College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

SPRING 2023 NEWSLETTER

MECHANICAL ENGINEERING

BRAIN POWER

Undergrads contribute to research advances

Greetings from Madison!

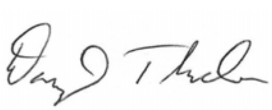
The department has a lot of updates to share with you—so many in fact that we expanded this newsletter by four pages. The most exciting update is the move of the engineering mechanics and aerospace engineering (EMA) faculty and programs from the Department of Engineering Physics to our department. This strategic move unites faculty with expertise in fluid and solid mechanics into a single department, which will enable more coordinated planning of mechanics research and educational activities for the benefit of students across the college. Eight EMA faculty—Riccardo Bonazza, Curt Bronkhorst, Wendy Crone, Jennifer Franck, Roderic Lakes, Jacob Notbohm, Ramathasan Thevamaran and Fabian Waleffe—joined the ME department in January 2023.

The EMA undergraduate and graduate educational programs should be fully integrated into the ME department by the start of the 2023-24 academic year. In addition, we also added three new assistant professors, Xiaobin Xiong, Luca Mastropasqua and Eric Tervo (who is also an ECE faculty member), bringing our faculty count to 47. I am thrilled that nearly one-third of these faculty are assistant professors, who are leading exciting new research initiatives in clean energy, robotics and data-driven mechanical engineering.

Our undergraduate ME program continues to grow, registering as the fourth-largest and sixth-fastest growing major at UW-Madison. We now have more than 1,200 students in our undergraduate ME program and more than 200 in the undergraduate EMA program; that constitutes 29% of the college's undergraduate population. I invite you to check out the student and alumni stories on our ME blog (go.wisc.edu/meblog) to learn about the great things our ME students and alumni are doing.

In addition, our research activities continue to grow and are addressing societal challenges in energy systems, sustainable manufacturing, autonomous systems and healthcare. We are excited about the future of the department and are thankful for your continued interest and support. At last fall's scholarship night, your generosity helped us keep college affordable by awarding a record $790,000 in scholarships to undergraduate ME students. It was a particularly special night as Assistant Teaching Professor Kris Dressler was present to award the first Dressler STAR Scholarship to Jude Stephenson, a talented freshman who shares the passion for engineering that Kris exhibited. While Kris passed away all too soon in December 2022, his incredible impact and legacy lives on in the countless students he mentored and with the faculty and staff who had the pleasure to work alongside him. Rest in peace, Kris.

On, Wisconsin!



Darryl Thelen
John Bollinger Chair of Mechanical Engineering
& Bernard A. and Frances M. Weideman Professor
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Accelerated Engineering Master's Programs

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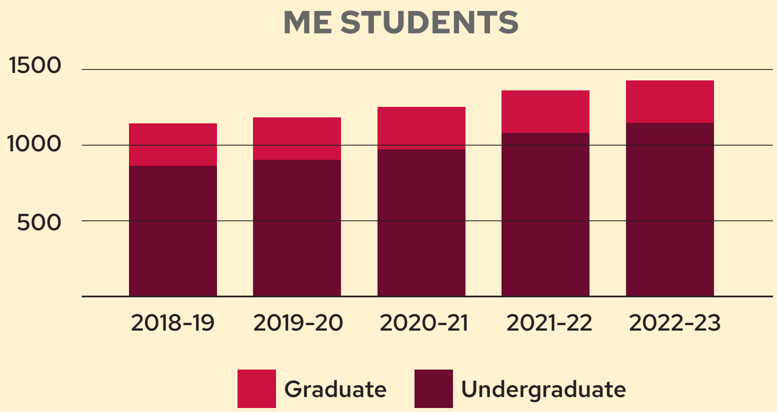
FACTS AND STATISTICS



