Cullen College of Engineering
UNIVERSITY OF HOUSTON

PARAMETERS

Cullen College of Engineering Magazine • Spring 2026

FACES OF THE FUTURE:

Innovating on Campus and Beyond

Undergraduates **Zeyad Lotfy** *(left) and* **Linda Pham** *(right) are wrapping up work on their final projects in the Create@UH lab. Create@UH is a program to enhance the experience for undergrads doing course-based design projects. It provides students with real-world design projects, as well as the space and equipment needed to complete their projects.*

LETTER FROM THE DEAN

DEAR FRIENDS OF THE CULLEN COLLEGE OF ENGINEERING,

One of the things I find rewarding about serving as dean of Cullen College is that our college is constantly evolving. Each cohort of students brings new ideas, including new ways of learning and working. Demographic and population changes in the Houston area mean there are now new locations for our university to serve. And, of course, as engineering and technology fields constantly change – so does the university and the world. Nowhere is this evolution better represented than with our young faculty.

Each year, we welcome a group of faculty who bring new, emerging research areas in health, infrastructure, robotics, energy and more. They also bring new instructional methods and tools, including the growing use of AI, which we're actively learning how to integrate into our pedagogy across the college. Many of our young faculty already have impressive early careers, receiving major awards and substantial research funding.

In this Spring 2026 edition, you'll read about the unique backgrounds and exciting research areas of several of our young faculty who are making an impact in the classroom, the lab and beyond. You can also read about the most recent expansion of our UH campus in the Houston suburb of Sugar Land; an $8 million grant for nuclear fusion research; and a new state-funded $1.4 million manufacturing hub to provide small businesses with the manufacturing expertise of our faculty, students and professional engineering staff.

Thank you for taking time with Parameters Magazine to explore our UH Engineering community.

Sincerely,

Pradeep Sharma

Dean of the Cullen College of Engineering

Hugh Roy and Lillie Cranz Cullen Distinguished University Professor

CONTENTS

IN EVERY ISSUE

PARAMETERS
Parameters is published biannually by the University of Houston Cullen College of Engineering, Office of Communications.

Cullen College of Engineering

Dean of Engineering
Pradeep Sharma

Managing Editor
Carl Apple

Graphic Designer
Olga Medrano

Contributing Writers
Stephen Greenwell | Alex Keimig
Laurie Fickman | Jonathan Adams
Byran Luhn | John Lienhard

Contributing Photographers
Jaxon Lara | Jeff Lautenberger
Andrew Dees

Stock imagery provided by iStock, Shutterstock and Freepik

Contact us:
University of Houston
Cullen College of Engineering
Office of Communications
Engineering Building 2
4722 Calhoun Road, Suite E311
Houston, Texas 77204-4009

UHEngineering
@uhengineering
uhengineering
UHEngineering
University of Houston Cullen College of Engineering

Cullen College of Engineering
UNIVERSITY OF HOUSTON

IN THE MEDIA **SPOTLIGHT**

UH ENGINEER USING SATELLITES TO FIND BRIDGE CRACKS

READ ONLINE AT:

https://www.houston-chronicle.com/news

A new approach from engineers that uses extensive satellite data from the European Space Agency's Sentinel-1 could help to identify cracks in bridges as small as the width of a credit card.

Pietro Milillo, an associate professor in the Civil and Environmental Engineering Department, is part of an international team that is refining existing methods to monitor bridge stability from space. Using Sentinel-1, the team estimates that spaceborne monitoring could provide coverage for 60 percent of structures, as compared to the current inventory of less than 20 percent.

The team's findings were published in Nature Communications and amplified by coverage in The Houston Chronicle, ABC 13 and the UK's New Civil Engineer.

MAKING AI FASTER, REDUCING POWER CONSUMPTION

AI is known for its vast potential, but also the intense demand it puts on energy and water systems. **Alamgir Karim**, Dow Chair and Welch Foundation Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, has developed a thin film to address these issues.

With his former doctoral student Maninderjeet Singh, Karim is using Nobel winning organic framework materials to develop dielectric films. "These next-generation materials are expected to boost the performance of AI and conventional electronics devices significantly," Singh said. He developed these materials during his doctoral training, in collaboration with CEE professor Devin Shaffer and his doctoral student, Erin (Picton) Schroeder.

InnovationMap, a leading outlet for startup, tech and invention news in Houston, picked the story up, as well as The Houston Chronicle and The Way Ahead, an online publication of the Society of Petroleum Engineers focused on young professionals.

READ MORE ONLINE AT:

https://houston.innovationmap.com

WHILE MELATONIN PUTS US TO SLEEP, IT WAKES UP PLANTS

Melatonin, a hormone produced in the brain and reproduced synthetically in labs, is America's sleep drug of choice, taken by roughly 27 percent of U.S. adults. But in plants, it turns out the hormone wakes them up and helps them grown as a result.

"Melatonin has emerged as a pivotal molecule in agriculture due to its ability to promote plant growth and alleviate abiotic stresses," reports **Adbul Latif Khan**, assistant professor of engineering technology, in iScience. **Imad Aijaz**, a graduate student of Khan's, is the paper's first author.

While most of the research so far has focused on food and medicinal crops, Khan notes that there are immense implications for determining how melatonin helps plants survive harsh winters or adapt to changes in nature.

This news was featured on Earth.com, one of the web's leading portals for nature and science news, and trade publications like the Farmer's Journal and AG Daily.

VIEW ONLINE AT:

https://www.earth.com/news

A POSSIBLE REPLACEMENT FOR PLASTIC?

VIEW ONLINE AT:

http://houston.innovation-map.com/

In a world overrun with plastic garbage, assistant professor of mechanical and aerospace engineering **Maksud Rahman** has developed a way to turn bacterial cellulose – a biodegradable material – into a multifunctional material with the potential to replace plastic.

Bacterial cellulose has emerged as a potential biomaterial that is naturally abundant, biodegradable and biocompatible. To strengthen the cellulose and create more functionality, the team incorporated boron nitride nanosheets, and fabricated bacterial cellulose-boron nitride hybrid nanosheets with even better mechanical properties and thermal properties.

The team's findings were initially published in NatureCommunications. The news was featured on the MSN portal and InnovationMap, and republished by a variety of professional associations like the American Society of Mechanical Engineers.

View Cullen College videos online at youtube.com/UHCullenCollege YouTube

SELVAMANICKAM

ELECTED TO NATIONAL ACADEMY OF ENGINEERING

Venkat Selvamanickam Recognized for Transformative Breakthroughs in Superconductivity

BY BRYAN LUHN

University of Houston engineering professor **Venkat Selvamanickam** has been elected to the National Academy of Engineering, one of the highest professional honors awarded to engineers worldwide.

Selvamanickam is the M.D. Anderson Chair Professor of Mechanical & Aerospace Engineering and director of the Advanced Manufacturing Institute at the UH Cullen College of Engineering. He was recognized for his cutting-edge contributions to industrial-scale advanced manufacturing processes for high-temperature superconductor wires for electric power applications and their commercialization.

A globally recognized innovator in superconductivity, Selvamanickam, who earned his M.S. and Ph.D. in engineering at UH, has spent decades developing and commercializing high-temperature superconducting technologies that have transformed the energy industry. His work has helped modernize electric grids, strengthen energy resilience and accelerate the development of next-generation energy systems.

At UH, Selvamanickam has built one of the nation's premier academic programs in advanced superconducting manufacturing, securing major federal and industry partnerships to accelerate domestic production of next-generation superconductors and strengthen U.S. competitiveness in critical energy technologies. Last fall, he was awarded $8 million in federal funding to advance superconducting magnet research for compact fusion reactors — work aimed at keeping the nation at the forefront of fusion innovation.

"Year after year, Professor Selvamanickam pushes the boundaries of engineering, producing breakthrough innovations to drive society forward," said UH President **Renu Khator**. "From medical treatments to motors, his 40-year career advancing superconductor technology has significantly impacted quality of life and economic development.

> **I AM DEEPLY HONORED BY THIS RECOGNITION FROM THE NATIONAL ACADEMY OF ENGINEERING. I AM GRATEFUL TO MY STUDENTS, FELLOW RESEARCHERS AND INDUSTRY PARTNERS WHO WORK ALONGSIDE ME TO ADVANCE SUPERCONDUCTOR TECHNOLOGIES. TOGETHER, WE'RE MOVING INNOVATIONS FROM THE LAB INTO REAL-WORLD SYSTEMS THAT STRENGTHEN ENERGY INFRASTRUCTURE AND OPEN THE DOOR TO NEW APPLICATIONS.**
>
> –VENKAT SELVAMANICKAM

He personifies UH's mission to transform lives and communities and is richly deserving of this honor."

Selvamanickam is among 130 U.S. members and 28 international members in the NAE's Class of 2026. He is the 29th NAE member from UH.

"Professor Selvamanickam's election to the National Academy of Engineering shines a global spotlight on the groundbreaking work taking place in his lab and across the University of Houston," said **Diane Z. Chase**, UH senior vice president for academic affairs and provost. "Our students are learning and working alongside a true pioneer whose work is shaping the future of engineering, an experience that strengthens their education and reinforces UH's reputation as a place where breakthrough ideas and student success go hand in hand."

Election to the NAE honors individuals who have made outstanding contributions to engineering research, practice or education, including significant advances in new and developing fields of technology. Academy membership represents the pinnacle of professional achievement in engineering.

