MECHANICAL ENGINEERING

UNIVERSITY OF MINNESOTA

ME at the FRONTIER:

FROM AIRBORNE PATHOGEN DETECTION TO NFL SIDELINES, ME STUDENTS AND FACULTY ARE ON THE LEADING EDGE

ME NEWS
Spring 2026

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Spring 2026

Contents

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Design
University Printing Services

Published by the **Department of Mechanical Engineering** for alumni, students, and friends of the department.

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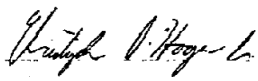
A message from the Department Head

As one of the most "senior" branches of engineering, Mechanical Engineering has helped to define new disciplines at the frontiers of current engineering practice. These frontiers are all around us; this spring, our theme, ME at the Frontier, captures the breadth and ambition of our work. Our faculty members, staff, and students are advancing research across artificial intelligence, biomedical innovation, advanced manufacturing, energy systems, and fluid dynamics, among others. In the classroom, artificial intelligence is reshaping how we teach and learn. Our students are presenting research internationally and engaging deeply with emerging technologies that are shaping the future of the profession.

The frontier is about responsibility; using new tools thoughtfully, building strong collaborations across industry and academia, and preparing students to solve problems that have not yet been defined.

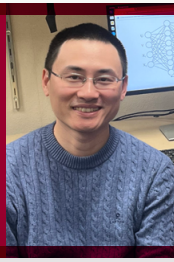
As you read this issue, I hope you see not only the breadth of work happening across our department, but also a shared mindset: curiosity, rigor, and a willingness to move confidently into new territory.

Best regards,



Chris Hogan, Ph.D.
Department Head
James J. Ryan Professor

HOW AI IS EXPANDING THE FRONTIER OF ME



Across teaching, research, and departmental planning, ME is using AI to move efficiently, see deeper, and tackle problems that were previously out of reach, all while reinforcing the central role of humans in engineering judgment.

Lowering Barriers, Raising the Ceiling

In ME 8362: Introduction to Plasma Technology, Professor Uwe Kortshagen reimagined a traditional "paper-and-pencil" graduate course as a coding-driven exploration of plasma physics. Plasmas are ionized gases in which electrons can reach temperatures between 10,000 and 50,000 Kelvin while surrounding gas molecules remain near room temperature—a concept that can be difficult to grasp analytically.

Using Google Colab and integrated AI coding assistants, students build molecular dynamics simulations to model electron energy distributions—concepts that would otherwise require solving the notoriously complex Boltzmann equation. What could consume a full semester of derivations can now be explored, visualized, and tested in a week.

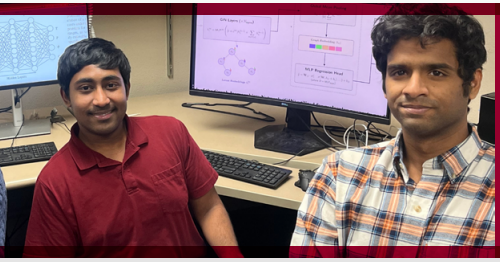
But AI does not remove responsibility. "Students still have to check the physics," Kortshagen notes. A missing elementary charge in an equation can produce results off by orders of magnitude. AI accelerates exploration—but understanding remains essential.

Seeing the Invisible

For Professor Jiarong Hong, AI functions as a new kind of vision.

Hong's lab replaces traditional, computation-heavy imaging pipelines with neural networks trained to extract physical meaning directly from raw, noisy data. In fluid flow experiments where particles are too dense or images too chaotic for the human eye, AI can detect patterns that were previously inaccessible.

Traditionally, turning that raw data into a clear, three-dimensional picture of how fluids move and how microparticles are distributed requires enormous computing power and time. By teaching AI to perform this step more efficiently, Hong's team removes that bottleneck—allowing advanced imaging systems to



Artificial intelligence is reshaping engineering, but in Mechanical Engineering, it isn't replacing fundamentals. It's amplifying them.

move beyond the lab, from drone swarms tracking wildfire smoke to portable sensors that provide rapid bacteria detection and medical diagnostics.