ME SCHOLARSHIPS

$789,600
awarded to ME undergrads in 2022-23

35
awards to first-year students

54
awards to women in ME

6
Faustin-Prinz research fellows

14
STAR (Strategic Targeted Achievement Recognition) scholarships

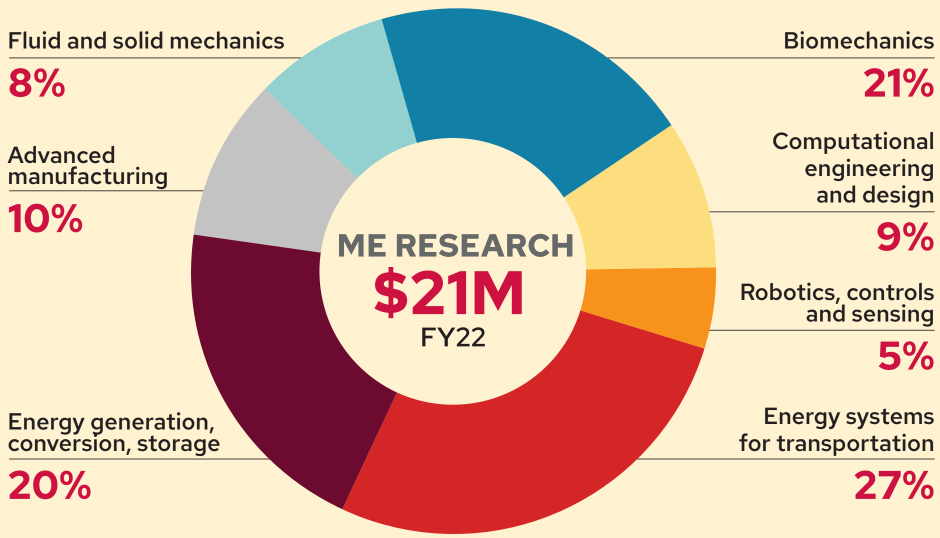
4th
largest major at UW-Madison

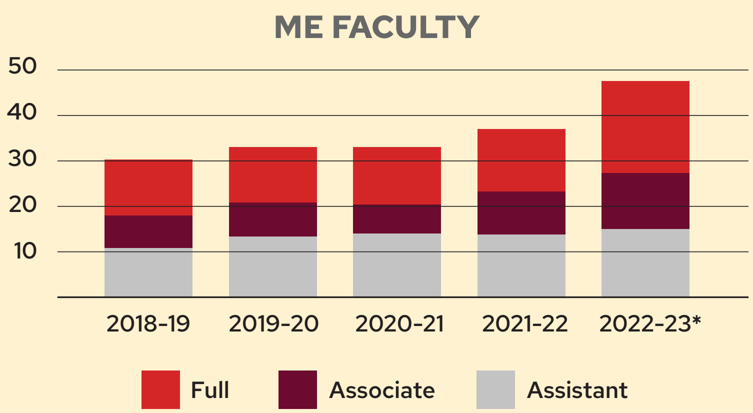
6th
fastest growing major over the last 5 years

#7
graduate ranking among public universities

#12
undergraduate ranking among public universities

$72,000
average starting salary for BSME graduates





*Includes 6 EMA faculty who moved tenure homes from engineering physics to mechanical engineering in January 2023.

8 faculty hires in '2022-23
leading new research in
- Data-driven design and simulation
- Energy storage technologies
- Robotics and autonomous systems

4 centers
- Center for Traumatic Brain Injury (new)
- Engine Research Center (ERC)
- Polymer Engineering Center
- Solar Engineering Lab

FOCUS ON NEW FACULTY

Luca Mastropasqua eyes electrochemical devices to advance decarbonization

Industrial production of steel, cement and plastics emits a significant amount of carbon into the atmosphere.

While viable options at scale for decarbonizing such industries don't yet exist, Luca Mastropasqua is leveraging his expertise in electrochemical systems to develop more sustainable solutions for industry sectors that are difficult to decarbonize.

"The production of many industrial commodities, such as steel, cement, plastics and chemicals, require molecules as feedstock, which are currently produced almost exclusively using fossil fuels," says Mastropasqua, who joined the department as an assistant professor in January 2023. "Electrochemical systems are important for decarbonizing our economy because they offer a way to produce these molecules using renewable energy sources, which would make manufacturing processes more sustainable."

The electrochemical systems Mastropasqua studies include fuel cells and electrolyzers. Fuel cells convert a fuel into electricity. Conversely, electrolyzers are devices that convert electricity into a fuel.

For example, an electrolyzer can use electricity, which is generated from renewable sources such as solar and wind, to break water into hydrogen and oxygen. "Studying electrolyzers is one of the biggest parts of my research, because there's a big push today for producing renewable fuels, including hydrogen and hydrogen derivatives such as renewable synthetic hydrocarbons, ammonia and methanol," he says. "For example, the maritime sector is very interested in using ammonia as a fuel to decarbonize ships, and low-carbon ammonia also has applications in the fertilizer and chemical industries."

Mastropasqua's research involves both experiments and computational tools. He develops new electrochemical devices and tests them in the lab to uncover ways to reduce their lifetime cost. And, with a background in system-level analysis, he uses simulations to study how the devices can be integrated into energy conversion and industrial processes.

Mastropasqua received a bachelor's degree in energy engineering and a master's degree in power generation engineering from Politecnico di Milano in Italy, as well as a master's degree in thermal power from Cranfield University in the United Kingdom. After earning his PhD in energy and nuclear science and technology from Politecnico di Milano, he was a postdoctoral researcher at Princeton University and then took a position as a senior researcher at University of California, Irvine, in the National Fuel Cell Research Center.

FOCUS ON NEW FACULTY

Eric Tervo aims to harness heat

In general, heat is the enemy of most technologies; engines and motors can fail when they overheat and computer components tend to fritz out when they get too hot. But for Assistant Professor Eric Tervo, all that excess heat is an opportunity.

Tervo specializes in developing semiconductor materials for energy conversion and thermal management. In practical terms, that means researching thermophotovoltaics, or devices that convert heat into electricity; thermoradiative cells, which convert infrared heat into electricity at night; and other technologies that harness and control heat.

For Tervo, joining UW-Madison is a homecoming. Raised in Plymouth, Wisconsin, he attended UW-Madison as an undergraduate studying mechanical engineering before completing his PhD at Georgia Tech. He then spent two years at the Southwest Research Institute in San Antonio, Texas. For the last three years, Tervo has worked at the National Renewable Energy Laboratory (NREL) in Golden, Colorado, as the Nozik Postdoctoral Fellow, which has given him wide latitude to pursue his own research.

One of his major focuses is thermophotovoltaics. While photovoltaics produce electricity when bombarded by photons of light from the sun (that's the technology behind solar panels), thermophotovoltaic semiconductors produce electricity when exposed to light emitted by nearby hot objects. These devices have many potential applications, like harnessing electricity from waste heat produced in steel or glass making, or in industrial engines or automobiles. The technology could also complement solar and wind by storing energy for use at night.

At NREL, Tervo was part of a group that improved the efficiency of thermophotovoltaic cells from 30% to 40%, making the technology commercially feasible. In fact, he is currently advising several companies hoping to bring the technology to market.

At UW-Madison, Tervo, who is both a theorist and experimentalist, will continue his work on thermophotovoltaics and also plans to push forward thermoradiative cells, which have not yet been demonstrated at the device scale.

FOCUS ON NEW FACULTY

Xiaobin Xiong wants to help robots walk off the beaten path

Moving from California to Wisconsin, Xiaobin Xiong was particularly excited to live in an area with snowy winters—although not necessarily because he loves the season.