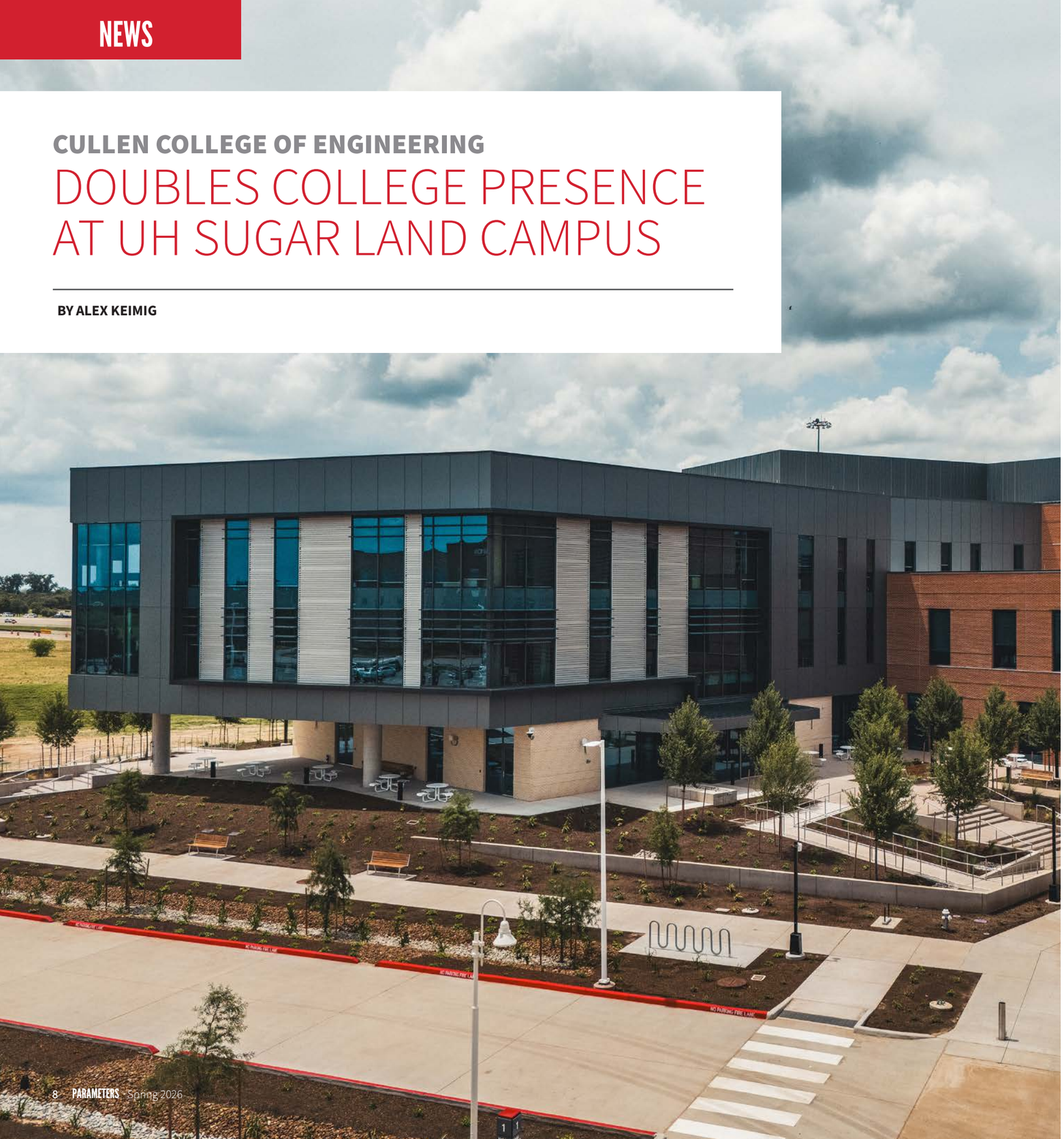
"This is a proud and defining moment for the University of Houston as it is powerful validation of the transformative work happening in our classrooms and labs every day," said Claudia Neuhauser, vice president for research at UH. "Selva's research not only advances his field, it elevates UH's standing as a leader in engineering innovation and reinforces the real-world impact our faculty and students are making on the technologies that shape our future."

Selvamanickam and the other members of the class will be formally inducted during the NAE Annual Meeting in the fall.

CULLEN COLLEGE OF ENGINEERING

DOUBLES COLLEGE PRESENCE AT UH SUGAR LAND CAMPUS

BY ALEX KEIMIG



AFTER TWO YEARS of active construction, Sugar Land Academic Building 2 – now known as Engineering 4 – officially opened its doors to programs of the Cullen College of Engineering in Fall 2025. Alongside UH System Chancellor and University of Houston President Renu Khator, Texas House Representative Suleman Lalani, officials from Rep. Matt Morgan's office and representatives of local industry, more than 120 supporters, faculty and staff of the University of Houston gathered to celebrate this grand opening with a formal ribbon cutting ceremony in October.

Sitting adjacent to Sugar Land Academic Building 1, now Engineering 3, the three-floor, 75,000-square-foot building houses state-of-the-art wet and dry laboratories, active learning classrooms, student advising facilities, lounge spaces and conference rooms.

The new construction allows 40 percent of theCullen College of Engineering to be located at UH Sugar Land and houses the Engineering Technology, Human Development and Consumer Sciences and Information Science Technology departments, which comprise a total of 10 undergraduate and seven graduate programs.

"This new building represents the next leap forward," said Pradeep Sharma, Dean of the Cullen College of Engineering and Hugh Roy and Lillie Cranz Cullen Distinguished University Professor. "By next year, UH Sugar Land will educate more than 4,000 students across 10 undergraduate degrees in engineering and technology, as well as multiple graduate programs – from biotechnology and mechanical engineering technology to information systems and cybersecurity."

UH Sugar Land is also served by a weekday shuttle during the fall and spring semesters, allowing students who are living on or taking face-to-face classes at the main campus as well as at Sugar Land to travel between the two locations as needed.

"Our students come from every walk of life. Some are single parents working two jobs. Some are freshmen in our dorms pursuing double majors. They share one goal: to use engineering to build better lives—for themselves, their families and their city," said Sharma.

"This new building will allow us to teach, research and innovate at an even greater scale. We are Houston's college of engineering—and now, very proudly, Sugar Land's."

From left to right: Jason Smith, UH System Vice Chancellor for Government and Community Relations; Durga Agrawal, UH System Board of Regents, Diane Z. Chase, UH Senior Vice President for Academic Affairs and Provost, Jay Neal, Associate Vice President and Chief Operating Officer for UH's Sugar Land and Katy campuses, Renu Khator, UH President and System Chancellor, Pradeep Sharma, Dean of the Cullen College of Engineering and Adrian Caraves, UH System Student Regent

OPENING DOORS TO SMARTER DEVICES & SAFER DRUGS

RIMER CONTROLS CRYSTAL FORMATION

BY LAURIE FICKMAN

Bending and Twisting Crystals at The Welch Center for Advanced Bioactive Materials Crystallization

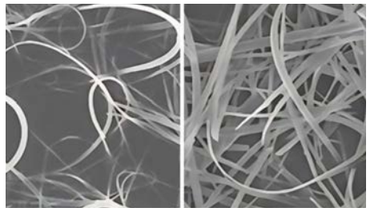
From creating flexible gadgets to better medicines, the art of bending crystals is reshaping technology and health, and at the University of Houston a crystals expert makes it look almost like a magic trick.

Jeffrey Rimer, Abraham E. Dukler Professor of Chemical Energy, has shown how to bend and twist crystals without physical force — no touching, poking or prodding and no heat or radiation, conditions typically required to achieve reshaping.

Instead, he is using a molecule called a tautomer, which is doing all the work, inducing bending and twisting of biogenic crystals.

In the world of crystals, tautomers are shifty characters — molecules with the ability to shift their atoms around. All at once a hydrogen atom might be in one place, then hop to another, while other atoms slip around.

One of the pharmaceutical applications where this will be of potential importance is in drug delivery, where approximately 30 of the top 200 drugs are tautomers.



Ammonium urate, a salt that can form kidney stones, naturally bends and twists during crystallization.

"Here, we present a unique case of natural bending without the application of external forces," reports Rimer in the journal PNAS.

Rimer's work was performed at The Welch Center for Advanced Bioactive Materials Crystallization at UH.

"This is a mechanistic investigation showing how tautomerism induces controlled, natural bending and twisting by virtue of the minor tautomer, which is a growth modifier that causes defects in the crystal structure (e.g., twins, screw and edge dislocations), leading to macroscopic effects on material properties," said Rimer.

> "OUR FINDINGS PROVIDE A GREATER UNDERSTANDING OF THE DEFECTS GENERATED DURING PATHOLOGICAL CRYSTALLIZATION OF A TAUTOMERIC MATERIAL AND HOW THIS PHENOMENON CAN LEAD TO UNIQUE BENT, TWISTED AND DENDRITIC MORPHOLOGIES OBSERVED IN BOTH BIOLOGICAL AND SYNTHETIC MATERIALS."
>
> – JEFFREY RIMER

THE IMPORTANCE OF CONTROL

Understanding and exploiting material flexibility through phenomena such as bending and twisting molecular crystals has been a subject of increased interest because of the number of applications that benefit from these properties, like optoelectronics, soft robotics, smart sensors and pharmaceuticals.

"We have shown that bending leads to physical deformations that impact dissolution, which can impact pharmacokinetics in the delivery of active pharmaceutical ingredients," said Rimer.

In the work, the Rimer team showed that the degree of curvature can be tailored based on the judicious selection of growth conditions. A combination of state-of-the-art microscopy and spectroscopy techniques were used to characterize the origin of bending.

"Our findings provide a greater understanding of the defects generated during pathological crystallization of a tautomeric material and how this phenomenon can lead to unique bent, twisted, and dendritic morphologies observed in both biological and synthetic materials" said Rimer. "The ability to selectively control this behavior opens broad avenues for crystal engineering."

Rimer's colleagues on this project are Weiwei Tang, University of Houston; **Tamin Yang**, Stockhom University; and Qing Tu, Texas A&M University.

THE WELCH CENTER

The Welch Center for Advanced Bioactive Materials Crystallization was established at UH in 2023 with a $5 million grant from the Welch Foundation. The program, open to all Texas institutions, is meant to accelerate progress in fundamental chemical research.