Still, Hong emphasizes a crucial distinction in how these tools are used: "Traditional neural networks are our observers, giving us vision into chaotic flows. But modern AI, like large language models, can actually act as a collaborative physicist, helping us interpret data and uncover the 'why.' Ultimately, the human engineer remains the director, validating these insights against physical laws."

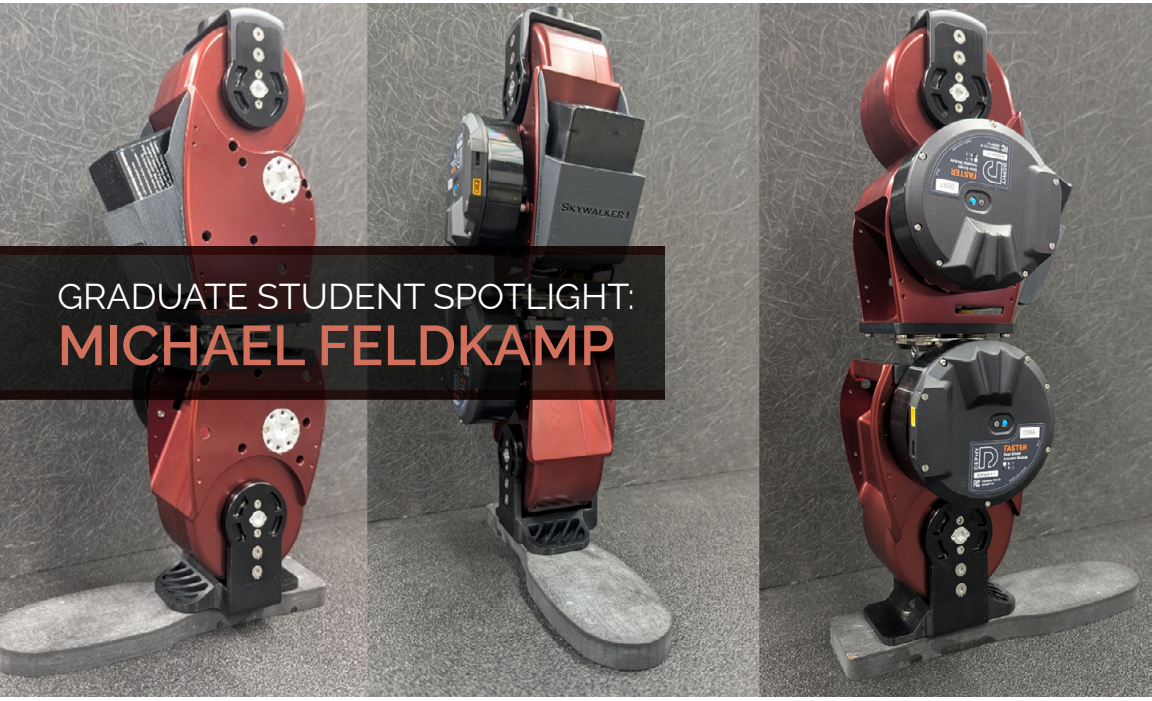
Beyond the Simulation: How AI is Augmenting the Future of Thermofluid Physics

In Professor Suo Yang's Computational Reactive Flow & Energy Lab, AI is a powerful "augmenter" of engineering thinking. By fusing Artificial Neural Networks (ANNs) directly into Computational Fluid Dynamics (CFD), His group replaces slow or crash/failure-prone numerical solvers with faster, more stable alternatives. Beyond standard simulations, his lab uses Graph Neural Networks (GNNs) to "read" molecular structures and creates "surrogate" models: AI stand-ins that mimic complex physics-based simulations but run nearly instantaneously.

