College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

FALL 2025 NEWSLETTER

DEPARTMENT OF

INDUSTRIAL & SYSTEMS ENGINEERING

Professor Jim Luedtke, an expert in optimization, developed a new course in the discipline that teaches undergraduates and graduate students more advanced modeling techniques. Photo: Joel Hallberg.

Greetings from Madison!

As a new academic year begins, our campus is buzzing with energy and purpose—and there's never been a more exciting time to be part of the UW-Madison Industrial & Systems Engineering (ISyE) community.

Our students are learning from world-renowned faculty and engaging in cutting-edge coursework spanning industrial AI, optimization, human factors, health systems and beyond. Upon graduation, they're stepping directly into high-impact roles in industries as varied as manufacturing, cybersecurity, healthcare and even cosmetics. The reach and relevance of our program continue to grow.

We're proud to share that our department is ranked fifth among public universities for undergraduate programs, and fifth for graduate studies. These rankings reflect the exceptional quality of our academic offerings, faculty, and students.

A key driver of our success is the strength of our research. In the past year alone, our faculty and graduate students have secured over $22 million in research funding, published more than 100 journal articles, and earned a No. 1 national ranking in scholarly research productivity, as recognized by Academic Analytics.

As a result of this growing reputation, demand for our programs is at an all-time high. Our total undergraduate enrollment has increased nearly 10% this fall. This past spring and summer, we celebrated the graduation of nearly a dozen new PhDs, many of whom have accepted academic positions and are already shaping the future of the field.

To support this momentum, we're investing in new ways to enrich the student experience—expanding scholarships, strengthening student organizations and growing professional development opportunities. We're also continuing to grow our outstanding faculty. This year, we welcomed Assistant Professor Michael Biehler, who joined us in January and brings expertise in advanced manufacturing, and Assistant Professor Jackie Cha, who joined this fall with a focus on human factors and health systems.

Finally, we're proud to highlight the leadership of Professor Laura Albert, former department chair, who has spearheaded a national initiative to establish Industrial and Systems Engineering (ISE) Day—a new annual event to raise awareness of the field and inspire future generations of engineers. We are deeply grateful for her vision and dedication.

Thank you for your continued support of our department. Together, we are shaping the future of industrial and systems engineering.

On, Wisconsin!

Shiyu Zhou
David H. Gustafson Department Chair
Vilas Distinguished Achievement Professor

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New advanced optimization course provides industry preparation

Professor Jim Luedtke brings his experience developing mathematical models for real-world problems such as power distribution to the classroom. Photo: Joel Hallberg.

Industrial engineering students who are interested in learning the basics of optimization—mathematical techniques that can solve problems such as choosing the quickest route from point A to point B—can sign up for one of two introductory courses in the discipline.

PhD students who want to delve deep into the theory behind the full range of optimization models can choose from a series of upper-level courses.

Professor Jim Luedtke saw a gap between those two ends of the optimization knowledge spectrum.

"There wasn't really a good course for trying to advance the practice of optimization beyond the introductory courses," says Luedtke, whose work in optimization informs topics such as energy management and cybersecurity. "Most of our students are going into industry, and they're not necessarily interested in the theory. But some of them want to learn how to use these tools to solve problems that are more challenging than what they see in the introductory courses."

So, Luedtke created a course, ISyE 603: *Advanced Optimization Modeling*, to build on students' basic knowledge of optimization, teach them to apply more advanced modeling techniques and introduce them to real-world considerations like prioritizing computational efficiency. Having launched in spring 2024, it's open to undergraduates all the way up to PhD students.

Luedtke says he doesn't know of a similar course at any other university. The class is also unique in that it doesn't include a traditional exam; Luedtke says the nature of the advanced modeling work, along with writing code and implementing models in software, doesn't lend itself to an exam format.

Instead, students work through models for challenges—such as power generation and distribution—in class and implement those models using the modeling language JuMP in their homework assignments. They learn to reformulate their models in ways that are easier to solve in existing software.