The center recently held a symposium that included a new industrial advisory board from eight major pharmaceutical companies. Over the summer the center held a summer crystallization camp for high school and undergraduate students.

BME RESEARCHERS AWARDED $3.6M

to Examine Retinal Diseases, Blindness

BY LAURIE FICKMAN

A team of professors and vision researchers at the University of Houston's Cullen College of Engineering has been awarded more than $3.6 million by the National Eye Institute to investigate a gene in the eye, crucial for normal vision, but when mutated causes retinal diseases that lead to blindness.

When working properly, the gene — called peripherin 2 — provides instructions for making a protein essential for shaping the outer segment of photoreceptor cells in the retina, the light sensitive structure responsible for capturing visual information. Photoreceptor cells are crucial because they convert light into electric signals that the brain interprets as images.

But when mutated, the PRPH2 gene, with more than 300 variants, can cause a spectrum of retinal disease, ranging from retinitis pigmentosa to cone and macula-predominant disorders like pattern dystrophy, cone-rod dystrophy and several forms of macular degeneration.

With it all, the underlying mechanisms of PRPH2 are not well understood.

“We want to understand how defects with the PRPH2 gene lead to eye diseases. Our main objective is to uncover the mechanisms underlying PRPH2-associated pathology, with a focus on its roles in rods and cones, the two types of photoreceptor cells in the retina," said Muna Naash, the John S. Dunn Endowed Professor of Biomedical Engineering.

Her research partner is Muayyad Al-Ubaidi, John & Rebecca Moores Professor of Biomedical Engineering.

> GAINING A THOROUGH GRASP OF THE MECHANISMS ASSOCIATED WITH PRPH2 DISEASES IS CRUCIAL FOR DESIGNING EFFECTIVE THERAPIES.
>
> – MUAYYAD AL-UBAIDI

“We will also examine how these cells are built and organized, and how proteins are transported to their outer segments,” said Naash.

With so many mutations linked to eye diseases, PRPH2 has become an important target for developing gene therapy.

“Despite considerable scientific advancement, there are still no clinically viable therapeutic options for PRPH2 retinal diseases,” Al-Ubaidi said. “Gaining a thorough grasp of the mechanisms associated with PRPH2 diseases is crucial for designing effective therapies.”

To address these knowledge gaps, Naash and Al-Ubaidi developed experimental models and various therapeutic platforms that allow them to evaluate disease mechanisms and test therapeutic strategies for PRPH2 disorders.

Human eye retinal screening

“Our focus is to further explore the biochemical properties of PRPH2 and its key binding partner, retinal OS membrane protein 1,” Naash said. “This will aid our understanding of the precise mechanisms governing PRPH2's involvement in rod and cone outer segment rim formation, an elusive goal that has long hindered the development of effective therapies.”

Addressing these previously poorly understood PRPH2-associated disease mechanisms will pave the way for future improved therapeutic strategies, said the researchers.

From right to left: Ph.D. student Hazar Amer, Al-Ubaidi, Research Professor Lars Tebbe, Naash, Lab Manager Mustafa Makia, and on the far left is Ph.D. student Ranya Khalifa.

MAE'S SELVA SECURES $8M in Federal Funding for Fusion Research

BY JONATHAN ADAMS

UH Among 23 Institutions to Receive Part of $134M from U.S. Department of Energy

The University of Houston, a global leader in energy research and innovation, will receive $8 million in federal funding to help ensure the U.S. remains at the forefront of fusion technology.

UH is one of 23 institutions around the country, and the only one in Texas, that will share part of $134 million from the U.S. Department of Energy. **Venkat Selvamanickam**, M.D. Anderson Chair Professor of Mechanical & Aerospace Engineering and director of the Advanced Manufacturing Institute, will lead research on superconducting magnets. Selva said these make compact fusion reactors possible.

"I've dedicated 38 years to advancing superconductor technology, and my goal is to unlock the full potential of this magical technology for society," said Selva, who secured UH's role in the research initiative. "Beyond fusion, superconductors can transform how we deliver power to data centers, enable highly efficient motors and generators and improve electric power devices. They also enable critical applications such as MRI and proton beam therapy for cancer treatment. I want society to experience the broad benefits this remarkable technology can provide."

The funding comes from the DOE's Fusion Energy Sciences division, which is tasked with developing an energy resource through fusion, the same type of energy the sun produces, Selva said.

The total funding is split across two initiatives: $128 million for the Fusion Innovation Research Engine and $6.1 million for the Innovation Network for Fusion Energy program.

Funding for FIRE was awarded to seven teams looking to create a fusion energy science and technology innovation ecosystem through virtual, centrally managed teams. The goal is to bridge the DOE Fusion Energy Sciences program's research programs and growing fusion industries.

Meanwhile, the INFUSE program has selected 20 projects that boost fusion energy development in businesses by removing barriers to collaboration between companies and national laboratories or universities.

The projects selected include research in materials science, laser technology development, high temperature superconducting magnet assessment, artificial intelligence for fusion modeling and simulation, and enabling technologies to move toward achieving economical fusion energy.

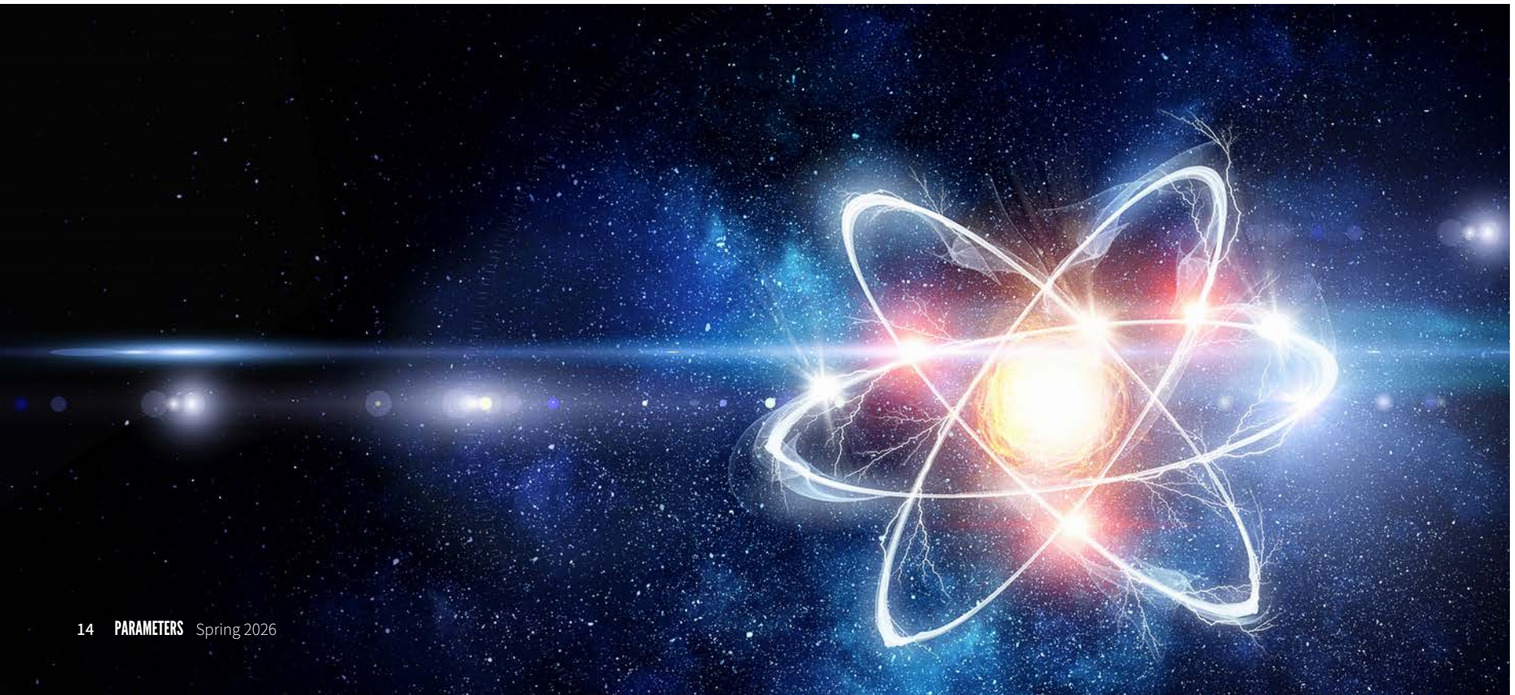
Venkat Selvamanickam

"Under President Trump's leadership, DOE is unleashing the next frontier of American energy," said U.S. Secretary of Energy Chris Wright. "Fusion power holds the promise of limitless, reliable, American-made energy — and programs like INFUSE and FIRE ensure our innovators have the tools, talent and partnerships to make it a reality."

Fusion energy isn't a new idea but progress in developing the technology has been slow. Only in the past decade have new concepts emerged to build compact fusion reactors — but their lifespan isn't ideal, Selva said.

Working with UH partners in the FIRE Collaborative, Selva aims to change that. The goal of the research is to understand why superconducting magnets in fusion reactors break down, and to develop solutions to make them more resilient.

"The advantage of fusion is it's clean and it does not require storage. Solar energy can't be used at night, and wind energy depends on wind conditions," he said. "Our goal is to make fusion a truly viable energy source."



> "I'VE DEDICATED 38 YEARS TO ADVANCING SUPERCONDUCTOR TECHNOLOGY, AND MY GOAL IS TO UNLOCK THE FULL POTENTIAL OF THIS MAGICAL TECHNOLOGY FOR SOCIETY"
>
> – VENKAT SELVAMANICKAM

LED BY CHBE'S KARIM

CULLEN ENGINEERS MAKING AI FASTER,

Reducing Power Consumption

BY LAURIE FICKMAN

Team Invents New Thin Film Materials Based on Nobel Prize Winning Methods

Addressing the staggering power and energy demands of artificial intelligence, engineers at the University of Houston have developed a revolutionary new thin-film material that promises to make AI devices significantly faster while dramatically cutting energy consumption.