Rather, he says Wisconsin winters will provide an ideal setting for studying how robots with legs can traverse complex, unstructured environments—such as walking on snow and ice.

His research focuses on how two- and four-legged robots move, and includes dynamic motion planning and feedback control. To study their locomotion, he uses a variety of techniques from dynamics modeling, control theory, numerical optimization and data-driven approximations.

Xiong's goal is to design motion algorithms that enable robots to walk efficiently and dynamically in a variety of real-world environments.

"It's important to study bipedal robots because the built environment we've created is designed for humans, who are bipeds," says Xiong, who joined the department as an assistant professor in January 2023. "So designing and building bipedal robots that can work in human environments will make these robots more useful. This research can also increase understanding of bipedal locomotion, which can help in developing better robotic assistive devices like exoskeletons and prosthetics for people."

In addition, Xiong says that enabling robots to walk on complex terrains, such as sand, gravel, snow and ice, could make them useful for conducting search-and-rescue operations and even exploring other planets, where walking robots could reach areas that rovers can't.

Xiong earned his bachelor's degree in mechanical engineering from Tongji University, Shanghai, China, and a master's degree in mechanical engineering from Northwestern University, where his research focused on robotic manipulation. He began his PhD at Georgia Tech, researching locomotion on granular terrain, and then transferred to the California Institute of Technology, where he joined Professor Aaron Ames' Advanced Mechanical Bipedal Experimental Robotics (AMBER) Lab. In the AMBER Lab, he worked on nonlinear control and bipedal locomotion with a robot called Cassie, which resembles a pair of robotic ostrich-like legs.

"For my PhD work, I designed the first primary algorithms for bipedal locomotion in the robot Cassie, and those algorithms turned out to be very efficient, robust and versatile," he says.

After earning his PhD, he worked as a postdoctoral researcher in the same lab prior to joining UW-Madison.

Jennifer Detlor teaches with added intention

In January 2023, Jennifer Detlor began as an assistant teaching professor—an exciting role in which she plans to focus on pedagogical research, with a particular interest in recruiting and retaining underserved students.

"Much research has been conducted on the pursuit of engineering degrees for underserved students," Detlor says. "This research is generally focused on women, students of color and low-income students. However, rural students are also vulnerable to exiting the engineering pipeline. As a first-generation college student from a small town in Wisconsin, I have particular interest in the aspiration and pursuit of engineering degrees for rural students. I plan to conduct research to better understand the challenges and barriers rural students face in realizing, pursuing and obtaining engineering degrees. In addition to this research, I plan to propose and implement programs to assist students in progressing through their programs."

In the classroom, Detlor plans to enhance clarity, incorporate relatable examples, and provide practice for students to develop intuition and confidence. "I am interested in developing interactive lectures and text, as well as the gamefication of course content," she says.

She also hopes to increase awareness that mechanical engineers work on projects with strong societal purpose and plans to develop outreach programs to schools in Wisconsin to engage students with demonstrations and discussions.

Detlor earned her PhD in mechanical engineering from UW-Madison in 2022 and was advised by Professor John Pfotenhauer and Gregory Nellis, the William A. and Irene Ouweneel-Bascom Professor. She currently teaches ME 306: *Mechanics of Materials* and will teach ME 364: *Heat Transfer* in summer 2023.

Drawing on paper, computer modeling course puts design into perspective

In ME 231, undergraduates learn perspective drawing to enable them to quickly communicate their design ideas. Above: Students Kate Nelson (left) and Madison Noe (right) work with Jay and Cynthia Ihlenfeld Associate Professor Kate Fu (center).

When Kate Fu revamped ME 231: *Geometric Modeling for Design and Manufacturing*, she knew the new hands-on drawing exercises would take many students out of their comfort zones.

After all, the students are training to be engineers, not artists.

"A lot of people think about drawing as a fine art skill, but I really emphasize to the students that this is not a fine arts class and they're not going to be graded on their fine arts abilities," says Fu, the Jay and Cynthia Ihlenfeld Associate Professor. "It's about visual communication. Being able to quickly sketch something on paper to explain what you're thinking and how it might work is a very powerful communication tool for an engineer."

It's such an important tool that the students spend the first five weeks of the course learning and practicing techniques to draw geometries in 2D perspective before they advance to using computer-aided design (CAD) software later in the course.

"One of the most important reasons perspective sketching has been integrated into the course and taught before the students learn CAD is to emphasize the importance of working out early-stage ideas on paper, before moving to a detail design tool like CAD," she says. "A lot of time can be wasted trying to work out early designs in CAD, since it requires so much more time, detail and specifications to create a design. With sketching, engineers can quickly iterate, modify and start over until they reach a design they are happy to move forward with."

Fu revamped ME 231 based on a course she developed in her former faculty role at the Georgia Institute of Technology with colleagues Julie Linsey and Denis Dorozhkin. She began teaching the new version of ME 231 at UW-Madison in fall 2022.