"Most of the cases, we have limited computational resources or face large amounts of data. How are we going to do that? This course blends in that idea and gives us some techniques to solve that," says undergraduate Eddy Yeung, who graduated in May 2025. "It's really useful."

Luedtke also added a final project for the spring 2025 semester, allowing students to apply their enhanced optimization skills to a topic of their interest. Kaitlyn Campbell, who's enrolled in the accelerated industrial engineering master's program in systems engineering and analytics, studied aerospace engineering as an undergraduate at the University of Florida and hopes to one day work in the aerospace industry. Her group worked on a model to plan flight routes for drones to minimize energy loss from drag while flying to a set of locations.

"It has been a very comprehensive class," says Campbell. "It's definitely a significant step up from the introductory course, but at the same time, I feel like Professor Luedtke has made the concepts very digestible and approachable and also very motivated in the real-world applications of all the things we're doing. So it's not just complexity for the sake of complexity, but it's really a focused and intentional walkthrough of solving different problems."

PhD student Fernando Acosta-Pérez, who came to UW-Madison with a National Science Foundation Graduate Research Fellowship, has paired his doctoral studies with an internship with the data science team at UW Health. Photo: Joel Hallberg.

Mathematical modeling helps hospitals efficiently assign patients to the right space

A hospital's emergency department swells with patients, a chunk of whom will need to be admitted to the facility's inpatient unit.

But decision-makers in emergency care face a dilemma: When deciding to admit a patient, they need to make sure there will also be enough hospital beds for patients coming out of surgery, as well as those transitioning out of intensive care units. To make any admission decisions, they first need to know not just how many beds are currently available, but also how many beds will be needed and how many patients will be discharged to open up beds in the near future.

A team of UW-Madison industrial engineers determined a way to help forecast discharges, almost in real time. In collaboration with UW Health and the Department of Emergency Medicine, the researchers have developed a mathematical model that allows for more granular predictions—covering the next hour or next four hours, rather than full-day projections that are typically used in the healthcare industry.

The researchers detail their model in a paper published in the *Journal of Medical Internet Research*.

PhD student Fernando Acosta-Pérez and Associate Professor Gabriel Zayas-Cabán say their work could allow hospital decision-makers to work more nimbly and cut down on emergency department "boarding," in which patients are admitted but left waiting in the emergency department for open beds. Studies have shown that boarding is not only bad for the hospital system but also leads to worse patient health outcomes.

"It's very hard to effectively coordinate and determine how to route patients," says Acosta-Pérez, a third-year PhD student from Puerto Rico who is the lead author on the paper. "What we're doing a little differently is we have constant predictions every hour of the day. So we can definitely use the information in a better way, rather than just one single prediction for the entire day. When you need to make decisions now, you need an updated forecast with the most recent information."

Acosta-Pérez used historical data from UW Health to build and train the model, which uses a collection of algorithms called decision trees to generate its predictions. In partnership with the UW Health data science team, the researchers are continuing to test their model to further validate and refine it. To make that possible, UW Health data scientists created a pipeline to generate real-time data.

In addition to his PhD research, Acosta-Pérez is also interning with the UW Health data science team.

"Fernando not only had access to a richer data set, but he was interacting with these practitioners on a regular basis for key context and experience," says Zayas-Cabán, who's a longtime collaborator with Brian Patterson, an associate professor of emergency medicine and senior author on the paper.

For his dissertation research, Acosta-Pérez plans to employ additional mathematical techniques to develop more advanced models that can not only offer predictions but also provide prescriptive recommendations across a network of affiliated hospitals.

Acosta-Pérez, who earned a National Science Foundation Graduate Research Fellowship, says the chance to pursue research while also gaining practical experience with UW Health was one of the reasons he chose UW-Madison for his graduate studies.

"I have this opportunity to not only do research," he says, "but also hopefully have some meaningful impact and use the stuff that I do for improving systems, which is what industrial engineers try to do."

