College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

FALL 2026 NEWSLETTER

DEPARTMENT OF

CIVIL AND ENVIRONMENTAL ENGINEERING





Greetings from Madison!

Last spring, I described the excellent progress we're making in building community among our undergraduate and graduate student communities. For this edition of the newsletter, we're highlighting our success in recruiting top-notch faculty who will continue our tradition of leading and inspiring positive change for public and environmental good.

I'm thrilled to announce that four vibrant individuals have accepted offers to join our faculty. One of them, Dr. Carolyn Voter, started this fall. Carolyn's research focuses on sustainable and resilient communities, with an emphasis on hydrologic modeling, urban ecohydrology, and green stormwater infrastructure. Carolyn is an alum of our department, and we're excited to have her back on campus.

Drs. Emily Franklin and Cathy Li will join us in January. Emily's research leverages environmental chemistry, data science, and community-based research to identify, anticipate, and mitigate the adverse effects of air pollution on community health. Cathy's research studies the human-energy-climate nexus to help develop sustainable and resilient urban futures by using earth system modeling, multi-fidelity modeling, and remote sensing.

Dr. Emma Payne will join us in Fall 2027. Her research focuses on water chemistry to improve the efficiency, resiliency, and sustainability of engineered water treatment for beneficial uses, including drinking water.

These new additions come with other faculty transitions, and I would be remiss if I did not acknowledge their contributions. Over the last three years, Professors Jim Hurley, Jim Park, and Jamie Schauer have transitioned to retirement while Professors Nimish Pujara and Jim Tinjum have found excellent opportunities at other universities. Their contributions in the water, air, and geo environments as well as alternative energy systems are much appreciated and we wish them well in their new journeys.

For over 150 years, Badger engineers have led the charge to develop creative solutions that meet our vision, integrating advancements in science, technology, and automation along the way. With your continued support and the positive momentum on here on campus, I am confident that we will continue this tradition of excellence for years to come.

On Wisconsin!

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With DOE early-career award, Hampton maps earthquake 'family trees' to understand their interconnection

Whether studying microscopic fractures in the laboratory or earthquakes in the Earth's crust, Jesse Hampton is interested in the same question: how are individual cracking events connected?

Hampton, an associate professor, says the cracks, or fractures, in rocks are "fractal." That means they tend to follow similar, branching patterns at different scales—whether that's along a sprawling, miles-long fault line or a tiny crack in a rock you can hold in your hand.

"It's kind of like a snowflake," Hampton says. "If you zoom into a very small scale on the snowflake, you'll see a pattern. Zoom out and you'll see that pattern at a bigger scale. For seismicity, if you look at the lab scale, we have microcracks, which behave similarly to natural and induced earthquakes; helping us learn a lot from lab-scale experiments."

While it's common to use those similarities to study earthquake behavior or to focus on an individual earthquake catalog consisting of datasets that include thousands of earthquakes, Hampton's research steps further by studying the connections among earthquakes. For example, one earthquake might trigger another shortly after and in the immediate vicinity. But sometimes, Hampton says, an earthquake can influence seismic activity surprisingly far away, revealing long-range stress communication through the Earth's crust.

With funding from a U.S. Department of Energy Early Career Award, Hampton is studying how tiny seismic events connect to one another and organize into larger patterns under different stress conditions. Those lab-scale events, called nanoseismicity, can mirror larger seismic systems because rock fractures behave similarly across scales. Hampton is using machine learning to identify and locate vast numbers of tiny seismic events in laboratory experiments. He then uses graph theory to determine how those events are connected and how stress propagates through rock.

Mapping these connections can reveal tree-like structures, with roots, branches and leaves that represent how seismic activity propagates through rock. Hampton says even the shapes of the trees—dense and branching like a conifer or long and sparse like a palm—can reveal information about earthquake relationships.

Hampton's research could deepen understanding of how fractures spread below the earth's surface. That could be critical for industries like geothermal energy, which circulates fluids through hot rock deep underground to extract heat, which can trigger weak earthquakes known as induced seismicity.

"Understanding these connections helps us get better at harvesting geothermal energy," Hampton says. "It helps us better understand how fractures develop and interact within geothermal reservoirs, which can ultimately improve energy production while reducing the risk of larger induced seismicity events."

