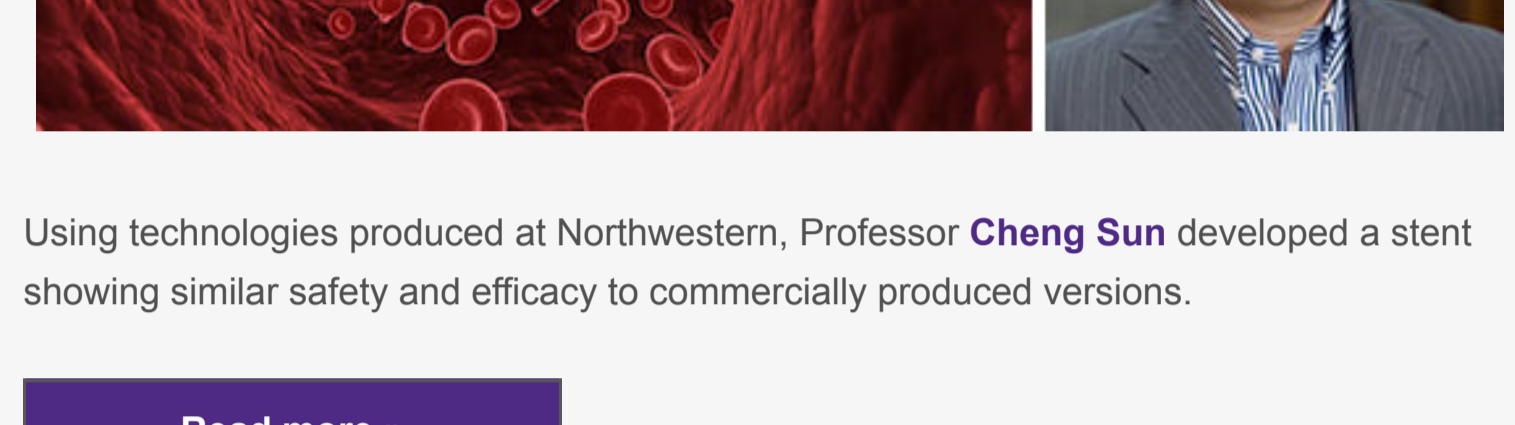
New Twist on Artificial 'Muscles' for Safer, Softer Robots



The simplified, low-cost soft actuators developed by Professor Ryan Truby enable worm-like crawling, bicep-like lifting, and more. VIDEO

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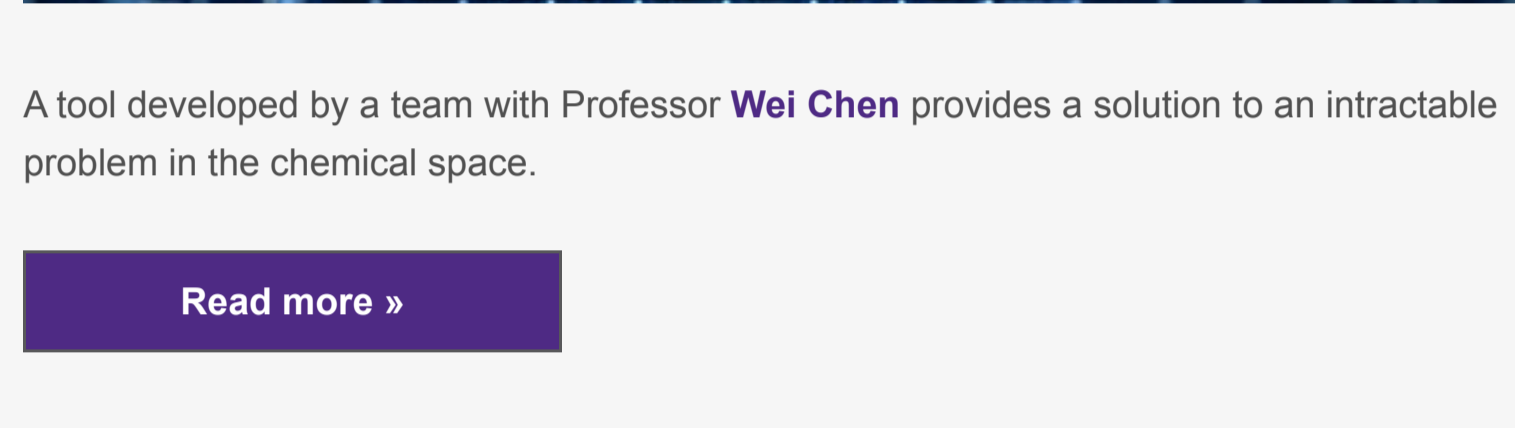
3D Printing and Citrate Biomaterials Could Allow Dissolvable Stents