FOCUS ON NEW FACULTY

Jackie Cha helps humans, robots work together smoothly in surgery

A surgeon sits in front of a console, head tucked into a cavity that shows an enhanced view of the operating field, controlling a multipronged robot that's actually performing—mechanically, at least—the procedure. Studies have shown that robot-assisted surgeries result in smaller incisions, less blood loss, shorter recovery time, and other positive patient outcomes.

But how does this technologically enhanced setup affect the members of the surgical team? How does it impact their behavior and cognitive performance? What about their physical health?

These are the sorts of questions Jackie Cha works to answer.

Cha has brought her work on human-robot interactions in healthcare to ISyE, joining as the Patricia Flatley Brennan Assistant Professor. She arrived at UW-Madison in fall 2025 as part of the university's RISE-THRIVE (Research, Innovation and Scholarly Excellence: Transforming Healthspan through Research, InnoVation, and Education) initiative.

Cha spent the previous four and a half years at Clemson University, where she received a National Science Foundation (NSF) CAREER Award, along with additional grants from the NSF, the National Institutes of Health and the Agency for Healthcare Research and Quality.

In addition to surgical robotic systems, which are increasingly used in general surgery, urology, and gynecology, Cha studies the use of wearable technologies such as exoskeletons and artificial intelligence-based decision support systems. She measures the effects of those technologies through a human factors lens, all aimed at improving performance, efficiency and safety.

"When you have a robot in the operating room, everything right now is mostly controlled by the surgeon or a human operator, but we're going to get to a point where the control will shift," she says. "If robots actually do have some level of autonomy and they're able to do specific tasks, how is that interaction going to change between the actual teammates?"

Cha, who was born in Korea but moved to Michigan at a young age, became interested in human factors engineering as an undergraduate researcher in ergonomics and biomechanics at the University of Michigan. After earning bachelor's and master's degrees in biomedical engineering at Michigan, she switched to industrial engineering for her PhD at Purdue University.

"I've always been interested in the intersection of healthcare and engineering. During grad school, much of my work was in surgery, looking at how technology was also affecting operating rooms, surgeons, the entire surgical team, as well as the patients," she says. "Being in the operating room for hundreds of hours really exposed me to what was happening in the space and how the technology may actually be aiding, as well as, hindering the work and patient care."

Cha says she looks forward to collaborating with her new colleagues in ISyE's human factors and ergonomics research cluster, bringing a unique perspective on investigating the physical and cognitive demands of emerging technologies. She's long admired Duane H. and Dorothy M. Bluemke Professor Robert Radwin and remembers participating in a mentor-mentee lunch with Emerson Electric Quality & Productivity Professor John Lee at a Human Factors and Ergonomics Society conference as a student. And she is also excited to work closely with the rest of the group—Doug Wiegmann, Ranjana Mehta and Tony McDonald—and the rest of the ISyE faculty.

"The human factors group in ISyE at UW is, I believe, one of the strongest," she says. "And then also, of course, with the strong medical school, this is a really exciting place for the next stage of my career."

Before starting her faculty career at Clemson, Cha briefly worked as a lead reviewer with the robotic assisted surgery device team at the U.S. Food and Drug Administration. She drew on that experience to create a class on human factors and device design and analysis at Clemson, and she plans to develop a similar course at UW-Madison.

"I try to expose the students to real-world applications, either through examples that I've seen in the operating room or everyday life," she says, "and then ask a lot of open-ended questions."

Touched by cancer, Liu trains artificial intelligence to uncover the genes behind disease

As an industrial data science researcher, Kaibo Liu has devoted much of his adult life to improving quality in manufacturing systems and monitoring the health of machines.

That changed in 2021, when the ISyE professor expanded his focus to human health.

Liu's then-9-year-old son, Joseph, was diagnosed with a cancerous germ cell tumor. Inspired by watching his son's treatment at St. Jude Children's Research Hospital in Memphis, Tennessee, while on sabbatical, Liu resolved to give back through his work.