Above and on the cover: PhD student Ana Paula Villaquirán Vargas checks equipment in a geological engineering lab. Vargas works with associate professor Jesse Hampton to measure how stress propagates through rocks. Photos: Joel Hallberg.

Wei developing low-cost 'first-step' method to test contaminated drinking water

Every day, water utilities across the United States monitor our drinking water for harmful pollutants. Associate Professor Haoran Wei wants to make that process more efficient.

Supported by a National Science Foundation CAREER Award, Wei is launching a research project to develop a sensor capable of detecting organic pollutants in water at trace levels—a few parts per billion, which is roughly equivalent to a few drops of water in an Olympic-sized swimming pool.

"Every water utility or public waterworks has to monitor for regulated organic contaminants before it can distribute drinking water to millions of people across the country. That is the law," Wei says.

To do this, most water utilities rely on sophisticated equipment such as liquid chromatography and tandem mass spectrometry. The equipment is expensive and requires specially trained operators. Wei says some tests can cost several hundred dollars.

Wei wants to create a test that's less than $1 per use.

He plans to develop a test that uses surface-enhanced Raman spectroscopy, a highly sensitive optical measurement technique capable of detecting contaminants at extremely low concentrations.

"Each chemical bond generates a unique Raman band," Wei says. "It's like a fingerprint. With the enhanced signal, we can detect pollutants at the parts-per-billion or sub parts-per-billion level."

Water often contains other substances, such as natural organic material, which can share overlapping Raman bands with pollutants. Wei is using a two-step learning algorithm. The first step identifies pollutants in "noisy" spectroscopy readings; the second quantifies how much is present.

If the project proves successful, Wei says he sees his scanning method fitting in as an early-use option for water utilities, rather than replacing existing laboratory tests.



"This isn't targeting replacing the standard," Wei says. "Those can get down to the low parts-per-trillion. This would fit in as a pre-screening method that can flag violation events so you could then use the standard method to determine exactly how much of a contaminant is present."

Associate Professor Haoran Wei is developing a low-cost test for drinking water. The test could function as a first step for identifying contamination in water systems. Photo: Joel Hallberg.



FOCUS ON NEW FACULTY

Voter studies water, urban infrastructure

Carolyn Voter wants to create a better picture of how water moves through the world around us.

Voter, who joined the UW-Madison CEE Department in fall 2026 as an assistant professor, is a water resources engineer who studies how water interacts with built and natural environments.

That focus surfaces in Voter's ground- and stormwater research. They can be closely connected: How a city manages stormwater can influence how rapidly water infiltrates local groundwater tables, with meaningful consequences.

For example, while several factors have contributed to recent flooding in Milwaukee, Wisconsin, one important aspect is that heavy rains can overwhelm the city's combined sewer system. Combined sewer systems merge stormwater and wastewater systems into one. When it rains, all of that water flows into the system's wastewater treatment facilities. Heavy rainfall can force the system to discharge untreated water.

A similar issue runs in the opposite direction: groundwater intrusion into the sewer system.

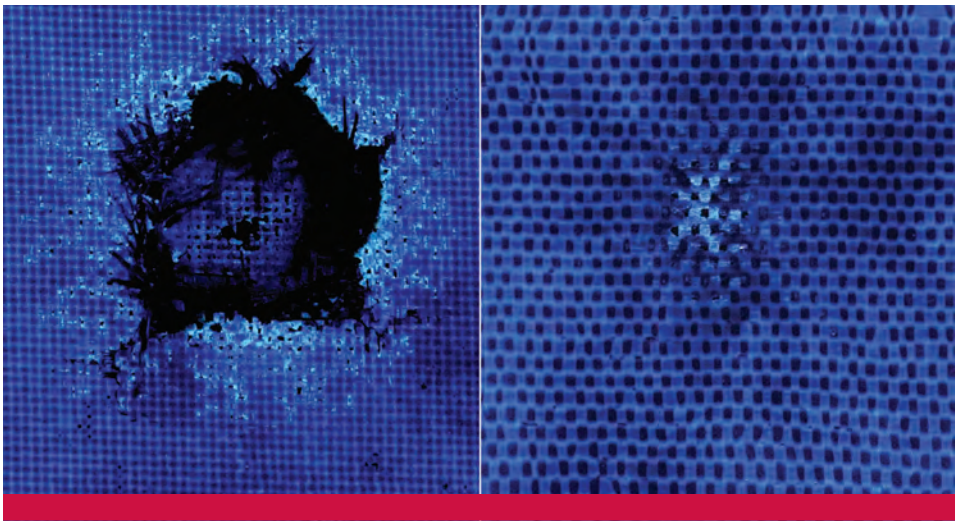
"Any sanitary sewer–combined or separate–is leaky at the best of times," Voter says. "If the groundwater rises such that the pipes are submerged, you can get infiltration into the pipes. Depending on how bad the leaks are, that can sometimes be a substantial portion of flow going into the wastewater treatment system."