The breakthrough, detailed in the journal ACS Nano, introduces a specialized two-dimensional (2D) thin film dielectric — or an electric insulator — designed to replace traditional, heat generating components in integrated circuit chips. This new thin film material, which does not store electricity, will help reduce the significant energy cost and heat produced by the high-performance computing necessary for AI.

"AI has made our energy needs explode," said **Alamgir Karim**, Dow Chair and Welch Foundation Professor at the William A. Brookshire Department of Chemical and Biomolecular Engineering at UH.

"Many AI data centers employ vast cooling systems that consume large amounts of electricity to keep the thousands of servers with integrated circuit chips running optimally at low temperatures to maintain high data processing speed, have shorter response time and extend chip lifetime," Karim said.

The solution: "Low-k" electronic material

To keep a lid on power usage while improving performance, Karim and his former doctoral student, **Maninderjeet Singh**, used Nobel winning organic framework materials to develop these dielectric films.

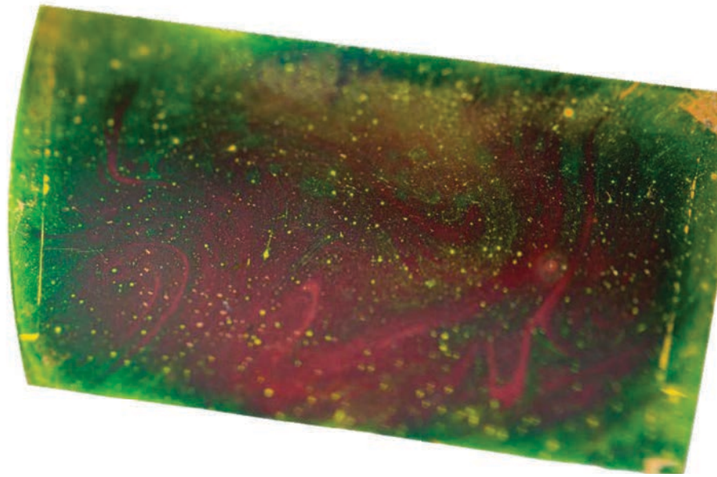
"These next-generation materials are expected to boost the performance of AI and conventional electronics devices significantly," said Singh, a postdoctoral researcher at Columbia University who developed these materials during his doctoral training at UH, in collaboration with **Devin Shaffer**, a UH professor of civil engineering and doctoral student, **Erin Schroeder**.

Not all dielectrics are created equally. Those with high permittivity, or high-k, store more electrical energy and dissipate more of it as heat than those with low-k materials. So, Karim focused on low-k materials made from light elements like carbon, known as lightweight covalent organic frameworks, which speed up signals and reduce delays.

"Low-k materials are base insulators that support integrated circuit conductors carrying high speed and high frequency electrical signals with low power consumption (i.e. high-efficiency because chips can run cooler and faster!) and also low interference (signal cross talk)," Karim said.

The team created the new material with carbon and other light elements forming covalently bonded sheetlike films with highly porous crystalline structures. Then, along with another student, **Saurabh Tiwary**, they studied their electronic properties for next generation low-k applications in devices.

"Incorporation of low-k materials into integrated circuit devices has the tremendous potential to greatly lower power consumption by the booming AI data centers growth. We discovered that the 2D sheets had an ultralow dielectric constant and ultrahigh electrical breakdown strength needed for high-voltage operation for high power devices, with good thermal stability even at elevated device operating temperatures," reported Karim and Singh.



To create the films, Shaffer and Schroeder used a method called synthetic interfacial polymerization, where molecules are dissolved into two liquids that don't mix and end up stitching molecular building blocks to form the strong crystalline layered sheets. It is a method discovered by 2025 Chemistry Nobel Prize winners Omar M. Yaghi, UC Berkeley professor of chemistry, and other Nobel colleagues.

The research was funded by the American Chemical Society's Petroleum Research Foundation New Direction program.

Professor Alamgir Karim and doctoral student Saurabh Tiwary

MILILLO, ITALIAN SPACE AGENCY CAPTURE NEW ANTARCTIC GLACIER INSIGHTS

BY LAURIE FICKMAN

A University of Houston scientist has teamed with international partners to examine how Antarctica's massive glaciers are shifting and how that could predict sea level changes. Their latest collaboration offers the most precise mapping to date in Antarctica of grounding lines, the points where glaciers lift from bedrock and begin to float on the ocean.

On Earth today, only two ice sheets, or continental glaciers, exist — one in Antarctica and the other in Greenland. Over thousands of years of snow compacting and compressing, the ice sheets formed and now cover most of the land in those areas.

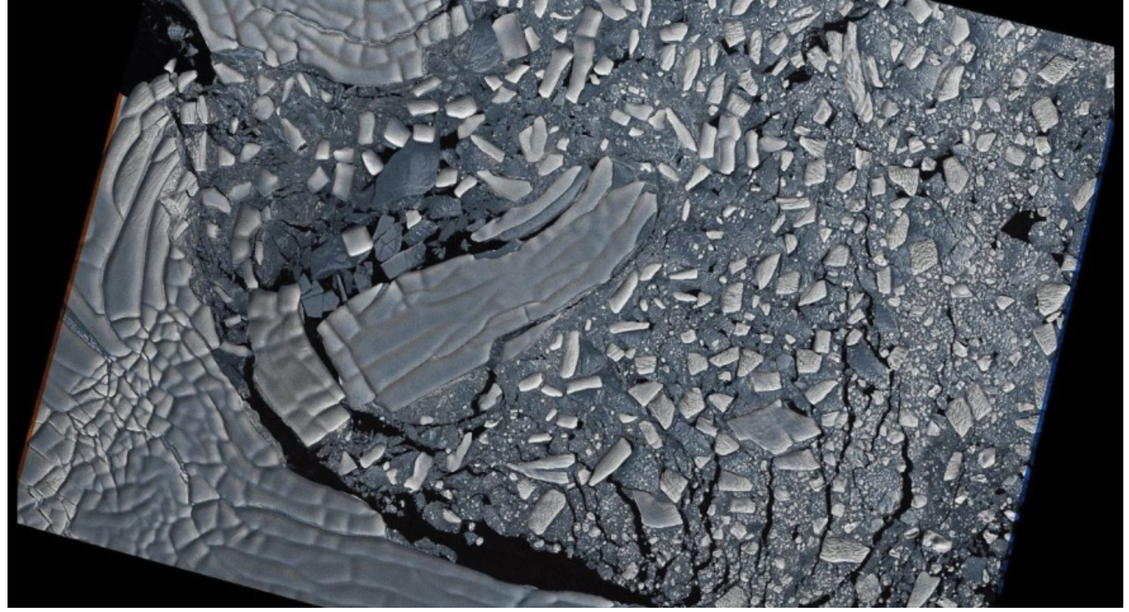
About five years ago, the Italian Space Agency began examining Antarctica's glaciers during its dedicated COSMO-SkyMed mission, meant to observe the earth using its constellation of four synthetic aperture radar satellites, first launched 17 years ago.

And now, after transcription and interpretation, these observations reveal tidal movements and retreat rates in Antarctica of up to 700 meters — or about a half mile — per year in some regions, providing an unprecedented view of glacier evolution.

Antarctica is a significant contributor to global sea level rise, with the potential to substantially increase sea level by the end of this century.

It seems a simple math problem: If the grounding line is measured as having moved inland, where glacier thickness increases, then more ice is flowing outland — or into the ocean. And the more ice into the ocean, means higher sea levels. And vice versa.

"Continuous monitoring of Antarctic evolution is important to understand ice sheet dynamics, minimizing uncertainties in sea level rise projections and develop strategies to mitigate the risks posed by rising sea leve,l" said **Pietro Milillo**, assistant professor of civil and environmental engineering. "This dataset provides the most detailed view yet of how Antarctica's glaciers are interacting with the ocean. For the first time, we can monitor fast-flowing glaciers at a continental scale using high-frequency radar observations."



COSMO-SkyMed image of Pine Island Glacier in Antarctica, which clearly shows icebergs of considerable size (the one in the center of the image is almost 9.5 miles) breaking away from the ice shelf formed by the flow of ice into the sea. Photo courtesy Italian Space Agency

Milillo and the Italian Space Agency published their findings in Scientific Data, a Nature publication.

