INDUSTRIAL AND SYSTEMS
ENGINEERING

UNIVERSITY OF WISCONSIN-MADISON

BEATING THE SYSTEM
FOR PATIENTS AND
MANUFACTURERS

CHAIR'S MESSAGE

Greetings and welcome to our fall 2018 newsletter!

The semester is off to a great start, as we've welcomed more than 400 new undergraduates and 30 new graduate students to our department!

We're also excited about our newest faculty member, Carla Michini. Carla received her PhD in operations research at Sapienza University of Rome and received postdoctoral training at ETH in Zurich and our own Wisconsin Institute for Discovery. Her research is motivated by the practical relevance of combinatorial optimization and integer programming in applied problems.

Our hiring process continues, so in subsequent newsletters I will be able to introduce you to even more great ISyE faculty.

I would also like to acknowledge two of our great alumni donors, Richard and Betty Streich, who founded the Eric Victor Streich Memorial Scholarship in 2007 to honor their late son. The scholarship has helped many students achieve their academic dreams while keeping Eric's memory alive. Be sure to read the full story on page 6 and get inspired!

Our faculty are certainly inspired to achieve their research goals by earning new grants (Kaibo Liu), winning early investigator awards (Nicole Werner) and publishing influential research texts (Rajan Suri). These are only a few of the highlights—be sure to check our Facebook (@ISyE.UWMadison) and Twitter (@uwisye) pages throughout the year for more news.

Another very exciting piece of news is the new Foxconn Technology Group collaboration with UW-Madison. With a donation of $100 million, Foxconn and the College of Engineering will establish a new interdisciplinary research facility focused on science and technology. Given Foxconn's interests in artificial intelligence, manufacturing processes and health systems, I am confident ISyE will play an important role in this partnership.

As the semester continues to get busier and busier, I want to stop and take a moment to thank you for everything you do to support our faculty, staff and, of course, our students through stewardship and mentorship. Your support is essential to the success of our department. I look forward to connecting with you soon. Please feel free to drop me an email, give me a call or stop by 3270 Mechanical Engineering if you are back on campus!

ON, WISCONSIN!

Jeffrey Linderoth

Jeffrey Linderoth
Professor and Chair
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Productive partnership

UW-Madison Chancellor Rebecca Blank (center) and College of Engineering Dean Ian Robertson (second from right) give Foxconn Technology Group representatives, including Chairman Terry Gou (right), a tour of the engineering campus in August 2018. Foxconn's $100 million investment in UW-Madison includes funding to help establish a new interdisciplinary research facility for the College of Engineering. *Photo: Bryce Richter.*

MORE: www.engr.wisc.edu/100-million-foxconn-gift-launches-major-new-partnership-uw-madison/

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MICHINI FINDS OPTIMAL HOME

We might not realize it, but anytime we pack a travel bag, we're entering the world of optimization.

Every item that goes in bears a volume and a value—and there's only so much room. This "knapsack problem" is a classic puzzle in combinatorial optimization, a field that seeks the best possible solutions to problems with finite sets of options.

And it's a conundrum that Carla Michini, the department's newest faculty member, takes seriously.

"I am a packing expert," Michini, who started as an assistant professor in fall 2018, says with a smile.

Of course, Michini's expertise extends beyond optimally packing her sisters' suitcases when they visit Madison from her family's native Italy. Michini works on the theoretical side of combinatorial optimization, examining the structures of problems to identify efficient algorithms that will yield optimal—or near-optimal—solutions.

"I like the rigorous kind of reasoning of math in general, the beauty of simple questions that are hard to answer and the depth of thinking that makes me discover new properties. And, of course, I enjoy the fun and the reward of coming up with my own theorems," says Michini, who used to tutor her high school classmates in Roseto degli Abruzzi, Italy, so that they could cover more advanced material in class. "It's a very creative process."

While she's new to the department, she's been on campus for the past four years as a postdoctoral associate at the Wisconsin Institute for Discovery.

There, she worked in WID's optimization group, where she collaborated with future ISyE colleagues Jeffrey Linderoth and James Luedtke and computer sciences professor Michael Ferris on problems with applications ranging from power networks to traffic congestion to programming languages.

Now she plans to expand her expertise to questions in the field of game theory.

"Instead of looking at a single combinatorial optimization problem, I am interested in a game theoretical framework where there are several players: Each player wants to solve his or her own optimization problem, and the decisions of one player influence the decisions of the other players," she says. "For example, in a road network where there's congestion, each player wants to go from a certain origin to a certain destination in the shortest possible amount of time. The strategies of each player are all the routes from origin to destination, but the time required to travel each road segment depends on how many players are using it."