Using technologies produced at Northwestern, Professor Cheng Sun developed a stent showing similar safety and efficacy to commercially produced versions.

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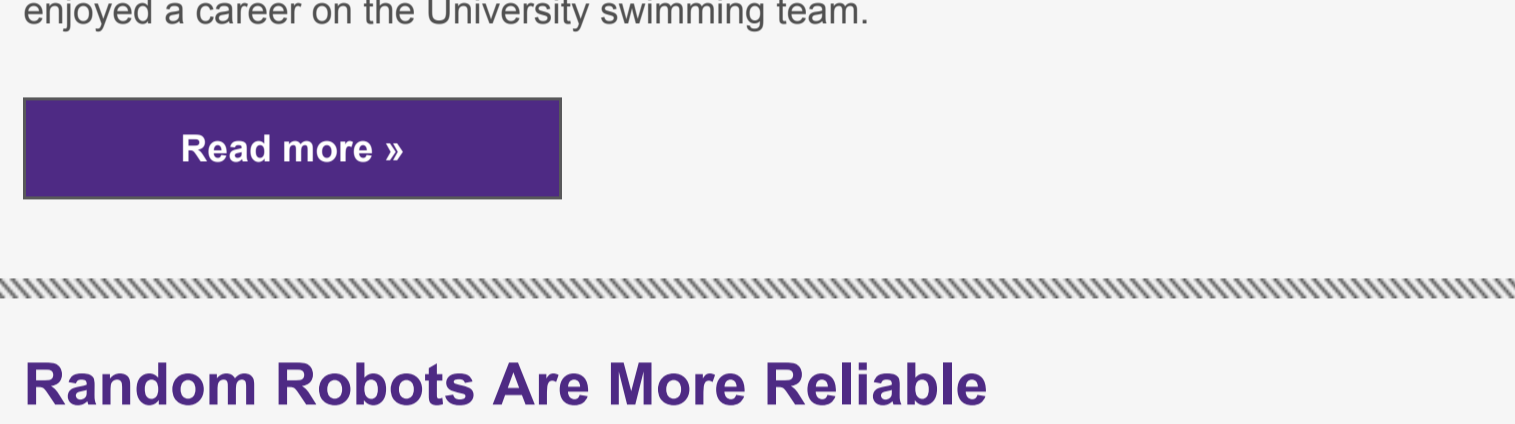
AI Algorithm Identifies High-Performing Electrolytes for Batteries



A tool developed by a team with Professor Wei Chen provides a solution to an intractable problem in the chemical space.