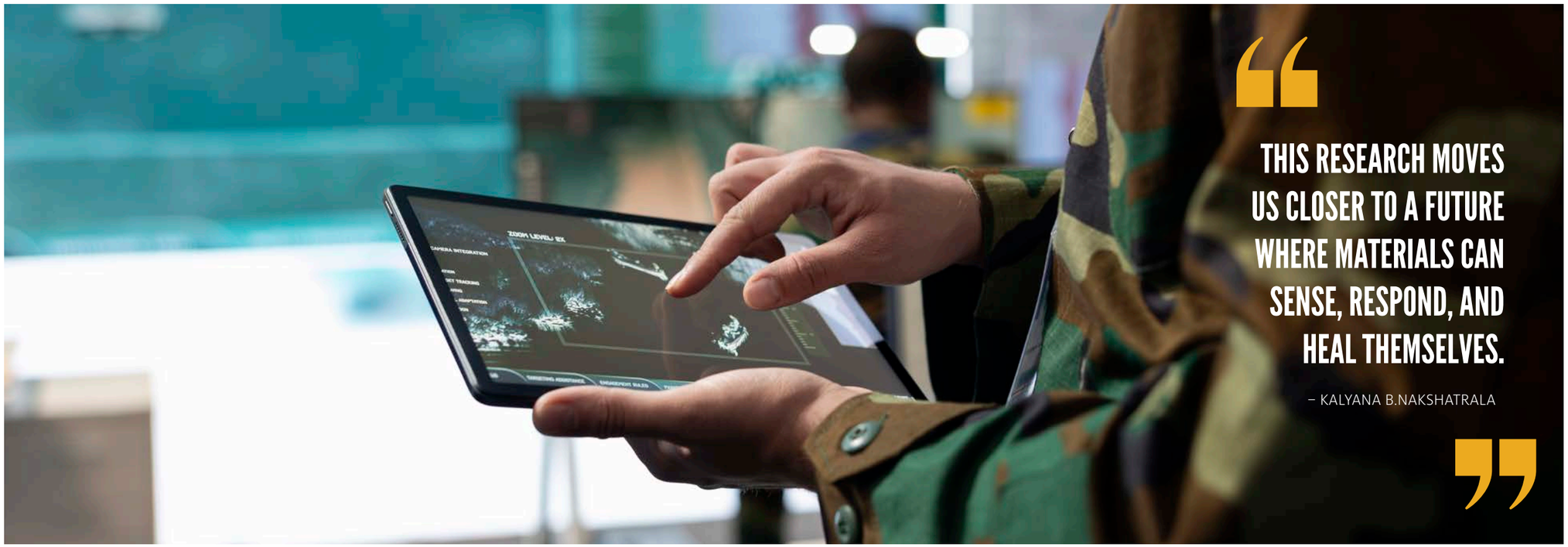
The paper presents an Antarctic grounding line dataset, manually mapped using Differential Interferometric Synthetic Aperture Radar (DInSAR) data. Over the years, various techniques have been developed for mapping grounding lines, but DInSAR stands out for its ability to operate under all weather conditions, and its proven effectiveness in continuously monitoring grounding lines and detecting their rapid migrations.

To measure tiny movements in the ice, the team analyzed 794 images from over 74 glaciers in East Antarctica, West Antarctica and the Antarctic Peninsula between July 2020 and March 2022.

"Our collaboration with NASA and the University of Houston highlights how international cooperation can advance the frontiers of Earth observation," said Luigi Dini of the Italian Space Agency, coauthor of the study. "The COSMO-SkyMed system's radar technology gives scientists a powerful lens to observe Antarctica's evolution in near real time."

The dataset fills major data gaps left by previous missions which struggled to map fast-flowing glaciers and is freely available to the scientific community.

"By partnering with the Italian Space Agency and funding by NASA, we've made these data publicly available so scientists worldwide can better understand and model how Antarctic glaciers are evolving and contributing to sea-level rise," Milillo said.



NAKSHATRALA AWARDED ARMY RESEARCH LABORATORY GRANT

for Self-Healing Materials

Imagine bridges, aircraft or military vehicles that can heal themselves after damage — much like skin repairing after a cut or bone after a break. It might sound like science fiction, but that's the future **Kalyana B. Nakshatrala**, the Carl F. Gauss Professor of Civil and Environmental Engineering at the University of Houston, is working to make commonplace.

He is teaming up with his experimental collaborator, Jason Patrick, Associate Professor of Civil, Construction and Environmental engineering at North Carolina State University, to make it happen.

Nakshatrala has received a $690,050 grant from the Army Research Office (ARO), a directorate of the U.S. Army Combat Capabilities Development Command Army Research Laboratory, to advance the development of self-healing composite materials, which are engineered structural materials that can self-repair internal damage. This dramatically extends the life and reliability of critical infrastructure.

The project, "**MEND-SCI — Mechanics and Experimental/Numerical Development of Self-Healing Composites for Military Infrastructure**," combines computational modeling and experimentation to make self-healing materials practical for real-world use. The University of Houston is the lead institution on the grant and has subcontracted a portion of the research to North Carolina State University (NCSU). Patrick serves as co-PI.

Nakshatrala will lead the development of mathematical models and predictive mechanics tools to understand how self-healing occurs in fiber-reinforced polymer (FRP) composites — lightweight materials widely used in aerospace, energy and defense applications. Patrick's lab will provide material property inputs and experimental validation to test those models and ensure they hold up under real-world conditions.

"The research community already knows how to make FRP composites heal themselves," Nakshatrala said. "In our earlier work, published in Nature Communications with Jason, we showed that these materials can successfully heal more than 100 times — something no one had achieved before. But now the question becomes: Can we capture self-healing behavior with new fracture models and predict other mechanical responses of these cutting-edge materials?"

That's exactly what the new ARO-funded project aims to uncover. The team will explore whether repeated healing introduces new kinds of failure in the material, or whether the composites can continue to perform as intended, even after hundreds of repair cycles.

"Modeling failure in composites is already challenging," Nakshatrala explained. "When we add the extra heterogeneity needed to make them self-healing, the failure modes multiply, and their interactions become far more complex. The fibers, resin, and healing agents all work together. The fibers provide strength, the resin binds, the thermally remendable polymer drives the healing, and resistive heater layers activate the process. We're trying to understand how all these parts interact. Does the material get weaker or stronger after healing? Does it fail differently the next time? We want to answer those questions from first principles so we can design more reliable, longer-lasting materials."

"This research moves us closer to a future where materials can sense, respond, and heal themselves," he added. "We're grateful to the Army Research Office for supporting our efforts to make infrastructure smarter, stronger, and more sustainable."

The implications are wide-reaching. For the Department of Defense, self-healing composites could extend the lifespan of critical infrastructure and reduce maintenance costs. Beyond military applications, the same technology could transform aerospace, energy, and civil engineering, particularly in environments exposed to extreme or unpredictable conditions.

"If we can understand how materials behave through repeated cycles of damage and repair, we can start designing infrastructure that lasts decades (or perhaps centuries) longer," Nakshatrala said. "That's the long-term vision—a world where structures can literally take care of themselves."

Nakshatrala expressed gratitude for his collaborators and colleagues.

"I'm lucky to have an excellent experimental collaborator such as Jason, who's always willing to test my wild mathematical models and mechanics theories," he said with a smile. "And I'm fortunate to be surrounded by strong mechanicians at UH, like our dean, **Pradeep Sharma**, and my department chair, **Roberto Ballarini**."

He paused, then added with a laugh, "Now, it's time to roll up my sleeves and start scribbling equations on my yellow. "

FACES OF THE FUTURE:

Cullen College Young Faculty Innovating on Campus and Beyond

Whether they specialize in areas such as robotics or disaster mitigation, in novel ways to recycle plastics or the use of AI in healthcare, Cullen College of Engineering faculty are constantly changing the face of both education and research while shaping their students into emerging leaders in engineering and beyond.

For those still early in their careers, the first few faculty years can be a whirlwind of change and opportunity. Some might be returning to teach in what was once their hometown, while others are starting fresh across the country; one assistant professor might throw himself wholeheartedly into developing solid frameworks for his curriculum, while another remains intently focused on connecting her students to high-impact research and lab opportunities. Together, they enrich our academic programs and student experiences beyond the simple sum of their parts.

In these next pages, get to know a bit more about seven of our early-career Cullen faculty members and their approaches to research, education, mentorship and innovation in engineering and beyond: what brought them to the University of Houston, why they study what they do and how they're setting their students up for success through critical thinking, hands-on learning and nonstop opportunities for discovery.

ANDREW NORDIN

BIOMEDICAL ENGINEERING

BY ALEX KEIMIG

Assistant professor of biomedical engineering **Andrew Nordin** first started his lab in kinesiology at Texas A&M University, but felt increasingly drawn to the Cullen College of Engineering's biomedical engineering program and the city of Houston. He joined the Cullen faculty in 2024 and shortly opened his newest biomechanics and neural movement control lab.

Nordin first completed his undergraduate degree in physics while competing as a track athlete, and he was interested in finding applications for his studies to human movement. He later earned a second undergraduate degree, a master's degree and a Ph.D. in kinesiology with a concentration in biomechanics.

"I became interested in neural control of movement and neuroscience, which led to my postdoctoral research in human neuromechanics and developing EEG methods for recording electrical brain activity during walking and running. This opened many research applications in multi-sensory processing during gait, including visual processing, bodyweight unloading and virtual reality," he said.

"The ceiling is very high for conducting research within the department, university and broader community, given the proximity to the many labs and researchers throughout the city and the Texas Medical Center," he continued. "[UH] students and faculty have been very welcoming and encouraging, with tremendous opportunities for collaboration and growth. It's been an exciting process to find students and collaborators to work with."

Nordin has found students to be very interested in getting involved in research "at every level, including high school, undergraduate, medical and graduate students. There's very little need to recruit when so many strong students are actively seeking out opportunities to get involved," he said.

He aims to encourage critical thinking with his students whenever possible, increasingly moving them toward independence. He finds that "aligning student interests and systematically expanding boundaries of research is fun and makes teaching and mentoring rewarding."

These expanding boundaries apply even to his own work as artificial intelligence rapidly transforms the disciplines of both education and engineering.

"Adjusting my course delivery style and assessment methods to keep students engaged and actively learning has always been necessary, but changes in how we acquire knowledge, communicate in writing and develop code for solving problems seems to have accelerated more rapidly in the last five years than the previous several decades," he said. "It's been interesting to navigate the use of AI as a learning tool and encouraging to observe students finding that AI doesn't replace critical thinking."

Still, Nordin believes that continuing to push existing lines of research forward and exploring new areas of interest is what keeps science itself interesting, both for learners and for researchers like himself.

"It's encouraging to know that we are making exciting short-term advancements, but it's fun to consider that some of the next steps are unknown," Nordin said. "Not knowing what we don't know about the future leaves great room for exploration and growth."

KELLY HUANG

MECHANICAL & AEROSPACE ENGINEERING

BY ALEX KEIMIG

Kalsi Assistant Professor of Mechanical & Aerospace Engineering **Kelly Huang** has just wrapped up her second year as a UH faculty member, and it looks like nothing will be taking the wind from her sails.