Michini is also excited to interact more with students in her new role, after teaching *Linear Programming Methods* during the spring 2018 semester.

"My goal is to help the students to develop the skill of thinking in a rigorous way, and hopefully a passion for it," she says. "One of the most rewarding aspects of teaching is to see the progress of a student gaining a deep understanding of a topic. My ultimate goal in teaching is to inspire the students to learn the subjects that I am passionate about, and to motivate them to work hard."

> **"My ultimate goal in teaching is to inspire the students to learn the subjects that I am passionate about, and to motivate them to work hard."**

More to come

Justin Boutilier, whose work applies machine learning and optimization to healthcare, will be joining ISyE in fall 2019. He holds a PhD from the University of Toronto and is completing a postdoctoral fellowship at Massachusetts Institute of Technology during the 2018-19 academic year.

FROM FACTORY FLOOR TO WAITING ROOM, LI ELEVATES EFFICIENCY

Photo: Sarah Page

Jingshan Li craves the kind of vexing, complicated theoretical challenges that chew up existing methods and require novel solutions.

But that doesn't mean the professor is content to operate solely in the theoretical realm, removed from the demands of reality. Li's work on manufacturing and healthcare systems reaches factory floors and shapes patient experiences—tangible results that start with extensive site visits to truly grasp the challenges at hand.

"You cannot just stay in your office," he says. "Typically my students and I go to the plant, we go to the clinic or hospital many, many times to discuss with physicians, with engineers. Only after you fully understand the problem, then you can start work on it. Otherwise, the work you develop may not be useful for them."

> **"I think we can help to improve our healthcare systems. It's really critical. It impacts everyone's life."**

Over the course of his career, Li has collaborated with the likes of Toyota, Chrysler, General Motors, Kraft Foods, UW Health and Dean Health System. Whether he's examining a production system for an automaker or the workflow in a hospital pharmacy, Li develops models to improve efficiency, throughput and quality.

Just as a vehicle goes through a set, predictable assembly process, Li notes, a medical patient progresses through a series of checkpoints at an appointment.

"It's also from one stage to another stage to another stage," he says.

He comes from a manufacturing background, having worked extensively with Chrysler and Ford plants as a PhD student at the University of Michigan. He then spent more than six years as a researcher at General Motors before returning to academia as an assistant professor at the University of Kentucky.

There, Li helped Toyota—known as a leader in "lean manufacturing"—reduce inventory and improve throughput, and he co-wrote the textbook *Production Systems Engineering*. He also started dabbling in healthcare research, beginning with the emergency department at the university's hospital, where he and his collaborators identified the CT scan as the bottleneck.

Since coming to UW-Madison in 2010, Li has analyzed the workflow at UW Health's CT imaging center and helped to reduce physician workload and improve efficiency at Dean clinics. He's currently working with Madison's St. Mary's Hospital to develop a prediction model for patient readmission. By using machine learning techniques, Li and his group can predict the risk of readmission after discharge and identify critical factors, allowing doctors to personalize treatment.

"There are a lot of opportunities," he says. "I think we can help to improve our healthcare systems. It's really critical. It impacts everyone's life."

Li is an associate director of the Wisconsin Institute for Healthcare Systems Engineering (WIHSE), which hosted its second annual conference in May 2018. He sees WIHSE as providing a tangible link between engineering faculty and those in the UW-Madison School of Medicine and Public Health, the School of Nursing and the School of Pharmacy.

"If you're only working by yourself, it's like a silo. Your impact is very limited," he says. "I think only when you're able to apply your results in the clinical field, then you can see the impact. And to do that, you have to work with medical people."

He remains active on the manufacturing front as well. Every spring, he teaches ISyE 615, *Production Systems Control*, a course that includes a class project in partnership with an industry sponsor such as Chrysler or Harley-Davidson. True to Li's approach to research, those projects involve class visits to Chrysler's assembly plant in Belvidere, Illinois, or Harley-Davidson's powertrain operations facility in Menomonee Falls, Wisconsin.

"Even the class projects," he says, "we always can find something new."