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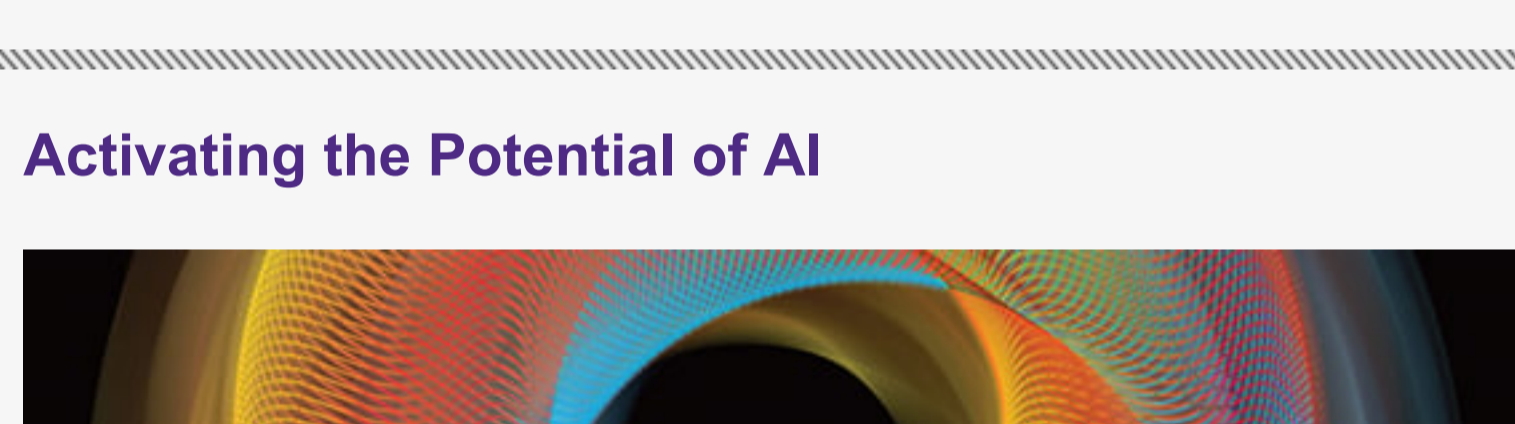
Forbes Discusses his Splashy Time at McCormick



Ben Forbes, a BS/MS student who graduated in June from Northwestern Engineering with a master's degree in mechanical engineering, conducted robotics research and enjoyed a career on the University swimming team.

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Random Robots Are More Reliable



A new AI algorithm for robots developed by Professor Todd Murphey and PhD candidates Thomas Berrueta and Allison Pinosky consistently outperforms state-of-the-art systems.

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Activating the Potential of AI



Professors Brenna Argall and Wei Chen are two of many Northwestern Engineering researchers pushing the technology's boundaries across multiple fields. VIDEO

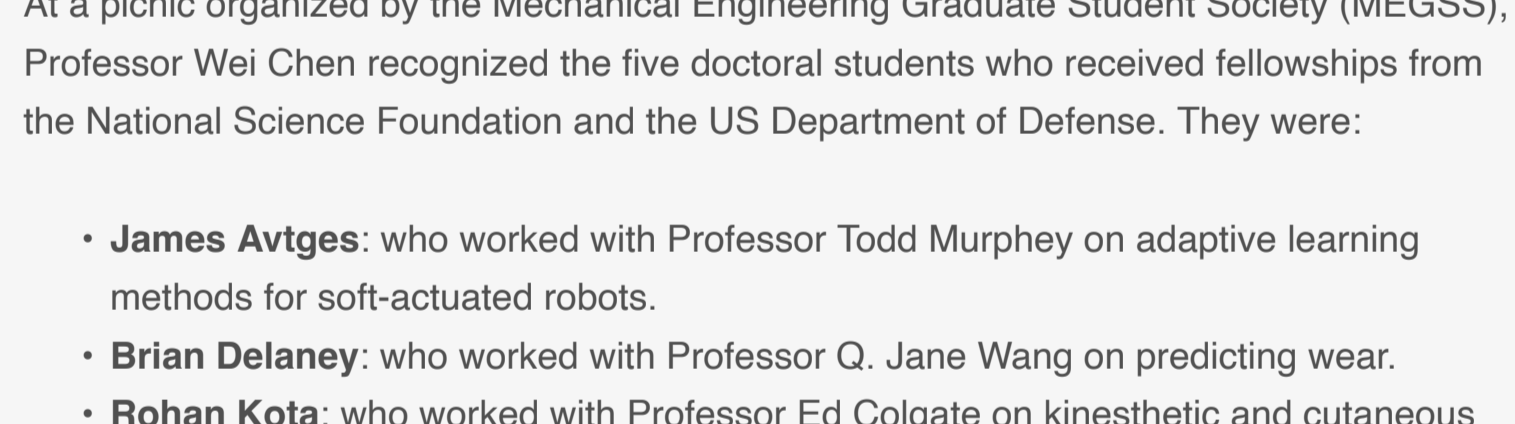
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Learning What Design Really Means