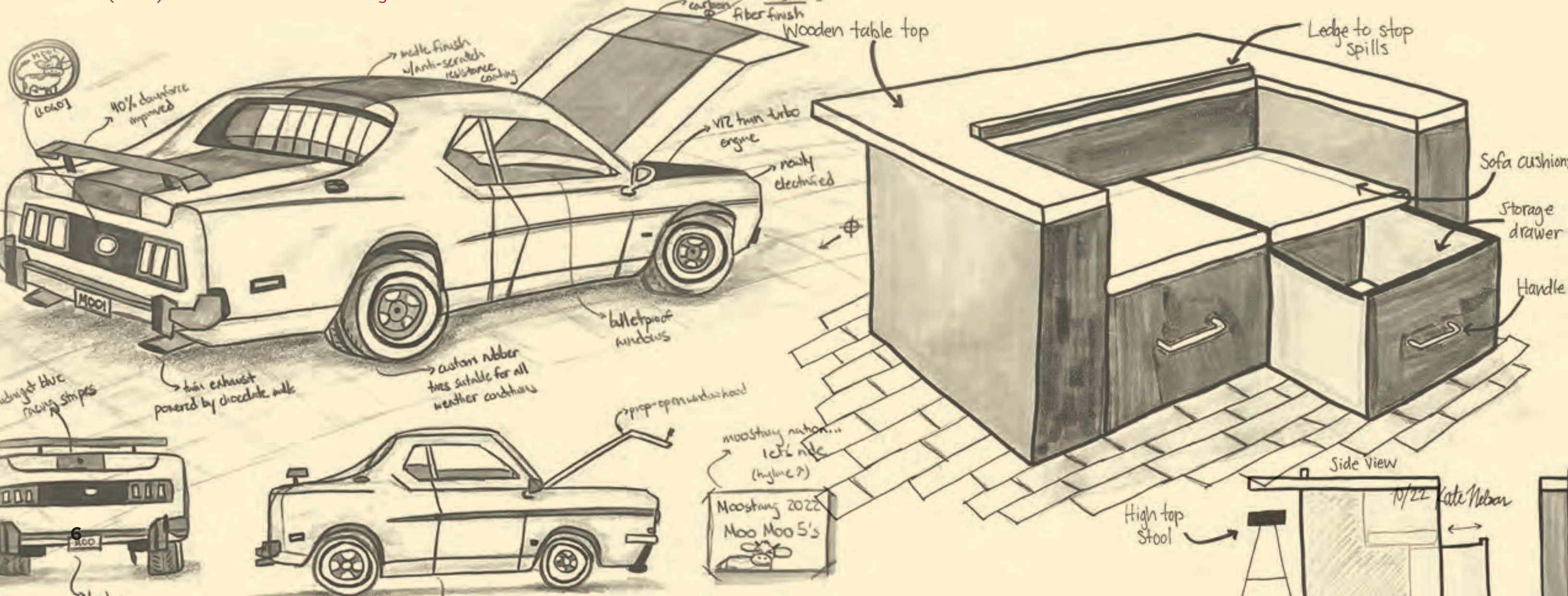
In the course, undergraduate students learn how to use the computer-aided design software SOLIDWORKS to model and create visualizations of parts for engineering purposes. Students learn the software from watching recorded video lessons outside of class, then they spend time in their lab sections doing hands-on practice with SOLIDWORKS.

Fu uses her lectures to discuss the reasons why the students are learning this material, connecting the lessons to the broader context of their engineering major and the practice of engineering. That includes helping students understand the connections between what they design and model and the capabilities and limitations of various manufacturing processes.

In updating the course, Fu's goals included expanding hands-on learning and incorporating more opportunities for creativity and open-ended design.

"I want the students to really have fun in this class," Fu says. "For many students, this

A collage of drawings by students Kate Nelson (sofa bar), Gavin Chang (car) and Madison Noe (clock) for ME 231. Submitted images.

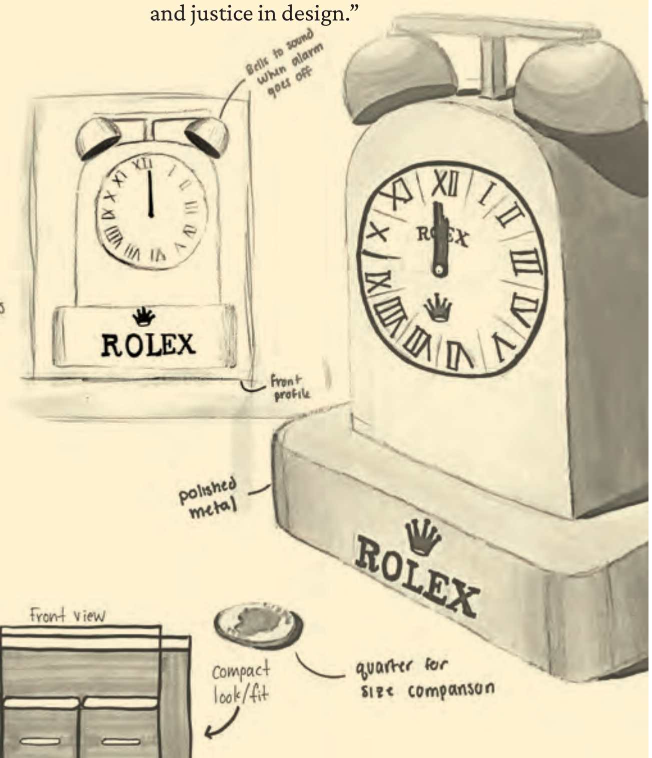


will be one of their first engineering courses, so I think it's important to set the stage to give them a good experience in engineering. A lot of attrition in terms of women leaving the major and leaving STEM happens in that first year of college, so I feel I have a great opportunity to make an impact by helping women, as well as students from all identities, to feel welcome, safe, included and valued in the major."

In place of quizzes and tests, students now work on a team modeling project. Working in four- or five-person teams, each student models at least three parts, and then all the parts need to be assembled together. Each team creates drawings, animations and renderings to showcase its designs.

Fu gives the students a lot of freedom to choose what they want to model. They can invent something new, improve on an existing product, or model something from fantasy or a concept design. It's an opportunity for the students to be creative and work on something that excites them. For example, students could model a lightsaber from *Star Wars.* Or a team of students passionate about aerospace could model a spacecraft and use the project to showcase themselves to employers as prospective interns or future full-time employees.