The payoff is unprecedented speed and reliability. Engineers can test thousands of "what-if" scenarios in a fraction of the time traditional methods would produce only a handful of results. Yang envisions a future in these hybrid models: AI delivers real-time speed, but traditional physics ensures accuracy. In this new landscape, students leverage tools like "vibe coding" to lower the barrier to entry, but they must still ground their work in deep physical intuition to recognize when an AI might "hallucinate" unphysical results.

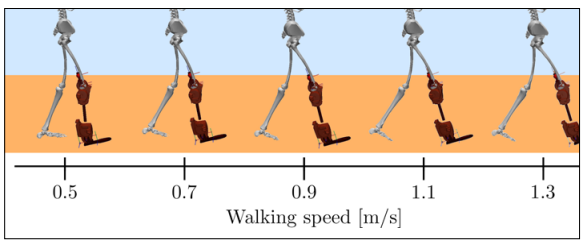
AI Behind the Scenes

AI's impact extends beyond classrooms and labs. Undergraduate Coordinator Jillian Moldestad and Prof. Matt Anderson are exploring how to use AI to assist with enrollment predictions. This tool could better forecast course demand, helping the department schedule offerings and labs more efficiently. By identifying patterns in historical enrollment data, the system supports smarter planning, while our team's oversight ensures flexibility amid uncertainty.



GRADUATE STUDENT SPOTLIGHT: MICHAEL FELDKAMP

More than 1.1 million people in the United States live with major lower-limb amputations—a number projected to increase significantly in the coming decades. While most rely on passive prosthetic legs, robotic prostheses have shown promise in reducing energy use and improving walking speed. The challenge lies in control.



Michael Feldkamp works in Prof. Rachel Gehlhar Humann's lab. His research focuses on a deceptively simple question: where should a prosthetic foot land at the start of each step? Rather than mimicking generic joint motions, he uses models of human walking to predict step placement across different speeds. At the International Conference on Robotics and Automation (ICRA)—the world's largest robotics conference—he will present this approach along with a new simulation environment that tests prosthetic control strategies across users and conditions.

For Feldkamp, representing ME internationally reflects the department's collaborative and rigorous culture—and the shared goal of developing technologies that move with people, not just for them.

UNDERGRADUATE STUDENT SPOTLIGHT: JORDAN NGUYEN

Photo credit: Minnesota Vikings.

Jordan Nguyen moves between two very different stages. By day, she is a fourth-year Mechanical Engineering student conducting directed research in the Tithof Lab, refining hydraulic network models of the glymphatic system to study how cellular variations influence fluid flow in the brain. By weekend, she performs in front of tens of thousands of fans as a **Minnesota Vikings Cheerleader.**

While the technical content of each role differs, the skills overlap. Teamwork, communication, leadership, and time management are essential in both arenas. Preparing to present research requires the same confidence and composure as stepping onto the field. Engineering has strengthened her discipline; performance has strengthened her resilience.

Balancing coursework, research, and a public-facing role demands intentional time management—and community. Nguyen credits classmates, professors, and teammates for helping her build a system that works.

After graduation, she plans to apply to medical school—carrying these skills into her next frontier.