Huang attended middle and high school in the Sugar Land area, but it was during her undergraduate experience at Cornell University that she "fell in love with fluid mechanics."

"To me, it's a topic that touches so much upon our daily lives; it's how a lot of industrial processes work, but it also dictates so much of our natural environment," she said.

Knowing that she wanted to both continue her research and teach at the college level, Huang further pursued fluid mechanics and turbulence research while earning her Ph.D. at Princeton University, followed by her postdoc at the University of Notre Dame.

"That's where I started taking more of a pivot towards environmental fluid mechanics. After that, I was lucky enough to be able to secure a position at the University of Houston and come back to the area I grew up in," said Huang.

It was serendipitous: in addition to being back near family and old friends, UH offers the experimental facilities Huang would need, including a large wind tunnel, to continue her laboratory experiments in fluid mechanics. She also appreciates how involved Cullen undergraduate students are with research; as an experimentalist, Huang enjoys involving undergraduates in her lab work.

"UH has a great fluid mechanics community as well, so I have a lot of colleagues who investigate similar areas to mine, and I'm excited when we get to collaborate."

Huang describes these first few years as "very busy, but very rewarding."

"I've worked to streamline my teaching in such a way that I'm able to help my students as much as possible. Because I really enjoy teaching, I probably spend a disproportionate amount of time on my classes, but I know that going forward will be a good foundation for my future self. I'm all about increasing the signal-to-noise ratio."

When she's not busy working on class content, Huang also enjoys field experimentation: taking instrumentation out into the field, "staying there for weeks at a time to try to capture some phenomena or another."

"The last one I went on was looking for fog and turbulence interactions on a remote island off the Nova Scotia coast only accessible by boat or small airplane. It really gives you perspective when things don't go as expected; you have to pivot and figure out what to do when something malfunctions, because you don't always have the luxury of getting tech support on the phone. It's taught me a lot about staying flexible and has given me some really unique experience when it comes to teaching and mentoring."

Huang continues to look toward the future and its many unknowns with excitement.

"I'm being paid to learn, in a sense. I'm always learning new topics and trying to expand my research into different interdisciplinary areas, and I hope to continue to venture into different topics and work with new people to learn more and to help my students learn more, too."

QIN LIN

ENGINEERING TECHNOLOGY

BY ALEX KEIMIG

Engineering Technology's assistant professor **Qin Lin** has been a member of the Cullen faculty since 2024, and in that time, he has paid close attention to how students engage with and apply what they learn to become a deeply student-centered educator.

His educational background "lies at the intersection of computer science and electrical engineering," so robotics provides "a natural platform" to integrate the two disciplines.

"My research focuses on motion control for robotic systems," said Lin. "In simple terms, I aim to make robots move more safely and reliably in real-world environments."

Running a lab taught him how to build research infrastructure, support students and navigate research challenges, and the experience has strongly shaped how he approaches research, mentoring and hands-on work.

"My teaching philosophy is informed by how learning has changed in the age of AI and abundant online resources," he continued. "While students have access to many self-learning tools, the real challenge is often not a lack of information but knowing where to start and how to learn effectively. I see the instructor's role as providing clear guidance and structured learning paths tailored to students' backgrounds.

"I strongly value hands-on learning. I believe students learn best when they work with tangible systems and practical problems, where concepts become something they can see, build and test."

Lin also places a high value on this direct interaction in his own work, which he sees as much more valuable than publishing for the sake of publishing.

"I'm not someone who only works at a high level or stays in theory and stimulation. I really enjoy building things, writing code, debugging systems and working directly with hardware. Even now, I still spend a lot of time working side by side with students, in the lab or at home, iterating on robot platforms.

"For me, building robots is not just a means to publish results," said Lin. "I genuinely enjoy the process of turning ideas into working systems."

Lin received his Ph.D. from Delft University of Technology in the Netherlands before moving to the United States for a postdoctoral position at the Robotics Institute at Carnegie Mellon University. He also spent two years teaching and doing research at Cleveland State University before joining the University of Houston. He considers growing into the role of an independent Principal Investigator (PI) to be one of his biggest learning opportunities so far.

"Houston provides nearly all the resources I need to move my research forward," he said. "The first year and a half was especially busy as I relocated my research group from Cleveland and rebuilt the lab. Robotics research requires more than computers and notebooks; it depends heavily on experimental infrastructure. I am grateful to have great students who supported this transition."

> **I STRONGLY VALUE HANDS-ON LEARNING. I BELIEVE STUDENTS LEARN BEST WHEN THEY WORK WITH TANGIBLE SYSTEMS AND PRACTICAL PROBLEMS, WHERE CONCEPTS BECOME SOMETHING THEY CAN SEE, BUILD AND TEST.**
>
> – QIN LIN

ABIGAIL BECK

CIVIL & ENVIRONMENTAL ENGINEERING

BY ALEX KEIMIG

Assistant professor of civil and environmental engineering **Abigail Beck** has known from the start that she wanted to both teach and do research in her field, which made joining the Cullen faculty in early 2025 a perfect fit.

Beck's research centers around the intersection of natural hazards, structural engineering and community functionality with a focus on unlocking better decision-making and design codes to help improve community resilience. It's a unique combination of engineering and social science, and it has even inspired her to create an infrastructure decision-making board and computer game, which is being finalized for mass distribution this year.

"I did my undergraduate education at The University of Texas at Austin, so I wasn't too far away from Houston when Hurricane Harvey hit," she said. "My roommate's home flooded, and seeing the utter devastation that a lot of communities faced made that light bulb click on for me. We're seeing these hazards, and we're seeing resilient people, but can we say the same about our infrastructure? A building not falling down is very important, but there are a lot of other issues to consider when non-catastrophic failures occur too."

In graduate school, Beck had the opportunity to get involved with the NIST Center of Excellence for Community Resilience, working alongside engineers, social scientists, economists and urban planners around the issues of resilience research.

"My love for teaching also continued to blossom as I was able to mentor other students, get in the classroom and broaden some of the paradigms in structural engineering education to include resilience," she said.

"Many of these resilience issues are more complex and therefore haven't been as well-incorporated into earlier stages of the curriculum. I'm trying to figure out how we can bring appropriate levels of information to our students earlier."

Beck has greatly enjoyed her first year as a UH faculty member, describing it as both "a bit overwhelming" and "very exciting."

"In the KEEN Framework, curiosity, connections and creating value are the three Cs of an entrepreneurial mindset, and engineers with an entrepreneurial mindset transform the world. My teaching philosophy is really inspired by preparing students to know the fundamentals but also to see the broader impacts of what they're learning and to be able to apply that and take ownership of their ability to make a positive change in our world."

> MY LOVE FOR TEACHING ALSO CONTINUED TO BLOSSOM AS I WAS ABLE TO MENTOR OTHER STUDENTS, GET IN THE CLASSROOM AND BROADEN SOME OF THE PARADIGMS IN STRUCTURAL ENGINEERING EDUCATION TO INCLUDE RESILIENCE.
>
> – ABIGAIL BECK

TANIA BANERJEE

INFORMATION SCIENCE TECHNOLOGY

BY STEPHEN GREENWELL

> **I'M ESPECIALLY EXCITED ABOUT THE RAPID DEVELOPMENTS IN AI, CATALYZED BY ADVANCES IN HIGH-PERFORMANCE COMPUTING.**
>
> – TANIA BANERJEE

For **Tania Banerjee**, it wasn't just the research environment at the University of Houston's Cullen College of Engineering that ultimately convinced her to join the faculty. When she was evaluating her offers, the unique combination of Houston's strong healthcare ecosystem and her family considerations became the tipping points.

"My parents live with me, so access to excellent medical care was essential," said Banerjee, an assistant professor in the Information Science Technology Department. "Around that time, I received two faculty offers. Choosing Houston felt natural because of its outstanding healthcare ecosystem, including world-class hospitals like MD Anderson and Houston Methodist."

"Of course, I'm also very happy with my department and the University of Houston," she added. "Looking back, the timing, the opportunities, and the collaborative environment aligned in a way that felt right. The ability to work across disciplines and engage with strong partners in healthcare and data science has been incredibly supportive. There's only so much we can plan for, and in my case, everything worked out remarkably well."

That interdisciplinary environment directly supports the focus of Banerjee's research. She applies AI techniques in healthcare to analyze cellular and genomic data in collaboration with MD Anderson, with the goal of identifying correlations with disease recurrence in conditions such as cancer. She also works on predicting the success of deep brain stimulation (DBS) in patients with Parkinson's disease and essential tremor, as well as analyzing digital pathology slides to predict tumor types and patient survival outcomes.

Banerjee noted that certain computer algorithms – often described today under the AI umbrella – can identify patterns in health care data that are too complex or subtle for humans to detect on their own.

"I'm not a medical doctor, but I'm passionate about using the vast amount of health data available today to help predict outcomes or identify early warning signs," she said. "I'm also exploring cybersecurity, particularly computer network security, because it's an important area I teach at UH and one that impacts all of us in our increasingly digital world."

Banerjee pointed to two major sources for her research and academic success – the lessons she's learned from her advisors at the University of Florida, and from raising her son.

"My Ph.D. advisor, Professor Sartaj Sahni, had a tremendous positive influence on my academic life," she said. "My mentors, Professor Sanjay Ranka and Professor Anand Rangarajan, also played major roles in shaping my approach to research. From them, I learned not only the joy of discovery but also the importance of integrity and ethics in our work."

She added, "It may sound unexpected, but I've also learned a great deal from my son. Seeing the world through a child's eyes encouraged me to look deeper, beyond surface explanations and into the fundamental 'why' behind how things work."

When looking at the future of her field, Banerjee cited the continuing cross-pollination of disciplines as a promising development.