Fu cares deeply about diversity, equity and inclusion in engineering, and she's excited to include lectures on socially engaged design in the course. "I want the students to remember that how our work impacts real people in society is ultimately the most important part of our jobs," she says. "So I love the opportunity to teach about these issues from the perspective of diversity, equity, inclusion and justice in design."



Row, row, row your senior design project

It's not every day that college students get to work with Olympians, but it was just part of the coursework for the "Rowing Pains" senior design group.

The team's client for its project was mechanical engineering alumnus and men's rowing Olympian Grant James, who hoped 3D-printing a shell could be more cost-effective. Standard single-shell boats are expensive and time-consuming to manufacture; the Rowing Pains team hoped to 3D-print its boat for tenfold less than traditional boats.

While the jury is still out on costs, the boat floats. Team members tested their 3D-printed boat prototype in the university's Porter Boathouse in December 2022. It floated, didn't leak and sits in the water similarly to a regular single scull.

Tim Osswald, the Kuo K. and Cindy F. Wang Professor and co-director of the Polymer Engineering Center, says the team overcame process restrictions to manufacture a boat that is 27 feet long using additive manufacturing.

"The students' innovative piecewise assembly and modification of the additive manufacturing machine allowed them to create the boat," Osswald says. "The students were able to manage a new technology, machine breakdowns, bonding issues, warpage and strength issues to come up with a workable product. From the mechanics standpoint, they were able to measure the two main strength parameters that allow construction of a failure criteria that can be used in design."

The students say they were prepared to take on this design challenge. "My polymer processing coursework and mechanics of materials course played a major role in my own and the team's ability to select a material and explain why we made that choice," says John Steinbergs. "Additionally, my exposure to SOLIDWORKS throughout my undergraduate career was crucial for designing the boat hull and splitting it into printable STL files. Overall, our mechanical engineering courses laid a great foundation for problem solving and creative engineering."

Senior design team members Maggie Nunn, Jack Zacher, John Steinbergs and Ethan Foley created a rowing boat using additive manufacturing. Submitted photo.

The researchers' unique wearable sensor can help tune exosuit controllers to work effectively for individual users in various environments. Credit: Harvard Biodesign Lab.

Dylan Schmitz

Wearable sensor can help unlock the potential of exosuits in real-world environments

Wearing an exosuit could help people rehab from an injury or even give them extra oomph if they're carrying something heavy. Exosuits elicit a specific change in the wearer's biomechanics—for example, a robotic device worn on a person's ankle can be programmed to pull at just the right time during walking to potentially offload the calf muscles and Achilles tendon.

So far, creating the desired effect on an individual wearer has been challenging. There hasn't been a good way to directly measure the changes in loading on muscle and tendon tissue that occur when a person uses an exosuit. But a team of researchers from UW-Madison and Harvard University has solved that problem, employing a unique wearable sensor called a shear wave tensiometer.

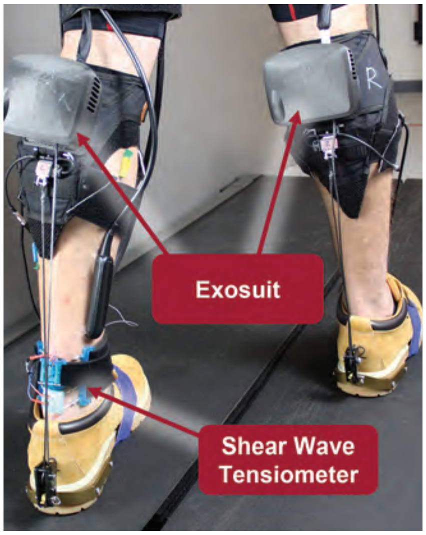
Developed by John Bollinger Chair and Bernard A. and Frances M. Weideman Professor Darryl Thelen and his collaborators, the simple, noninvasive device is easily mounted on the skin over a tendon. The tensiometer enables researchers to directly assess tendon force by looking at how the vibrational characteristics of the tendon change when it undergoes loading, as it does during movement.

The research team performed rigorous biomechanical experiments with the tensionmeter in the lab as well as outdoors to demonstrate real-world viability.

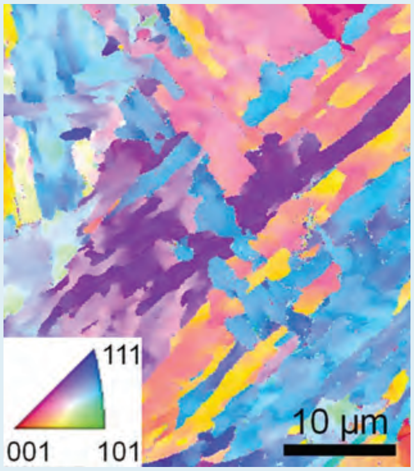
"If you want to send exosuits home with people, or if a person wants to buy one for personal use, then understanding how the exosuit performs in those real-world environments is really important," says ME PhD student Dylan Schmitz, who led the research.

The researchers' findings underscore the importance of customizing an exosuit to its user so that it can be more useful in real environments.

"Different people are going to react to an exosuit in different ways, so we can't assume that there is a one-size-fits-all exosuit controller that is going to work for everyone," Schmitz says. "Our tensiometer can be used as a powerful tool for tuning exosuit controllers to work effectively for individual users in different environments."



Credit: Harvard Biodesign Lab.



A microscopic image of 3D-printed 17-4 stainless steel. The colors of the image represent the differing orientations of crystals within the alloy. Credit: Qilin Guo.

Researchers uncover how to 3D-print one of the strongest stainless steels

Many airliners, cargo ships, nuclear power plants and other critical technologies contain a remarkably strong, corrosion-resistant alloy called 17-4 precipitation hardening (PH) stainless steel.