Voter has been researching how to predict which locations in a sewer system are most likely to experience groundwater infiltration. There are powerful modeling tools for both stormwater and groundwater. But there isn't a tool that combines those capabilities in the way they're needed to model groundwater intrusion into sewer systems.

"One of my group's current projects is coupling the gold standards in these areas so that we can get a better look at these interactions and understand where, how and under what conditions they happen," Voter says.

Voter researches groundwater cycles over long periods and how groundwater withdrawals affect surface water ecosystems. She also studies green infrastructure and how communities can use them to meet both hydrological and social goals for stormwater management.

New Assistant Professor Carolyn Voter researches water and how it interacts with built and natural environments, such as green infrastructure in cities.



With a body-hugging fit, an innovative composite can thwart lightning damage to aircraft hulls

A team of UW-Madison engineers has designed a protective hybrid fiber-reinforced polymer composite "blanket" that could significantly reduce lightning strike damage and improve protective coverage for aircraft and other high-flying vehicles. The research published in the June 2026 issue of the journal *Composites, Part B: Engineering*.

CEE and Mechanical Engineering Associate Professor Pavana Prabhakar says the material integrates metal "yarn" within the carbon fiber fabric and can be used as a fiber-reinforced polymer composite near the surface of a structure to distribute electrical charge away from a lightning strike site.

Aircraft bodies are often made of carbon fiber-reinforced materials that are lightweight and strong, but struggle to effectively conduct electricity. Prabhakar and her students wove stainless steel yarn into carbon fiber fabric, creating two metal-infused layers laid perpendicular to each other near the surface of the composite.

The two-layer structure creates a bidirectional path that more effectively dissipates electrical charge from a lightning strike. This dissipation reduces the concentration of heat at the strike site, ultimately reducing damage and improving the functional life of a structure.

So far, testing bears that out. Prabhakar and her students measured degradation of their protective layer in the amount of weight lost from the test sample. Lower weight loss pointed to successful performance.

"This hybridization, with the metal yarns in the composite, led to better conductivity and reduced material degradation during a simulated lightning strike," Prabhakar says. "In one test case, we saw just 0.03% weight loss with this design."

The research began as a senior design project in the 2023-24 academic year under the leadership of PhD graduate Hridyesh Tewani. Four of Prabhakar's former students—Vincent Scheere, Madison Owens, Emilio Cumbajin, and Camila De Leon—initiated the work, which grew into a full research project.

This image shows the damage a non-hybrid composite material sustained from a simulated lightning strike on the left, and the damage a protective hybrid fiber-reinforced polymer composite material sustained from a similar strike. The hybrid material, designed by Associate Professor Pavana Prabhakar's group, could protect aerial vehicles from lightning strikes. Submitted photos.



Jenna Gruter wins EarlyCareer Achievement Award

Jenna Gruter has come full circle.

A little over a decade after graduating from UW-Madison with a degree in civil and environmental engineering, she has returned as a senior project manager with Findorff to help oversee the largest building project in the College of Engineering's history. Gruter is leading the construction of the nearly 400,000-square-foot Phillip A. Levy Engineering Center.

Gruter says it's easily her proudest accomplishment to date. "I never would have thought, as a student, that one day I would have the honor of helping deliver this type of facility that will inspire and educate future generations of engineers," Gruter says. "My education at UW-Madison provided me with opportunities to go places in my career, and now here I am, helping to build a new facility that's giving more opportunities for our future students."