"When we talk about human life, nothing is more important than that," says Liu, the Grainger STAR Professor. "If I can save people's lives, if my research can contribute only a small percent to the better life of human beings, I think my research is worth it."

His subsequent efforts have started to bear fruit. Liu and collaborators at St. Jude have published a paper in the journal *Nature Methods* showcasing a first-of-its kind algorithm in the field of spatial transcriptomics. The algorithm uses generative artificial intelligence and allows investigators to characterize gene expression in tissues down to the single-cell level. The researchers have made their tool available for free on GitHub.

The field of spatial transcriptomics includes several methods that can reveal gene expression within a tissue sample—information that's useful for determining which genes are at work in a disease, better understanding disease progression, and informing treatments.

However, the leading methods either can't break down data to single-cell resolution or can't cover the full genome. Those limitations offered an opportunity when Liu connected with St. Jude faculty member Jiyang Yu, a computational biologist.

Adapting methods they've used in industrial applications, Liu and former PhD student Ziqian Zheng built a type of statistical model called a generative probabilistic model to create a tool they've dubbed "Spotiphy." The tool can determine the proportion of each type of cell within a given location and then break down aggregated gene expression data for the region to the single-cell level.

"One major advantage of our method is we go one step beyond getting to know the cell types in each tiny area," says Zheng (PhDIE '24), now a software engineer at the autonomous driving tech company WeRide.

Joseph (left) and Kaibo Liu. Submitted photo.

"Knowing which cells are there is pretty helpful, but if we can get to know the gene expression of each cell, it will be more helpful to the biologists."

Because it's trained on large collections of both spatial transcriptomics data and tissue images, Spotiphy can fill in gaps in the readout of gene expression.

"Imagine a picture of a hand, but the middle is missing," says Junmin Peng, a faculty member at St. Jude and one of the paper's senior authors. "The algorithm has acquired general rules from its training so that it can impute the missing part of the picture—like reconstructing where and what the palm should look like, or in reality, the space between imaging spots."

The researchers validated the tool by analyzing mouse models of Alzheimer's disease and cancerous tissues.

Three years after diagnosis, Joseph Liu's cancer is in remission, thanks to the treatments he received at St. Jude. The hospital covers all treatment costs through donations, meaning patients don't receive a bill.

Kaibo Liu hopes to keep paying back the larger medical community through his work. In partnership with their St. Jude collaborators, Liu and Zheng continue to refine their Spotiphy tool and hope to expand its capabilities.

"I feel so grateful," Liu says. "That's why I really wanted to do something, if I could, to return back to this amazing hospital and to this research work."

Faculty news

Procter & Gamble Bascom Professor Oghuzan Alagoz earned the Institute of Industrial and Systems Engineers' (IISE) David F. Baker Distinguished Research Award for outstanding research over the course of his career.

Professor Laura Albert has been named a 2025 INFORMS Fellow, a prestigious honor in the fields of operations research, analytics and data science.

Assistant Professor Michael Biehler was part of a group led by Georgia Tech Professor Jianjun Shi whose work earned a best paper award from the 2024 *IISE Transactions* focus issue on data science, quality and reliability.

Grainger STAR Professor Kaibo Liu received the Ragnar E. Onstad Service to Society Award for his work in collaboration with industry and students as part of the 2025 collegewide awards ceremony.

Professor Jim Luedtke received the Teaching Excellence Award from the IISE Operations Research Division.

Duane H. and Dorothy M. Bluemke Professor Robert Radwin was named an IISE Fellow, the highest class of membership in the organization.

Vilas Distinguished Achievement Professor and David H. Gustafson Department Chair Shiyu Zhou received the IISE's Medallion Award for his contributions to the industrial engineering profession.

Student news

PhD student Vipul Bansal received the 2025 Gilbreth Memorial Fellowship from IISE.

PhD student Oliver Nguyen earned an American Medical Informatics Association LEAD Fund Trainee Award.

Our student IISE chapter was awarded Gold Chapter Status at the 2025 IISE Annual Conference.