Applying the design thinking she developed at Northwestern, Hannah Chung (12) has built an enterprising professional life centered around social good.

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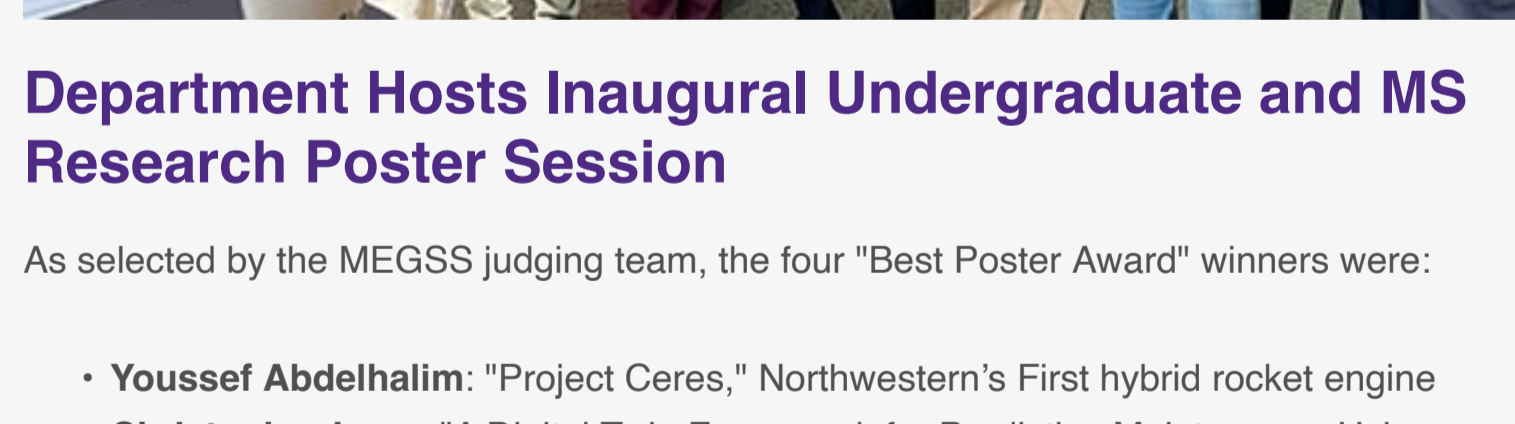


Chen Honors MEGSS Doctoral Students Awarded Prestigious NSF and DoD Fellowships

At a picnic organized by the Mechanical Engineering Graduate Student Society (MEGSS), Professor Wei Chen recognized the five doctoral students who received fellowships from the National Science Foundation and the US Department of Defense. They were:

- James Avtges: who worked with Professor Todd Murphey on adaptive learning methods for soft-actuated robots.
Brian Delaney: who worked with Professor Q. Jane Wang on predicting wear.
Rohan Kota: who worked with Professor Ed Colgate on kinesthetic and cutaneous feedback for high-performance telemanipulation.
Malachi Landis: who worked with Professor Ping Guo on an orbital-motion, wire-fed implementation of additive friction stir deposition and corresponding open-particle smoothed-surface hydrodynamics simulation.
Fiona Ann Neylon: who worked with Professor Brenna Argall on a learning for a customized control project.

Graduate students Shane Deng and Kyle Mumm also received Graduate Leadership and Service Awards.