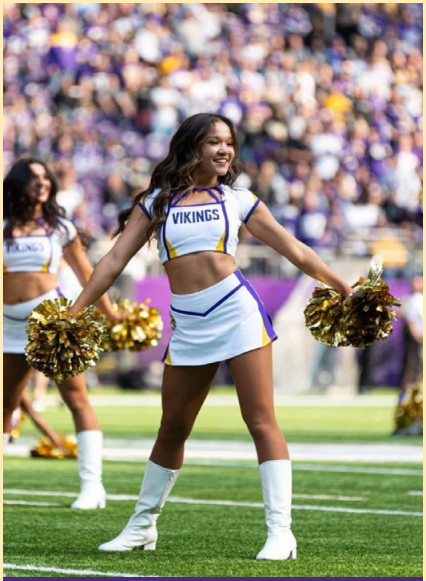


Photo credit: Minnesota Vikings.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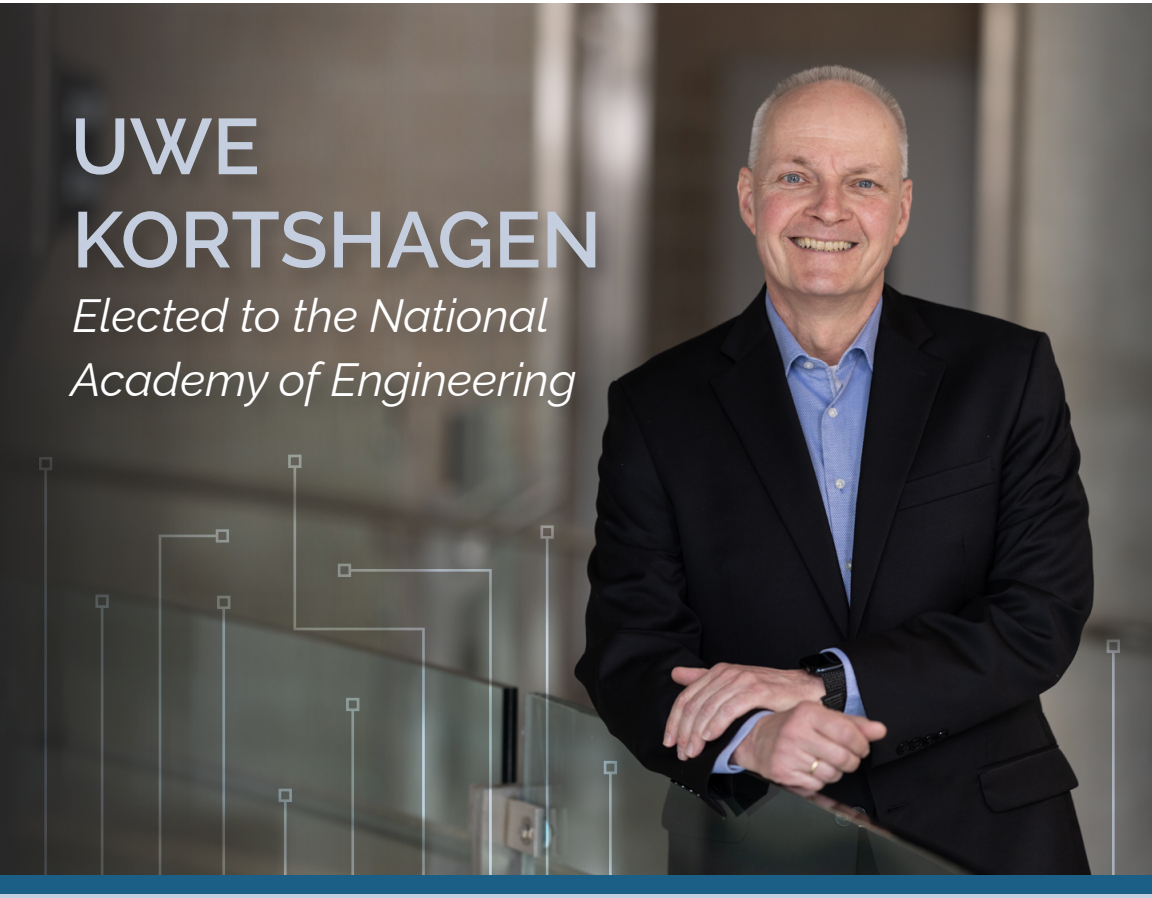


UWE KORTSHAGEN

Elected to the National Academy of Engineering

Uwe Kortshagen, Distinguished McKnight University Professor and Ronald L. and Janet A. Christenson Chair in Renewable Energy in the Department of Mechanical Engineering at the University of Minnesota, has been elected to the National Academy of Engineering (NAE).