SERVING CITIZEN NEED BY IMPROVING MENTAL HEALTH SERVICES
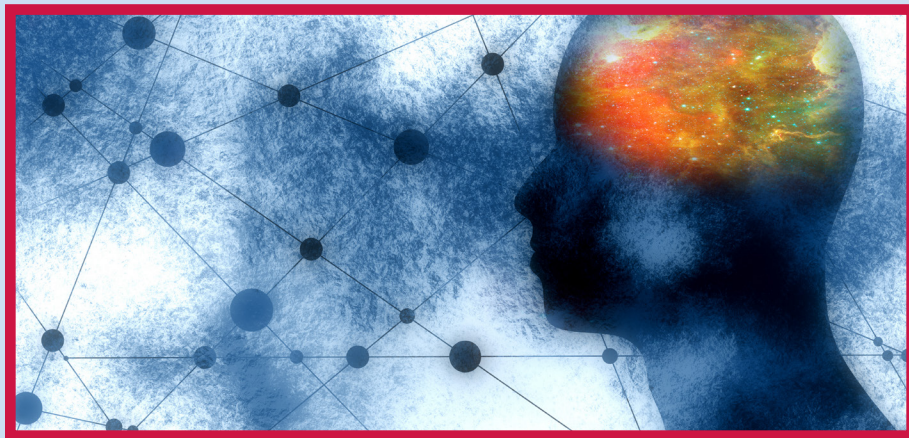
The Substance Abuse and Mental Health Services Administration hopes new regional mental health technology transfer centers will broaden access to training on new evidence-based approaches to treatment.

ISyE's Center for Health Enhancement Systems Studies (CHESS) is part of a new effort by the U.S. Department of Health and Human Services to strengthen mental health services across the nation.

CHESS received a $3.7 million, five-year grant in August 2018 to serve as the Mental Health Technology Transfer Center for Region 5, which includes Wisconsin, Illinois, Indiana, Michigan, Minnesota and Ohio.

As such, the new center will provide training and technical assistance to support the region's mental health workforce, covering treatment and recovery services.

"This is the Wisconsin Idea," says CHESS Senior Scientist Todd Molfenter, director of the center. "This is a great setting for this kind of center. The research environment is helpful as a strong foundation to be able to make sure we're promoting appropriate clinical practice."

The grant is part of a new approach by the Substance Abuse and Mental Health Services Administration, part of the Department of Health and Human Services, to broaden access to training on new evidence-based approaches to treatment. The administration has created 10 regional mental health technology transfer centers, plus additional ones focused specifically on the needs of tribal and Hispanic/Latino populations.

The Region 5 center will provide a variety of in-person and distance training opportunities, allowing a greater percentage of mental health workers to participate, and helping organizations cope with high employee turnover in the industry.

By partnering with local coordinators from each state's mental health provider association, the regional center will be able to tailor its offerings to match local needs. It will also act as a conduit for sharing best practices and resources across states and organizations, which the team hopes will result in better coordination among mental health providers.

In its grant application, CHESS identified areas of particular need in the region, including suicide prevention, youth safety, and the co-occurrence of substance use and mental health disorders. Given the region's demographic makeup, Molfenter says the center will also focus on Native American, Hispanic/Latino, Hmong and African-American populations.

CHESS is also home to the Great Lakes Addiction Technology Transfer Center, having received a $3.8 million grant from the Department of Health and Human Services in October 2017.

MORE: www.engr.wisc.edu/uw-madison-takes-lead-improving-mental-health-services-great-lakes-region/

NAE symposium focuses on data-empowered health

"Transforming Healthcare Through Engineering," the National Academy of Engineering regional symposium held in May 2018 in Madison, drew more than 120 attendees from academia and industry and showcased a campus on which transdisciplinary problem-solving is the norm.

Throughout the symposium, data-empowered healthcare and discovery was a common thread.

The keynote speaker was Professor Emeritus Patricia Flatley Brennan, director of the National Library of Medicine and interim associate director for data science for the National Institutes of Health. Positioned at the intersection of information processing and health data, the national library takes in and houses massive data and bibliographic repositories—which present myriad opportunities to transform information into discovery.

"We are facing a revolution," she said. "A data-powered health opportunity."

Engineers could solve many challenges that would accelerate the library's impact on healthcare, Brennan said.

She cited such aspects as sustainable data infrastructure; robust information access and dissemination methods; information security and privacy; and automated information collection, curation, integration and storage, among many others.

"How do we ensure the information we have is accurate, complete and fulfilling public needs?" she asked. "That's an engineering challenge."

The symposium also included sessions on smart and connected healthcare, integrating imaging and data, and envisioning the augmented and connected healthcare experience of 2050.

MORE: www.engr.wisc.edu/nae-symposium-campus-focuses-data-empowered-health/

MEMORY SERVES:
SCHOLARSHIP HONORS STREICH'S WORK ETHIC

Matt Ward (BS '05) remembers playing marathon racquetball games against Eric Streich (BS '05), all-out battles that left the two friends so tired they could barely hobble home from the Natatorium to Slichter Hall.