Department Hosts Inaugural Undergraduate and MS Research Poster Session

As selected by the MEGSS judging team, the four "Best Poster Award" winners were:

- Youssef Abdelhalim: "Project Ceres," Northwestern's First hybrid rocket engine
Christopher Luey: "A Digital Twin Framework for Predictive Maintenance Using Probabilistic Temporal Fusion Transformers"
Siddhant Pradhan (MS '24): "The Effects of Damping Componentry on Stance Phase Prosthetic Work During Level and Ramp Walking"
Julian Rocher (24): "Fabrication of Nanoporous Tungsten Via Liquid Metal Dealloying as a Plasma Facing Material for Nuclear"

Luey and Rocher were named winners of the "Most Popular Poster" award, voted by all attendees.

Department News

Northwestern Engineering launched a joint Mechanical Engineering-Materials Science MS program that offers a curriculum that combines the strengths of the two departments, enhancing graduates' career opportunities in industry and research.

Professor Jian Cao is part of a team that was awarded a \$20 million grant from the National Science Foundation for work on measuring, understanding, predicting, and accelerating technology innovations. Cao also won the Hideo Hanafusa Outstanding Investigator Award, a plaudit given biennially to recognize an individual who has made significant contributions to the field of flexible automation.

Professor Wei Chen was one of three Northwestern engineering faculty members elected to the American Academy of Arts and Sciences, one of the nation's oldest and most prestigious honorary societies.

Professor Yonggang Huang received the prestigious Rodney Hill Prize at the International Congress of Theoretical and Applied Mechanics in Daegu, South Korea. The award is given every four years.

Professor Junsoo Kim received the 9th Hanwha Non-Tenure Faculty Award, was selected as a Scialog Fellow by the Research Corporation For Science Advancement, and was chosen as a Kavli Frontiers of Science Fellow by the National Academy of Sciences.

Professor Greg Wagner was named a Fellow of the American Society of Mechanical Engineers.

Karen Willcox, Peter O'Donnell, Jr. Centennial Chair in Computing Systems at the University of Texas at Austin, delivered the annual Ted Belytschko Lecture.

Shupeng Li was given the 2024 Belytschko Outstanding Research Award for his dissertation, "Design of Bio-integrated Electronics, From Mechanical Structures to Multi-physics Applications," advised by Professor Yonggang Huang.

The department's June 2024 Undergraduate Research and Innovation Award was given to Julian Rocher; the Undergraduate Academic Achievement Award was received by Rocher and Charles Chenz, and the Undergraduate Leadership and Service Award was earned by Marina Hutzler.

Alumni News

Former postdoc Faez Ahmed, now an assistant professor at MIT, received the 2024 ASME Design Theory and Methodology Young Investigator Award.

Hannah Chung (12) published a book, The Perfect Persimmon.

Former postdoc Wonmo Kang was promoted to associate professor with tenure at Arizona State University.

Former postdoc Harrison Kim, a professor at the University of Illinois Urbana-Champaign, received the 2024 ASME Design Automation Award.

Brad Kinsey (PhD '01) was elected a Fellow of CIRP (International Academy of Production Engineers).

Ebot Etchu Ndip-Agbor (PhD '18), now a technical fellow at General Motors, received 2024 SME Susan Smyth Outstanding Young Manufacturing Engineers Award.

Former postdoc Liwei Wang, now an assistant professor at Carnegie Mellon University, received the Inaugural 2024 ASME Design Automation Dissertation Award.

Hongyi Xu (PhD '14), an assistant professor at the University of Connecticut, received the 2024 ASME Design Automation Young Investigator Award.

Yong Zhu (PhD '05), Andrew A. Adams Distinguished Professor of Mechanical Engineering and associate head for research and faculty advancement at North Carolina State University, received the 2024 ASME Bazant Medal.

FACTS & FIGURES
9 National Academy of Engineering members
14 Major centers, institutes, and programs led by ME faculty
#6 Ranking by Research.com among mechanical and aerospace engineering programs

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