Kortshagen's research group is known for its work in the science and technology of plasma synthesis of quantum dots and nanocrystals—particles as small as one-twenty-thousandth the width of a human hair. His work focuses on materials that require high temperatures during synthesis, which are difficult or impossible to produce using traditional wet-chemical approaches.

A central contribution of Kortshagen's research is the development of plasma-based synthesis techniques for a broad range of materials, including semiconductors, ceramics, and metals. In this context, plasma refers to a partially ionized gas. Compared with other aerosol-based methods such as flames or pyrolysis, plasma synthesis enables improved control over particle size and material properties.

Kortshagen's work has played a key role in advancing the use of silicon quantum dots in practical applications. These include improved solar cells and photovoltaic technologies, as well as the development of light-emitting electronic devices. More recently, his research has contributed to emerging applications such as higher-performance lithium-ion batteries, new approaches to brain imaging in medicine, and agricultural technologies that modify the solar light spectrum to support plant growth.

In addition to experimental advances, Kortshagen has developed theoretical models describing how nanocrystals form, grow, charge, and heat within a plasma environment. His research has also expanded understanding of the physical properties and electrical transport behavior of quantum dot films produced through plasma synthesis.

Quantum dots—recognized with the 2023 Nobel Prize in Chemistry—are increasingly important for displays, photovoltaics, quantum computing, and medical imaging. Kortshagen's plasma-based synthesis methods have broadened the range of usable quantum-dot materials to include high-temperature compounds that cannot be produced using conventional wet-chemical methods.

"Being elected to the National Academy of Engineering is a tremendous honor," Kortshagen said. "My work has always been driven by the opportunity to advance fundamental plasma science while addressing challenges in energy, materials, and sustainability. This recognition reflects the contributions of many students, postdoctoral researchers, and collaborators, and I am grateful to be part of the University of Minnesota community that values interdisciplinary research and real-world impact."

Kortshagen has been a faculty member at the University of Minnesota since 1996. He served as head of the Department of Mechanical Engineering from 2008 to 2018 and Director of Graduate Studies from 2006-2008. In 2021, he and his wife, Dagmar, established a scholarship in mechanical engineering to help undergraduate students with an emphasis on first-generation college students.

Kortshagen has received numerous awards for research and teaching excellence, including the Plasma Prize from the American Vacuum Society, Fellow of the American Physical Society and the American Society of Mechanical Engineers, and the University's George Taylor Award for Distinguished Teaching. He has published more than 250 publications in refereed scientific journals and has advised 50 Ph.D. students, 36 master's students, and 21 postdoctoral associates.

Kortshagen joins other University of Minnesota faculty members who are part of the National Academy of Engineering.

A Career of Connection and Impact:

PROFESSOR STELSON

For Professor Stelson, engineering and academia were part of his lineage. With a father and grandfathers who were professors, he grew up around teaching and discovery. Early memories of watching tensile test specimens fracture—and tinkering with a shoebox full of pocket watches—sparked a lifelong fascination with precise mechanical systems. Strong preparation in math and science led him to Stanford and MIT, and eventually to the University of Minnesota's Department of Mechanical Engineering, where he devoted his career to research, teaching, and mentorship.

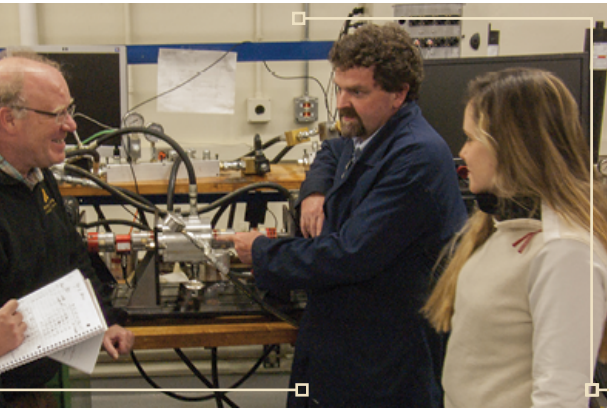
Among his proudest achievements is founding and directing the NSF Engineering Research Center for Compact and Efficient Fluid Power (CCEFP). Selected as one of five centers from 276 proposals, CCEFP united seven universities and 50 industry partners to modernize fluid

power research in the United States. At a time when little academic research existed in the field, the center helped redefine its efficiency, relevance, and national impact.