"I'm especially excited about the rapid developments in AI, catalyzed by advances in high-performance computing," she said. "The combination of these two fields is opening up possibilities that were unimaginable even a few years ago. Another emerging area that fascinates me is quantum computing. It has the potential to transform the way we think about computation altogether. I'm eager to learn more about it and hopefully contribute to the field someday."

SRIBALA GORUGANTU

CHEMICAL & BIOMOLECULAR ENGINEERING

BY STEPHEN GREENWELL

If you're asked to think about "plastics," your mind might naturally go to items you'd find at your local grocery or clothing store. But for **Sribala Gorugantu**, an assistant professor in the William A. Brookshire Department of Chemical & Biomolecular Engineering and Presidential Frontier Faculty Fellow, plastics are everywhere.

"When I speak to people about plastics, I try to begin with giving them a context about what we think about the word," she said. "We generally refer to water bottles, milk jugs or bags, things like that. But plastics have a much more significant influence in our lives, in clothing, automobiles, electronics and many other items."

Nearly every U.S. household has a green or blue bin for recycling, often made of plastic itself. The ubiquity and flexibility of plastics, and the complexity of their make-up, lead to challenges when it comes to further recycling.

"Even the plastics that we want to recycle can be difficult, sometimes because of colorants and additives," Gorugantu said. She leads the Reactor Engineering and Analytics for Complex Transformations (REACT) Lab, which integrates different approaches to study complex reactions in multiphase systems.

"We are researching different methods to chemically break down these materials into building blocks, which we can use to make new plastics and high-value chemicals. The goal is to do this in a way that uses fewer resources and makes less toxic waste, and supports a more circular use of plastics rather than a disposable one."

"Besides plastics recycling, we're exploring solvent- and temperature-controlled chemical processes that break down persistent contaminants such as PFAS [per- and polyfluoroalkyl substances] into less harmful products, and converting organic feedstocks into high-value chemicals," she added.

Cullen's reputation for chemical and biomolecular research was an important draw for Gorugantu when considering UH. **Megan Robertson**, Neal R. Amundson Professor and Director of the Materials Engineering Program, leads a $4 million grant from the Welch Foundation with a team including **Alamgir Karim**, **Ramanan Krishnamoorti** and others to transform plastic waste into useful materials.

"The department's strength in catalysis, reaction engineering and polymers was noticeable," she said. "Having colleagues with such deep expertise meant I could have potential collaboration opportunities in the department, and I could contribute to the department's growing capabilities as well … My colleagues at UH have been incredible in their support and mentorship. Starting a new lab and a teaching program is always challenging, and their support has been instrumental in helping me establish both in my first year."

Gorugantu currently serves as Co-PI on a CO2-assisted PET hydrolysis project with Linda Broadbelt at Northwestern and Ana Morais at the University of Kansas. She received a $100,000 sub-award from the original $250,000 NSF grant to Northwestern to support this work. She worked as a postdoctoral researcher for Broadbelt, a significant influence on her academic and personal development.

"Beyond the technical mentorship, she has been a personal inspiration to me," Gorugantu said. "I come from a family where women were traditionally not allowed to work or have careers, and to work alongside Linda and other accomplished women researchers showed me what was possible. That was very inspiring to me personally."

As she started her own lab, Gorugantu reflected on past experiences, especially with one advisor.

"My master's advisor in chemical engineering at the Indian Institute of Technology Madras was Vinu Ravikrishnan," she said. "I was his first student when he started his tenure track career in India. I got to help set up the new lab and I learned a lot about research infrastructure, which was very valuable when I was setting up my own lab at UH."

Going forward, Gorugantu is excited about expanding her research to consider broader impacts beyond just the chemistry.

"We are exploring collaborations to integrate lifecycle assessment along with our work on chemical process development and kinetics." she said. "We're not just asking, 'Is this chemistry going to work and what are the mechanisms?' But also, 'What are the environmental impacts? Does this make economic sense compared to existing methods?'"

Having three graduate students and a postdoc join her new lab has been both validating and motivating. These collaborations are part of what motivates her as a professor and a researcher.

"What keeps me going is the first set of students and postdocs who have trusted me in that process and signed up for a brand-new lab," she said. "That gives me confidence and motivation to support their research and build strong research fundamentals together."

JIANFENG ZHENG

ELECTRICAL & COMPUTER ENGINEERING

BY STEPHEN GREENWELL

While numerous technical advancements have been made in the fields of medicine and materials, they ultimately can't be implemented without practical, non-invasive methods. **Jianfeng Zheng**, an assistant professor in the Electrical and Computer Engineering Department at the Cullen College of Engineering, is using electromagnetics (EM) to make these advances possible.

"The complex environments I work with most often are the human body and underground (subsurface) structures. I study how electromagnetic fields interact with these complex materials," he said.

Zheng always likes to provide practical examples of research he and his team are doing. Some recent projects include:

Understanding how strong electromagnetic fields from medical equipment, especially MRI machines, interact with the human body and implantable medical devices.

Developing stable data links in or on the human body to support patient-centered healthcare.

Characterizing underground properties to help determine where petroleum may exist or whether CO_2 can be safely stored underground.

Building physics-informed AI tools to combine elegant analytical and numerical methods with the power of artificial intelligence.

Exploring how large language models can be used to build EM "agents" that assist everyday users.

"Framing it this way helps people connect the research to real-world applications," he said.

The campus environment at the University of Houston and the surrounding area, as well as the reputation of his colleagues in ECE, were what initially drew Zheng in.

"The university is home to several well-recognized experts in the EM field. Working with smart, kind, and hardworking colleagues is both exciting and motivating and it truly makes research enjoyable," he said. "I also value the fact that whenever I have a question or a new idea, I can always find someone to discuss it with."

Zheng noted that Houston was a great place to raise a family, between the warm climate, excellent food and convenient transportation networks. This is also likely why industry has flourished in the area as well.

"Houston offers tremendous industry opportunities in areas such as medicine, geophysical exploration, wireless communications and sensing," he said. "Collaborating with people on the front lines and using our expertise to benefit society is one of the most exciting things you can do in your career. To me, there is no reason not to pursue that."

When it comes to his development as a professor, a researcher and a person, Zheng pointed to different people from each phase of his life.

"My father, Chengye Zheng, worked as a small contractor, and he never did anything on science and research. But he has always deeply respected scientists and mathematicians," Zheng said. "He shaped my early understanding of how mathematics and science benefit society and gave me my initial curiosity about science."

> **COLLABORATING WITH PEOPLE ON THE FRONT LINES AND USING OUR EXPERTISE TO BENEFIT SOCIETY IS ONE OF THE MOST EXCITING THINGS YOU CAN DO IN YOUR CAREER.**
>
> – JIANFENG ZHENG

In academia, Zheng has had significant influences at before UH and now that he's at Cullen.

"I have to mention Professor Jianhua Lu, with whom I worked closely for several years at Tsinghua University in Beijing. Although he was not formally my supervisor, his leadership had a strong influence on me. He taught me how to dream big, and more importantly, how to turn big dreams into feasible research topics and concrete projects."

"At UH, from Professor Ji Chen I have learned how to respond quickly, work hard and be fearless. He emphasized the importance of taking action, not being afraid to make mistakes and learning through doing, which helped me, who is usually overthinking, a lot."

From a research perspective, like many others Zheng sees the promise in AI beyond trend-chasing. He calls its potential transforming for the way research is done.

"In my work, I use AI in two main ways. First, I apply large language models to create intelligent agents that can assist healthcare providers," he said. "These users may not have deep EM knowledge, yet they must deal with complex issues related to electromagnetic interactions with medical implants.

"Second, I use physics-informed neural networks to solve complex and unstable problems. For systems where our physical understanding is incomplete, large data sets and reference models can be extremely valuable."

"What excites me most is the feeling that I am helping improve the reasoning capabilities of AI itself, integrating human intelligence, which built our elegant scientific frameworks, with artificial intelligence, which is powerful and full of promise. Being able to work in such a disruptive and fast-moving area is something I find truly rewarding and enjoying."

UH PARTNERS WITH TMAC TO SUPPORT MANUFACTURERS IN THE GULF COAST REGION

BY STEPHEN GREENWELL

The Cullen College of Engineering has established a new partnership with the Texas Manufacturing Assistance Center (TMAC) to launch a Gulf Coast Manufacturing Assistance Center Gulf Coast TMAC at UH) — which will focus on providing small and medium-sized businesses in the Gulf Coast region with access to the professional expertise of Cullen professors, students and professional engineering staff.

The partnership became official on Sept. 1. The effort at Cullen is co-lead by **Dmitri Litvinov**, John and Rebecca Moores Professor and the Senior Associate Dean for Research and Facilities, and **Gino Lim**, Professor and the R. Larry and Gerlene (Gerri) R. Snider Endowed Chair of the Industrial and Systems Engineering Department.

TMAC is headquartered at UT Arlington and affiliated with the MEP National Network, which is overseen by the U.S. Department of Commerce's National Institute of Standards and Technology. TMAC specializes in providing small and medium manufacturing companies with help in the process optimization, supply chain, cybersecurity and regulatory arenas.

Success stories include helping Advanced Paperworks to increase their compliance to open new markets, generating $250,000 in new sales; and instituting new review standards at V&G Dynamic Machine to reduce defects by 25 percent.

Initial funding for UH is $1.4 million for two years from the State of Texas, which will, among other things, enable recruitment of professional engineering staff to support Center operations. Lim noted that Houston had unique positioning as a place of industry and logistics, identifying its status as a vital port and transportation spoke.

"The greater Houston area is the largest manufacturing hub in the State of Texas, and UH can contribute significantly to the local economy with resources made available by TMAC." Lim said. "It's about time for us to play a really big role as the hub of the manufacturing industry at the University of Houston."