Now a major advance will make manufacturing this strong alloy much easier and more cost-effective. A research team that includes Charles Ringrose Associate Professor Lianyi Chen and scientists from the National Institute of Standards and Technology and Argonne National Laboratory has identified particular 17-4 steel compositions that enable them to consistently 3D print the alloy so that it has the same properties as its conventionally manufactured counterpart.

The researchers' strategy, described in the November 2022 issue of the journal *Additive Manufacturing*, is based on high-speed data about the printing process they obtained using high-energy X-rays from a particle accelerator.

The approach they used to examine the material could also set the table for a better understanding of how to print other types of materials and predict their properties and performance.

"Our 3D-printed 17-4 is reliable and reproducible, which lowers the barrier for commercial use," Chen says.

The team is patenting its technology through the Wisconsin Alumni Research Foundation.

Engineers make headway in tackling traumatic brain injuries

An interdisciplinary research initiative led by UW-Madison is emerging as a global leader in developing better technologies for detecting and preventing concussions and other traumatic brain injuries.

Christian Franck, the Bjorn Borgen Professor in mechanical engineering, started the initiative, called PANTHER, in 2017. Under his leadership, it has grown to include more than 25 principal investigators nationwide, bringing together scientists from academia, industry and government to study traumatic brain injury through a range of approaches.

"There are a lot of research programs on traumatic brain injury around the country and the world, but most of them are focused on helping people after an injury has occurred," says Franck. "We are really taking the lead on enabling advanced detection of concussions and developing improved protective gear and guidelines to help prevent these injuries."

So far, the researchers have achieved many high-impact scientific advances and made significant progress in addressing the challenges of traumatic brain injuries. In 2021, for example, they discovered a new cellular pathology for traumatic brain injury that is caused by exposure to an explosion. In his research, Franck used a unique in vitro lab setup that allowed him to mimic the effects of an explosion on neural cells. He found that the blast-like conditions produced physical injuries to the brain cells that were strikingly different from the type of brain injury caused by a fall or blow to the head.

"This was a major discovery of a new kind of injury to the brain, and it has huge implications on how the brain recovers and treatment approaches," Franck says.

Franck believes this new cellular injury pathology could be occurring in the mysterious cases of "Havana Syndrome," in which U.S. personnel serving both at home and abroad have experienced sudden onsets of concussion-like symptoms, such as severe headaches, dizziness and nausea. The researchers are investigating a hypothesis that directed microwave attacks caused the Havana symptoms by producing rapid strain on brain tissue.

They've also identified the force thresholds—the levels of brain tissue strain and strain rate—for injury in this new pathology. That baseline is crucial knowledge as they seek solutions for better detecting or preventing brain injury.

These cellular injury thresholds can, for example, be used in the high-fidelity computational models of the human head and brain that PANTHER researchers have developed. The team uses these models to simulate head impacts and predict the resulting strain in the brain tissue. Then, based on the injury threshold data, the researchers can make better predictions about a person's concussion risk.

"This is really important because traumatic brain injury can occur without symptoms or with inconsistent symptoms," Franck says. "Since we can't rely on a symptom like dizziness to indicate injury, these simulations are currently our best predictor of injury. We can measure something like a punch to the head or a soccer header and run it through the simulation to predict the response of the brain and see if a given exposure is likely to cause injury."

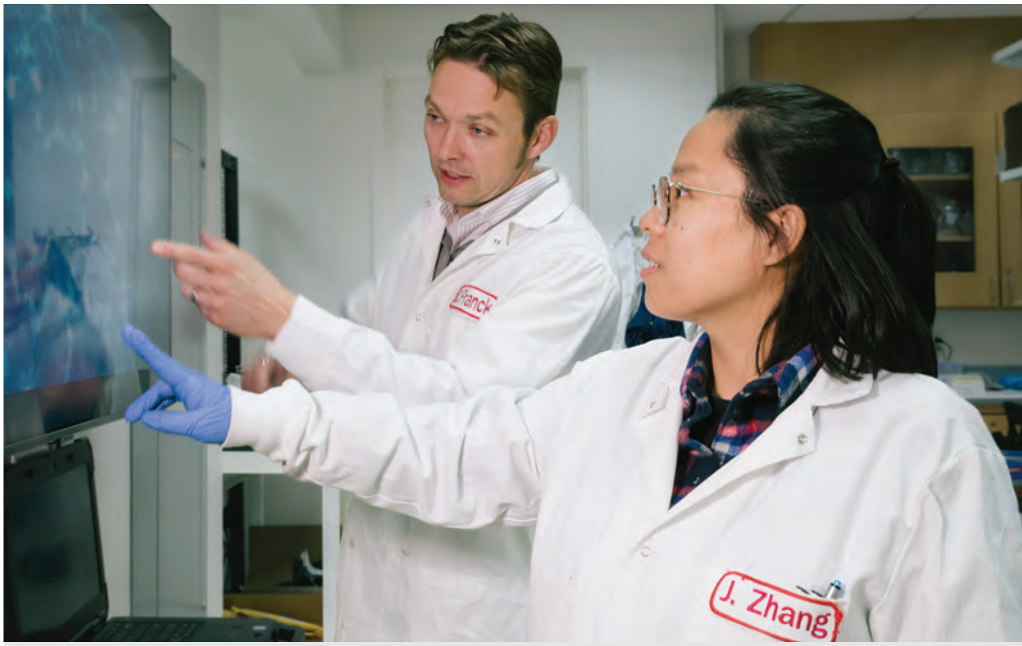
To measure impacts like soccer headers, Assistant Professor Joseph Andrews is developing advanced head sensors that can be worn like a thin headband to measure impact forces and head motion. The team also developed an algorithm that will use the sensor data to reconstruct human head motion with unprecedented resolution and accuracy.