Gruter is excited about the engineering behind the new building, which includes distinctive features such as a 122-foot cantilever on the north end and the first use of heavy timber on UW-Madison's campus.

As she leads a team of more than 300 people, Gruter says the human connections on site means just as much. "I always remember that I grew from a co-op who was eager to learn into a leader responsible for mentoring the next generation of construction professionals," she says. "That's even more true with this project. We have three co-ops right now who are UW-Madison students, and it's really cool to have the chance to mentor them as well as my own team."

For farmers, effectively filtering ammonia from manure requires the right pH



UW-Madison engineers have created a new model that sheds light on why reverse osmosis systems recover some forms of ammonia from wastewater more effectively than others.

Mohan Qin, an associate professor and corresponding author on the paper, says the research could have applications for agriculture in Wisconsin and beyond. She says the project grew out of visits to Wisconsin treatment plants where farms are already using membrane-based systems to separate water and nutrients from manure.

"We had the question of how ammonia moves in this treatment process," Qin says. "After visiting a few treatment plants, we saw that this was a question we really wanted to answer."

Water passes through thin-film semipermeable membranes during reverse osmosis. In the two-pass systems Qin studied, the first pass removed solids but was less effective at removing ammonia. The second pass adjusts the water's pH value to more effectively separate ammonia.

However, reverse osmosis does not remove all forms of ammonia equally, and until now, the mechanism for why that's the case has not been well understood. Qin collaborated with Ying Li, an associate professor of mechanical engineering at UW-Madison, to test why neutral ammonia and positively charged ammonium interact differently with reverse osmosis systems.

The study, published in the May 2026 issue of the journal *Nature Communications*, found that the neutral ammonia actually penetrates reverse osmosis membranes up to 30 times more easily than the positively charged ammonium does. They also found that the pH level in the water matters: near the neutral pH of 7, the reverse osmosis filter removed 89% of ammonia. And a pH below 8 ensures that more ammonia is present as ammonium, which is more easily stopped by the membranes.

The team combined molecular modeling with lab-scale experiments. Li says the research shows why reverse osmosis membranes are generally better at stopping charged particles than neutral ones.

Ammonia has supported global food supply and population growth for more than a century. It can be used directly as a fertilizer and is also a key component of a variety of nitrogen-based fertilizers. For decades, more than 80% of the ammonia produced in the United States has been used for fertilization, according to the U.S. Geological Survey.

Livestock manure, however, may account for as much as 60% of ammonia emissions in the United States. In manure systems, nitrogen can shift between ammonia gas and ammonium, depending on environmental conditions.

The reverse osmosis study builds on Qin's ongoing research into resource recovery from wastewater and manure. The team tested its model against both lab-made samples and real manure wastewater samples. Qin says it could eventually help farmers recover more nutrients from waste while reducing ammonia emissions.

"Right now, manure is often stored in a lagoon where water evaporates over time, and the concentrated remains are used for fertilizer," Qin says. "That process creates some problems, because it emits a lot of ammonia. Now we see more farms looking at advanced treatment processes to deal with that, and reverse osmosis is one of the most effective available methods to treat manure."

CEE Associate Professor Mohan Qin, left, discusses ammonia filtration with Ying Li, an associate professor of mechanical engineering. Photo: Joel Hallberg.

Steven Baldridge wins Distinguished Achievement Award



Steven Baldridge learned engineering lessons at the University of Wisconsin-Madison that have endured for more than 40 years.

Baldridge came to UW-Madison seeking a change of pace after two years as a student at the Illinois Institute of Technology. The College of Engineering's faculty members quickly made an impression on him. "They were great teaching professors," he says. "They wrote a lot of textbooks and started you out with theory, but a lot of the focus after that was on how you actually apply what you learn."

Few personified that approach like Civil and Environmental Engineering Professor Charles Salmon, who helped Baldridge secure a scholarship through the American Institute of Steel Construction. Salmon remained a mentor long after Baldridge graduated.

"He was easy to be around," Baldridge says. "Very down to earth. In the middle third of the semester, we'd start looking at real-world problems and how to solve them."