Nick McDonough (BS '04, MS '05) recalls working late into the night alongside Streich on a big project for the consulting firm Virchow Krause after graduation. The rest of the lights in the Milwaukee office had gone dark and the two young consultants were exhausted, but Streich wouldn't let them leave until they had finished.

Such is the fully committed way Streich approached life.

"It didn't matter if he was playing pickup baseball with the neighborhood kids or getting his co-workers to do a marathon," says his mother, Betty Streich.

Eric Streich tragically died of a traumatic brain injury October 12, 2006, leaving family and friends with only memories of his magnetic personality, genuine and loyal nature, and all-around determination. To honor him and sustain his memory, his parents created the Eric Victor Streich Memorial Scholarship in 2007, which annually supports one or two first-semester seniors majoring in industrial engineering.

Dick and Betty Streich, who have saved every thank you note and letter from the recipients over the years, recently made a planned estate gift to the fund. Eric's college friends also organize a golf tournament every fall in Madison to raise money; over its 12 years, the event has generated more than $50,000.

Photo: Sarah Page

Dick and Betty Streich (right) pose with department chair Jeff Linderoth and Stephen Bosak, a 2018 recipient of the Eric Victor Streich Memorial Scholarship, before the 12th annual golf tournament to benefit the fund, Sept. 7, 2018, at University Ridge Golf Course.

As an endowment fund, it will never run out.

"I think the whole point for us was that, given more years, Eric could have made a difference," says Betty Streich. "Our hope is that these graduates will make a difference."

Eric was days away from starting a new job as a senior consultant at General Electric Healthcare in Waukesha, Wisconsin, when he died. His interest in the healthcare sector emerged, at least in part, from a class project in which he and Ward worked with the radiology department at UW Hospital to improve patient flow. The two won a scholarship prize for their work.

"He did things the right way. He worked hard," says Ward.

"He was on his way to being really, really successful."

But it was Eric's infectious personality and competitive makeup that charmed his friends. He excelled in sports, particularly baseball, softball, soccer and golf.

"He was always very good at being himself," says Ward. "He made people feel a sense of belonging."

That explains why, year after year, friends and family members make a pilgrimage to Madison to golf, reconnect and reminisce about their old friend. For one day a year, they're all together.

"Eric would love this, and he would be the center of it," says McDonough. "He was the charismatic guy that everybody wanted to be around. And so, to some degree, he's still that. He's still the glue that's keeping the group together, after all these years."

2018-19 Eric Victor Streich Memorial Scholarship recipients

- **Stephen Bosak** is a senior from Easton, Connecticut, who will join IBM after graduation and work with manufacturing and healthcare companies as part of the company's Internet of Things team.
- **Kristjana Hrovat** is a senior from Madison, Wisconsin, who is interested in improving patients' experiences in healthcare settings. After graduation, she hopes to pursue a career in health systems or consulting.

Support the Eric Victor Streich Memorial Scholarship:
www.supportuw.org/giveto/streichfund

For the fourth straight year, *Becker's Hospital Review* included Procter and Gamble Bascom Professor in Total Quality **Pascale Carayon** on its list of "50 experts leading the field of patient safety." Each time, she's been the only engineer on the list. Carayon also earned the International Ergonomics Association/Elsevier John Wilson Award for Applied Ergonomics and will co-chair a National Academy of Medicine ad hoc committee examining clinician burnout.

Associate Professors **Laura Albert** and **Jim Luedtke** were selected as Harvey D. Spangler Faculty Scholars. The fellowships provide flexible funding for research. Albert also chaired the INFORMS 2018 Government and Analytics Summit, a new conference aimed at sharing operations research and analytics with policymakers and government officials.

Assistant Professor **Kaibo Liu** received a $797,820 grant from the U.S. Department of Energy for a project to establish big data analytics solutions to significantly advance the ability to assess equipment condition and support optimal maintenance decision-making in nuclear power plants.

Assistant Professor **Nicole Werner** received an emerging investigator guided research program award from the Children and Youth with Special Health Care Needs National Research Network for a project studying the role of in-home care of children with cerebral palsy.

Professor **Shiyu Zhou** received a nearly $245,000 grant from the National Science Foundation for research aimed at improving the diagnosis and prognosis of faults in mechanical structures and civil infrastructure. Zhou is also a principal investigator, along with Robert Ratner Professor **Raj Veeramani**, on a $149,749 grant sponsored by Welbit, titled analytics for Internet of Things (IoT) enabled commercial kitchen appliances.