In addition, the researchers have created a unique infrastructure for characterizing advanced helmet liner materials, including topological and structural materials, across a wide range of loading conditions and temperatures relevant to helmet use. This infrastructure is highly useful for industry partners in the program, including helmet manufacturer Team Wendy.

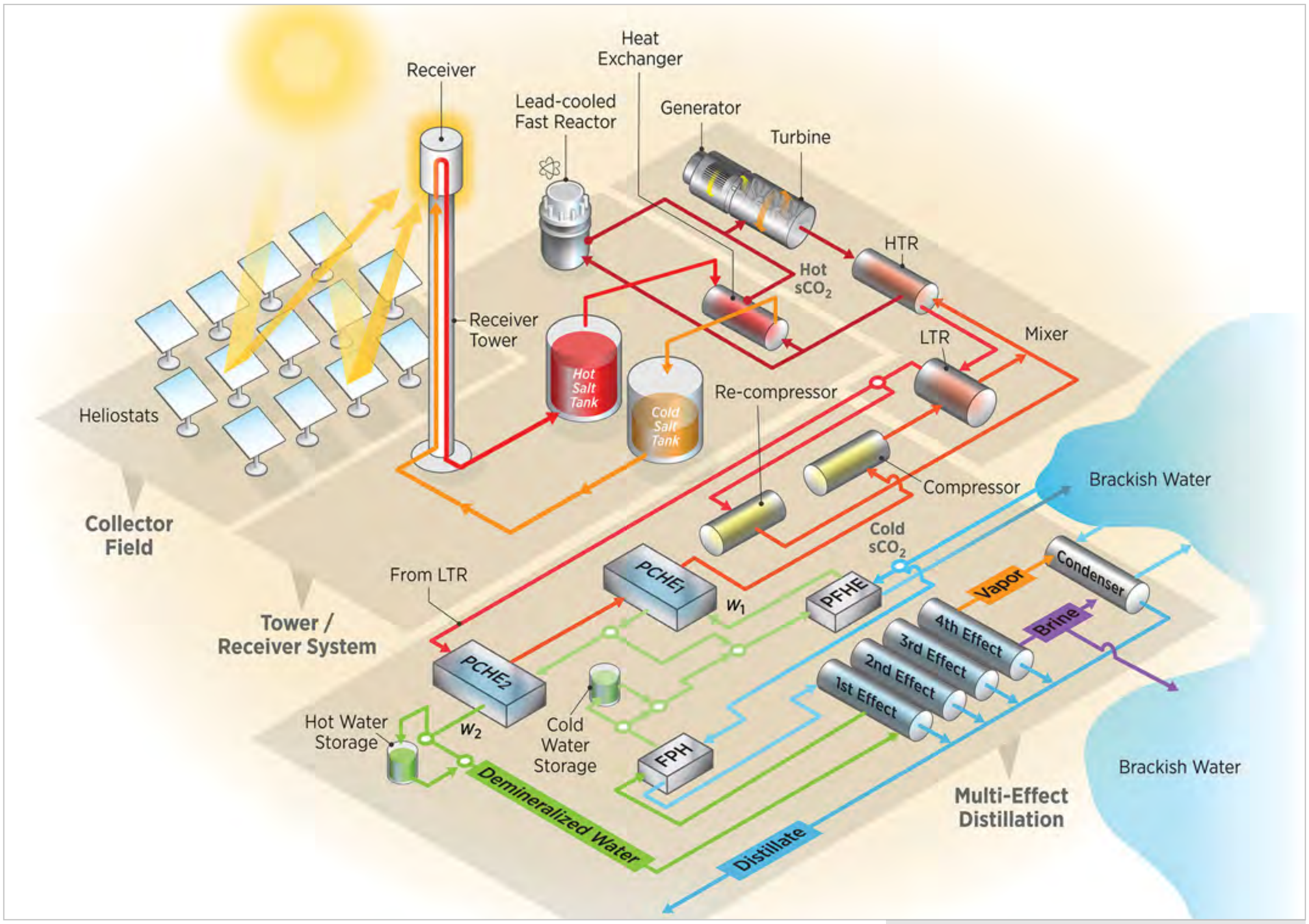
Prior to PANTHER, there was limited testing available to industry for characterizing a new soft protective material's properties compared to engineering materials like steel or concrete. Now, PANTHER researchers have developed ways to test foams to extract the important properties for material designers.

"Our framework for material testing and characterization finally allows engineers to predict helmet performance for a prescribed impact. We can now optimize helmet liners by tuning the material properties," Franck says. "This infrastructure is unique to PANTHER and unique in the world."

Recently, the U.S. Office of Naval Research awarded PANTHER nearly $5 million in new funding to advance its groundbreaking research.



Professor Christian Franck and Assistant Scientist Jing Zhang examine an image of brain cells in Franck's lab.



A graphic showing the research team's design for an integrated nuclear and concentrating solar power plant. Credit: Al Hicks, National Renewable Energy Laboratory (NREL).

Combining nuclear and solar tech could make a powerful pair

In energy policy debates, nuclear energy and renewable energy technologies are sometimes viewed as competitors.

In reality, they could be better, together.

Assistant Professor Mike Wagner, a solar energy expert, and Engineering Physics Assistant Professor Ben Lindley, an expert on nuclear reactors, are studying the feasibility and benefits of such a coupling.

In partnership with the National Renewable Energy Laboratory (NREL) and Westinghouse, they're designing an integrated energy system that combines a next-generation nuclear reactor and a concentrating solar power plant. In addition, they're developing tools and algorithms to optimize the energy production of these systems.