Over the years, he has seen the department broaden its research scope, modernize its laboratories, and deepen its commitment to teaching and student support. He remains a strong advocate for industry collaboration and international partnerships, shaped by his own sabbaticals abroad and industry-funded research.

To students, his advice is practical: pursue advanced education early if possible, before life grows more complicated. To faculty, he emphasizes personal connection and interdisciplinary collaboration, echoing his mentor's belief that "the interesting problems are at the intersection of different disciplines".

In retirement, he plans to focus on climate advocacy, civic engagement, and time with family—continuing a life defined by curiosity, connection, and impact.



A Career Defined by Curiosity and Commitment:

PROFESSOR STRYKOWSKI

Shear Flow Control Laboratory
Strykowski Research Group 2008

Professor Paul Strykowski's path to mechanical engineering was anything but linear. He began college intending to study photography, declared mathematics as a practical backup, then shifted to civil engineering before finding his home in mechanical engineering. What ultimately captivated him was fluid mechanics—especially the complexity and elegance of the Navier–Stokes equations. A formative NSF summer research experience at Yale solidified his passion for discovery and set him on the path toward academia. "Fluid mechanics is a beautiful subject," he reflects, "and I ended up using photography quite often after all in my research and teaching in the subject."

ME 4583 — Design for Life:
Water in Tanzania Ruaha National Park —
January 2023

Taking the dollar challenge!

Over nearly 40 years at the University of Minnesota, Strykowski built a career grounded in the belief that research, teaching, and service are inseparable. His research, supported for more than 25 years by the Office of Naval Research, advanced work in supersonic thrust vector control, jet mixing for noise reduction, and ramjet engine design—including large-scale testing at the Naval Air Warfare Center in the Mojave Desert.

In the classroom, his enthusiasm and early adoption of active learning left a lasting impression on students. He also co-founded *ME 4583: Design for Life – Water in Tanzania*, a transformative program that has sent more than 100 CSE undergraduates abroad to design potable water systems serving over 25,000 families.

After 16 years as Associate Dean for Undergraduate Programs, including overseeing the renovation of Lind Hall's first floor, Strykowski leaves a department he has seen evolve into a diverse, forward-looking community.

"Everything is about the students,"
he reflects—a philosophy that has shaped
his entire career.

Last lecture in fluid mechanics — December 10, 2025
Surprised by a visit of family and friends!

Celebrating last lecture — December 10, 2025 with Matt, Al, and my wife Jill

Finding Her Lane:

RAFA AT THE WOMEN WITH DRIVE V SUMMIT

When Rafaela "Rafa" Goncalves da Silva '26 attended the Women with Drive V Summit in Indianapolis, she was looking for clarity—and community. After previously connecting with Women in Motorsports North America (WMNA) at a racing event in Austin, TX, she was eager to learn more and connect with leaders who had built their careers in motorsports. Rafa reached out to the Mechanical Engineering department to request funding to support her trip.

From high school students to seasoned executives, the conference brought together women across every stage of the industry. By the end of the Summit, two important messages stuck with her: "Become comfortable with being uncomfortable," and "Be endlessly curious." Hearing leaders speak candidly about setbacks, resilience, and passion reinforced her confidence to chart her own path.

Rafa is majoring in Aerospace Engineering, but has built a community in ME through several classes, mechanical engineering internships, and as an involved member of ME's Gopher Motorsports team.

Her advice to other students is simple: send the email, ask the question. From funding for a conference to a great job opportunity, "people want to help," she says. "But you have to take the first step."