Veeramani is also part of a project sponsored by the Boldt Company called augmented reality-enabled smart project production system. Additionally, he received a one-year, $125,000 grant from the National Institute of Standards and Technology for research and outreach collaboration with the Wisconsin Manufacturing Extension Partnership.
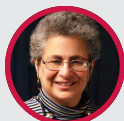
Decision Analysis, the flagship journal of the Decision Analysis Society, selected Professor **Vicki Bier** as its next editor in chief, starting January 1, 2019.

Professor Emeritus **Rajan Suri** published a new book, *The Practitioner's Guide to POLCA: The Production Control System for High-Mix, Low-Volume and Custom Products. ISE Magazine* selected it as its book of the month for June 2018.

Undergraduate scholarship recipients

Victor W. Bergenthal Scholarship
Nicholas Aho, Rebecca Graven, Samantha LeBlanc

Gilbert and Genevieve Buske Scholarship
Morgan Adkins, Sophie Albert, Ryan Behm, Allison Stevens, Tyler Wambeke

John Deere Foundation Scholarship
Rachel Degardner, Andrew Trafton

Richard W. DeWitt Scholarship
Kylie Hellenbrand

Martha Helen (Bergland) and George Walker Dollmeyer Scholarship
Stephen Bosak, Zachary Bonk, Ashley Hellenbrand, Emily Laborde, Nicholas Lawrence, Adam Mitchell, Tanapat Ratanaruengjumrune, Maximilian Shakal, Allison Stevens, Huifeng Su, Cole Thomson, Andrew Trotter

Fred W. and Josephine Colbeck Scholarship
Tyler Behle, Aaron Elledge, Kendal Fasching, Elaine Jarosz

Engineering Undergraduate Scholarship
Rahul Badjatia, Byron Buck, Luis Finol, Katie Korth, Tyler Mais, Alyssa Wang, Chenyi Zhao

Carl and Henry Grotophorst Scholarship
Vedant Agrawal, Inigo Ayala Roche

Industrial and Systems Engineering Department Scholarship
Jared Langenohl, Tanapat Ratanaruengjumrune

W.G. Kirchoffer Memorial Scholarship
Nathan Sondgeroth, William Wirono

Lyons Family Fund Scholarship
Sydney Peterson

Frank and Marilyn Roberts Scholarship
Bailey Benck, Joseph Crocco

Jeanne and Thomas Snodgrass Scholarship
Morgan Adkins, Kalley Anderson

Roland E. Stoelting Scholarship
Stephanie Wu

Anthony and Alice Thistlethwaite Scholarship
Grant Tesdahl, Jacob Volcensek

Graduate scholarship recipients

Industrial and Systems Engineering Graduate Support Endowment Fund
Oguz Akkas, Ali Hajjar, Changyue Song

Rea C. and David H. Gustafson Scholarship
Sujee Lee, Yasemin Limon, Liz Scaria

Vinod K and J. Gail Sahney Scholarship
Ravi Suman

PhD student **Chao Wang** received a Gilbreth Memorial Fellowship from the Institute of Industrial & Systems Engineers in the amount of $3,500.

College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

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2018 ENGINEERS' DAY AWARD RECIPIENT

The taste of success

Rahul Shinde's career has taken him all over the globe working on major brands. Shinde (MS '01, PhD '05), the executive director of Devyani International, is ISyE's 2018 Early Career Achievement Award winner as part of the college's annual Engineers' Day celebration.

Devyani International is a major franchisee for KFC and Pizza Hut restaurants in India. Shinde previously served as managing director of KFC India and then chief financial officer of Taco Bell Global for Yum! Brands. He's worked in the United Kingdom and India, helping to drive growth and rethinking branding in both markets. He's also directed corporate strategy for JCPenney and worked for leading global consulting firm McKinsey and Company since earning his PhD.

Not only has his work led to greater operational excellence, it has provided him opportunities to develop programs through which he has helped improve the lives of disadvantaged populations and people with disabilities in India.

"I am in a position now where I feel like I can influence people's lives positively," he says. "I was fortunate to get good coaches in my early professional years, and I feel like I'm able to pay that forward. Regardless of what I do, what business I'm in, I think the ability to do that is probably the most important accomplishment. Whether this is through employment to individuals or mentoring folks to become better versions of themselves or at times just help them find themselves, it is all very fulfilling."

The college presented Shinde with his award Oct. 19, 2018, during the Engineers' Day banquet at the Discovery Building on campus.

Read a Q&A with Rahul: www.engr.wisc.edu/rahul-shinde-2018-early-career-award-recipient/

Rahul is an inspiring industrial engineer and pragmatic leader who has successfully demonstrated how systems thinking and technology can transform business, upgrade customer experience and help improve lives within communities.