Those lessons proved crucial when Baldridge graduated into a difficult job market during the economic downturn of the early 1980s. He found work at a small engineering consulting practice in Chicago before shifting to attend graduate school. "My first boss was actually surprised at how well prepared I was to be in a consulting practice," he says. "That's all attributable to the University of Wisconsin."

Baldridge has responded to disasters around the world, including the 2009 earthquake and tsunami in Samoa and the 2010 Haiti earthquake. Those responses, funded by the National Science Foundation with support from the U.S. military, allowed him to assess structural failures and see communities unite after disasters.

After a decade in private practice, he founded BASE, where he has spent 30 years on projects ranging from luxury high-rises and affordable housing to Department of Defense base housing, schools and health clinics.

PROMOTIONS

CEE promotes four professors

Four CEE professors earned promotions during the 2025-26 academic year. Andrea Hicks was promoted from associate professor to full professor. Jesse Hampton, Mohan Qin and Haoran Wei were promoted from assistant to associate professor with tenure.



Andrea Hicks leads the Sustainability and Emerging Technology Research Group. Her research explores the intersections of emerging technology and sustainability through the consideration of environmental impacts. Hicks holds several leadership roles, including the Director of Sustainability Education and Research, as well as Assistant Dean for Sustainability Research and Education in the Nelson Institute.



Jesse Hampton leads the Geomechanics and Damage Group, and researches fractures from the nanoscale to earthquakes. His work spans subsurface energy, seismic risk and infrastructure monitoring with an emphasis on acoustic and distributed fiber-optic sensing. Hampton directs the STRIDE consortium, an interdisciplinary research partnership focused on using advanced sensing and data science in subsurface engineering. He has received several awards for his teaching, including the Harvey Spangler Award for Innovative Teaching and Learning Practices.



Mohan Qin 's research group, Qin Lab, focuses on sustainable resource recovery from unconventional wastewater using electrochemical and membrane processes, and detecting and managing microplastics in the Great Lakes. Qin has received the 2024 International Water Association (IWA) Membrane Technology Specialist Group (MTSG) Rising Star Award. Qin's research has been featured in Aquatic Sciences Chronicle, C&EN, Science News and on Wisconsin Public Radio



Haoran Wei leads the Environmental Analytical Technology Laboratory, where his team develops cost-effective technologies to detect emerging water contaminants, including PFAS, microplastics, and pesticides. His ongoing research includes an affordable and easy-to-use test for detecting neonicotinoids in groundwater in Wisconsin's Central Sands region. Wei is a 2026 National Science Foundation CAREER Award recipient, which supports his research on deep learning-enabled sensors for monitoring priority contaminants and safeguarding drinking water quality.

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Hiroki Sone wins 2026 Distinguished Service Award

Associate Professor Hiroki Sone has been awarded the 2026 Distinguished Service Award (Senior Level) from the American Rock Mechanics Association (ARMA) in recognition of his contributions to the organization. Sone's participation in symposium committees and seven-year involvement in organizing and delivering the educational workshop "Fundamentals of Experimental Rock Mechanics" have earned him this recognition.

Launched in 2018, the workshop serves as an educational hub, a space where both newcomers and experts may exchange knowledge and insight into the field of experimental rock mechanics. Rock mechanics apparatuses are less standardized than more common analytical equipment, so there is a gap in the foundational knowledge of how to operate and preserve these tools. Sone is bridging the gap by providing students with a chance to receive training, while also creating a space to share expertise and experience within the field. Over the years, the total number of participants has reached over 200 attendees, with around half being students.

Hiroki shares that one of his favorite parts of the workshop is the impact it has on participants. Receiving student feedback year by year is a huge motivator for Sone and the continuation of the workshop. The experience also offers valuable networking opportunities to connect with like-minded colleagues.



"Students appreciate how the tutorials cover the fundamental principles of how the experimental technology works, which is not taught anywhere else," says Sone. "I hope it can continue to be a recurring workshop organized each year and potentially become a technical committee in ARMA."

Associate Professor Hiroki Sone has been recognized by the American Rock Mechanics Association for his years of contributions to the organization. Sone, a professor of geological engineering, researches rock mechanics and geomechanics. Submitted photo.