In memoriam

Professor Emeritus Michael J. Smith, the founding force behind our department's human factors program, died Aug. 29, 2025, after a brief battle with pancreatic cancer. He was 80. Smith, a Madison native, was a pioneer in the fields of human factors and ergonomics, focusing on how technology interfaces with people in real-world environments.

Engineers' Day award recipients

In 2025, two industrial and systems engineering alumni earned College of Engineering honors for outstanding career contributions.

Identifying and cultivating future leaders

Early in her career, Nicole Rybeck Wolcott (BS '09) had the chance to take a "bubble assignment" and work as part of an international team to develop solutions for attracting, developing and retaining young talent.

Wolcott has since grown into a leader in the world of talent development and human resources. As senior manager of early talent programs at Kohler Co., she leads a team that runs all of the organization's internship, co-op and entry-level leadership development programs. She is ISyE's Early Career Award winner as part of the college's 2025 Engineers' Day celebration. After stints at GE Healthcare and Meta, Wolcott joined Kohler Co. in 2023 and was named to Milwaukee Business Journal's 40 under 40 list in 2025.

"I truly have the best job," she says. "I am grateful to have this opportunity to help grow the next generation of leaders and position them for success. It's incredibly rewarding and full circle, given I'm the product of so many people, including mentors and managers, that poured into me early in my own career."

Acts of service

Ask Jeff Roznowski (BS '80) about his career, and you'll need to clarify because he's had two distinct ones.

During the first, he spent 27 years in the telecommunications industry. In 2007, he made a very intentional pivot to public and community service. He's served as a city alderman in his home of Wauwatosa, co-founded the Wisconsin Wireless Association and worked as an adjunct faculty member at Milwaukee School of Engineering.

"After a lot of self-reflection, I learned my passion was people, community and making where I live and the lives of the people around me a little better," says Roznowski, ISyE's 2025 Distinguished Achievement Award winner as part of the college's annual Engineers' Day celebration.

Roznowski has also devoted considerable time and energy to advocating for his alma mater. As one of the leaders of the coalition for the Phillip A. Levy Engineering Center, he spent four years helping to drum up statewide support. Roznowski also regularly speaks to ISyE students.

"I like to say that's my thank you to the school for everything that I've been able to do with my career and my life," he says.

Department of Industrial and Systems Engineering
UNIVERSITY OF WISCONSIN–MADISON

1513 University Ave., Room 3107
Madison, WI 53706
engineering.wisc.edu/isye

PhD grad hopes optimization education will yield exponential dividends for future students

When Ashley Peper (PhD ’25) started to get serious about finding a career that would scratch her math itch, her teachers at Stevens Point Area Senior High floated the standard ideas: accountant or math teacher.

“I don’t want to do either of those,” Peper remembers thinking. “I want to do something more fun.”

About a decade later, Peper has a PhD in industrial engineering from UW-Madison and has started a faculty job at her undergraduate alma mater, UW-Stevens Point.

Photo: Joel Hallberg.

Peper spent the past five years working with Professors Laura Albert and Jim Luedtke applying operations research to cybersecurity systems. Specifically, Peper uses integer programming techniques to determine which cybersecurity measures complex organizations should prioritize when planning their systems.

“She’s really curious,” says Albert. “She really likes math and optimization. It’s like solving a puzzle, and algorithm design is how you solve that puzzle. It’s been fun to watch her tackle these really difficult problems computationally and elegantly using mathematics.”

At UW-Madison, she worked with Albert on a National Science Foundation-supported project on how to build and deploy cybersecurity defenses over time to mitigate risk in complex organizations.

Now, Peper is eager to inspire students to follow her lead by applying advanced mathematical techniques to solve interesting problems. Albert calls it a gift to the state that a product of the Universities of Wisconsin is sticking around to educate the next generation of students.

“I’m really excited because I really liked it there,” says Peper. “It’s cool to also just go back and work with people who were my teachers before, because they’re super cool people and now to think I’m going to be one of those cool teachers is fun.”