"With the growing use of variable renewable energy sources like wind and solar, there's increasing fluctuation in electricity prices and it's more important for energy technologies to be able to flexibly adapt their power output to match demand," Wagner says. "The challenge we're trying to solve is figuring out how to integrate a nuclear reactor and concentrating solar power in a cost-effective way that allows the entire plant to be more flexible in responding to energy markets."

In the integrated energy system, the concentrating solar power plant—specifically, its built-in thermal storage—would provide that enhanced flexibility. Concentrating solar power plants produce heat from the sun in the day, store this heat in large tanks of molten salt, and dispatch the heat as electricity when the demand is high, typically in the evening.

Lindley and Wagner created models to investigate synergies of coupling a lead-cooled fast reactor and a concentrating solar power plant in a single power cycle, with each sharing the molten salt thermal energy storage. They analyzed how a utility might go about coupling a lead-cooled fast reactor and concentrating solar power and identified configurations for doing that efficiently.

"We were able to uncover a good balance between efficiency and components synergy in this integrated energy system," Lindley says.

In other words, the two energy sources can share many components, and that can significantly reduce the capital costs. Much of the researchers' work also can apply to other advanced nuclear reactor technologies that operate at higher temperatures.

In future work, Lindley and Wagner will focus on an energy system in which an advanced nuclear reactor and a concentrating solar power plant share the same molten salt thermal energy storage.

A worldwide impact on ME education

When Professor John Pfotenhauer retires in spring 2023 after nearly 40 years at UW-Madison, he's leaving a legacy that includes a strong international study-abroad program and learning experiences that are engaging, inspiring and fun.

The eight-week summer program in China enables approximately 20 UW-Madison undergraduate engineering students to learn at Zhejiang University in Hangzhou, China. Students complete two required courses taught by UW-Madison professors while experiencing Chinese culture. Through the program, students make lasting friendships, increase their proficiency in teamwork, and broaden their understanding of how engineering happens around the world.

Photenhauer says he enjoys students' energy in the ME 370 lab course. "You get to observe many 'light-bulb' or 'ah-ha 'moments," he says. "These occur as the students revisit concepts they previously encountered as homework problems in their thermodynamics, heat transfer or fluid dynamics courses, but that now appear while they are operating a piece of equipment such as a gas turbine, air compressor, or refrigeration cycle. The concepts come to life and the students clearly enjoy the hands-on learning."

And he's extended that hands-on learning to the virtual world: In collaboration with other UW-Madison entities, Pfotenhauer developed "Cool-it," an educational game for ME 566: *Cryogenics.* A new virtual reality simulator, "ThermoVR," also is part of an NSF-sponsored project to help undergraduates in multiple U.S. universities grasp key concepts in their introductory course on thermodynamics.

College of Engineering honors elite alumni

2022 EARLY CAREER AWARD RECIPIENT

Saigopal Nelaturi
MSME '10, PhDME '11
Director of software research, Carbon

A pioneer in developing computational design tools, Nelaturi is recognized as a leader in the next generation of extreme innovators. His work in automated reasoning enables computers and people to participate as almost equal partners in the design thinking process, with each leveraging their distinct strengths to produce better engineering designs together. Previously, as research director for 3D technologies at the Palo Alto Research Center (PARC), he founded and grew a new research area that developed next-generation representation, modeling and analysis tools to support automation in systems engineering, design and fabrication.

2022 DISTINGUISHED ACHIEVEMENT AWARD RECIPIENT

James Braun
MSME '80, PhDME '88
Herrick Professor of Engineering, Purdue University

Braun has devoted his teaching and research to designing, controlling and monitoring thermal systems. That research has applications in quite a few areas—most notably, in how buildings function most effectively and efficiently to keep their occupants comfortable. He's mentored more than 100 graduate students and postdoctoral researchers and also directs the Center for High Performance Buildings. Itself a testbed, the building is full of innovative technologies that he, his graduate students and other collaborators use to study and improve building performance.

Pi Tau Sigma President Ethan Foley presents the 2022 Faculty Teaching Award to Kris Dressler. Submitted photo.

Remembering Kris Dressler

Kris Dressler, an assistant teaching professor in the department, passed away Dec. 1, 2022. Many of our students experienced the impact of his passion for engineering, innate curiosity, positive outlook, commitment to teaching excellence and adventurous spirit.

The Kris Dressler STAR Scholarship Fund has been established in his honor. The scholarship will help recruit and retain the most talented incoming students to the College of Engineering. Contribute here: supportuw.org/giveto/dresslerscholars

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Students among 2023 wind competition finalists

For the eighth consecutive year, our students will vie for top honors in the nation's most prominent undergraduate-level wind energy competition. The WiscWind team is among 13 selected for the second round of the U.S. Department of Energy's 2023 Collegiate Wind Competition, which connects undergraduate teams with industry leaders and challenges the students to design, build and test a model wind turbine.

In the competition's first round, students produced preliminary design reports for a prototype wind turbine and a hypothetical offshore wind farm site, an education and outreach plan, and a report on the relationships they established with members of the wind industry. "We have improved our designs and have worked cohesively, which is very exciting to see," says Nina Bosnjak, the WiscWind outreach coordinator.

As part of the competition's second round, finalist teams complete their prototype reports and site designs, build and test their turbines, and continue to foster connections with the wind energy industry and their communities. They'll present to judges in May 2023.

WiscWind team members Elijah Asher (left) and Michael Schmich (middle) prepare the team's model wind turbine for testing, and Nina Bosnjak (right) presents on behalf of the team at the 2022 Collegiate Wind Competition. Credit: Werner Slocum/NREL.