Litvinov added that unlike many academic initiatives, which often have goals that can be hard to identify and track as having direct economic impact, TMAC is focused on specific deliverables and measurables tied to the success of companies TMAC at UH is to serve. Through technical service agreements and various training/educational events, TMAC will generate quantifying benefits to local businesses, while ensuring sustainable center operation.

"The focus of the Center is not necessarily papers and publications, but rather helping companies improve their bottom lines and global competitiveness," he said.

With these industry partnerships and agreements, Lim said there will be an opportunity for students as well, in the form of capstone projects and internships. Litvinov and Lim also noted that this effort aligned with a national focus to bring more manufacturing back to the U.S.

"There are for-profit consulting companies that do this type of work, but they're expensive and often out of reach to smaller businesses," Litvinov said. "The University of Houston can provide the expertise for these companies to leverage."

Lim added, "We've been talking about bringing manufacturing back to America, so this is really the right time for us to have this."

Dmitri Litvinov

Gino Lim

MAE'S ARDEBILI RECEIVES EMMY NOETHER MEDAL

FROM SOCIETY OF ENGINEERING SCIENCE

BY ALEX KEIMIG

Haleh Ardebili has received the Emmy Noether Medal from the Society of Engineering Science (SES) for her "pioneering contributions to the development of solid electrolytes for stretchable batteries and the promotion of science to the general public."

"The SES Emmy Noether medal celebrates [excellence] in engineering and recognizes Noether's fundamental contributions to the development of conservation laws which are foundational to the field of engineering sciences," said former SES president and Bill D. Cook Professor of Mechanical & Aerospace Engineering Yashashree Kulkarni.

Emmy Noether was a 20th century German mathematician and an instrumental theorist in the foundations of modern abstract algebra, and Noether's Theorem fundamentally transformed physics' understanding of the universe. She was featured by John Lienhard in an early episode (#226) of The Engines of Our Ingenuity in the late 1980s; the show still continues today under an expanded team of presenters and writers, which includes Ardebili herself.

> IT'S A PRIVILEGE TO BE IN THE POSITION TO PROVIDE BRIEF, ACCESSIBLE DISCUSSIONS RELATED TO SCIENCE AND TECHNOLOGY TO THE GREATER PUBLIC, BOTH IN HOUSTON AND BEYOND.
>
> – HALEH ARDEBILI

"I'm very honored," said Ardebili of her recognition with this award. "It's really a privilege to be selected for this inaugural award. I appreciate that my work has been recognized both on the material science side, in my research on stretching polymers and their applications to stretchable batteries, as well as the educational side, interfacing with the general public through the Engines [of Our Ingenuity] radio program. It's a privilege to be in the position to provide brief, accessible discussions related to science and technology to the greater public, both in Houston and beyond."

Ardebili's research into stretchable polymers is dual purpose: it enables the development of more sophisticated deformable batteries, which can be integrated into items such as textiles with integrated electronics like biosensors and communications technology, but it also advances overall scientific research and understanding of stretchable polymers and ion conductivity.

"There are direct applications for this technology, of course, but this problem and this question were not fully answered in science," she said. "This really sparked my curiosity, so we wanted to try to answer this open question and address a gap in the body of scientific knowledge. That's what we're really trying to do."

GAME, SET, MATCH:

MAE Grad, Student Athlete Tijerina Reflects on Years at UH

BY ALEX KEIMIG

Nicholas Tijerina

Graduating with his master's degree in aerospace engineering this week, **Nicholas Tijerina** has balanced his thesis, academics and athletics with success across the board.

Tijerina's thesis concerns conformal trailing edges. Rather than traditional linear aircraft flap hinges, Tijerina has modeled his as a fourth order polynomial, reminiscent of a bird's wing, to reduce flutter and increase performance across different configurations. In addition to working an engineering job post-graduation, he intends to bring that research to fruition going forward.
"I really want to fabricate my master's thesis into a real, physical prototype and establish my own aerospace engineering company out of what comes from it," he said.

Tijerina is also a published author, with an original research paper published in a journal of the American Institute of Aeronautics and Astronautics.

"That was a big accomplishment for me personally, because I really wanted to establish myself as a researcher and give back to the aerospace community," he said. He also had the opportunity to complete an out-of-state Air Force research lab internship, which he described as "a great experience to get out of my comfort zone and meet new people."

Tijerina has been instrumental in growing the university's wheelchair tennis program, including in his performance as half of the winning team at the 2024 ITA National Wheelchair Tennis Championships – the premier competition in all of collegiate wheelchair tennis. He reports that multiple students have now come to UH specifically to participate in its collegiate wheelchair tennis program.

"Wheelchair tennis is a big part of my life," he said. "On top of the national championship and continuing to push myself, I also plan on competing in International Tennis Federation (ITF) tournaments, and I want to become a wheelchair tennis Paralympian."

"Everybody goes through different things in trying to find their place in the community, and because I'm in a wheelchair, my difference is a bit more visible," he added. "Trying to find my community, to figure out the people I get along with most while also keeping up with school – even figuring out where to sit, because not every classroom has [accessible] seating – it just took some getting used to and took some time to fit in and accept myself."
"I want to emphasize that I couldn't do this by myself," said Tijerina. "The people around me have really shaped and molded me into the person that I am. The different experiences, the different interactions, the friendships – it has all helped me push forward and get through. I couldn't have done this alone."

"The culmination of everything I've experienced at UH has changed the trajectory of my life," Tijerina concluded. "I'm so grateful for that."

Undergraduate students Rylee Bettis (bottom right), Vivian Nguyen (bottom left), Richard Witek (top left) and Christian Garcia (top right)

UH TEAM TAKES FIRST PRIZE

in VIVERSE Global Hackathon

BY ALEX KEIMIG

Two UH-based teams recently took top honors in the VIVERSE Spark 2025 Global Hackathon – a worldwide challenge for university teams passionate about immersive tech, digital storytelling and game design to build within VIVERSE and compete for cash prizes. Their entries were ranked among others submitted by 400 students from 40 universities around the globe.

The Knight Watcher, by digital media undergraduate students **Rylee Bettis**, **Vivian Nguyen**, **Richard Witek** and **Christian Garcia**, took first place in the Immersive Storytelling category. The team was awarded a First Prize cash award of $5,000.

"We approached this as both an Augmented and Virtual Reality [class] assignment and an opportunity to challenge ourselves creatively," said Nguyen. "The competition encouraged teams to focus on innovation, storytelling, and how well their experience fit within VIVERSE's immersive platform. Knowing this helped us shape our project so it would be engaging, atmospheric and easy for players to understand quickly."

The team came together by chance: Garcia and Nguyen were first randomly assigned as in-class project partners, as were Bettis and Witek, and it was Garcia's and Betiss's previous collaboration experience that brought all four students together for The Knight Watcher.

"None of us expected to win. It took a moment for it to sink in; there was a mix of excitement, surprise and disbelief because we knew how fast the timeline was and how much we were figuring out along the way. Overall, it felt really rewarding to see that the work our team put in, especially the atmosphere and visual style, connected with the judges in such a big way," she added.

"Individually, it was important because it showed us what we were capable of when we combined our strengths under pressure. As a team, we all feel like this project came at a really meaningful time for us: most of us are getting close to graduating, so having something like The Knight Watcher to add to our portfolios is genuinely helpful. Even though the hackathon started as a class requirement, it ended up becoming a piece of work we're proud of, and something that shows what each of us can do.

Betiss's art direction, Nguyen's story work, Witek's 3D modeling and Garcia's programming came together to make a single atmospheric and cohesive product, and now each team member is taking what they learned with The Knight Watcher into their next steps, whether job applications, other classes, or future creative work.

"The experience definitely helped us grow and gave us something strong to show as we get ready for life after graduation," Nguyen said.

VIVERSE Head of Growth Andranik Aslanyan reported that this year's diverse competitors submitted "amazing projects," and that VIVERSE "definitely plan[s] to hold more going forward."

"It's great to see the creativity come alive from these students and to have a place where they can put their projects out there to live forever, and it's a great way for them to build up their portfolios and build projects that have a true outlet – to get public eyes on these projects outside of the university," Aslanyan said.

Axolotl Adventure, by digital media undergraduate student **Katelyn Shapiro** and education graduate student **Garrett Ward**, was named the honorable mention in the Games category. In this game, the player – an axolotl – must complete a series of quests to help fellow characters. Although the Axoltol Adventure team didn't receive a cash prize, Shapiro was "very proud that [the] game received recognition."

"We, especially Katelyn, worked hard to create an engaging and well-structured interactive experience," Ward said. "Though I believed in our success, I did not anticipate receiving such recognition among a large and highly competitive group of development teams from around the world."

"As an educational game designer, this event provided a valuable opportunity to practice my craft alongside a like-minded and talented colleague," he continued. "Katelyn and I are both part of the University of Houston's AR/VR research lab, CougAR Lab, where we aimed to develop something together for the lab's development team efforts. The VIVERSE competition was the perfect opportunity to collaborate."

As a TA for associate professor **Tony Liao's** Augmented and Virtual Reality course, Shapiro enjoyed seeing all of the student projects come together while she and Ward worked on their own in parallel.

"I believe the University of Houston is on the verge of becoming a leader in AR, VR, and game development, perhaps establishing Houston as a central hub for these industries. The talent and potential within our city and university are evident in the successes of our passionate students, faculty, and colleagues working in these fields," said Ward.

Thy Mitchell

MITCHELL PARLAYS DEGREE, TRAVEL INTO HOSPITALITY GROUP

BY STEPHEN GREENWELL

Having grown up around restaurants and working in one owned by her family, **Thy Mitchell** hadn't planned on getting involved in that industry when she decided to attend the University of Houston for her consumer science and merchandising degree.

At the time, she was working in higher-end retail stores – Tootsies and Tiffany & Company – and wanted to explore retail management programs. The networking and versatile education that UH provided turned out to be fruitful for her.

"I actually met a recruiter from Target on campus. I wasn't trying to interview with the company, but we really connected," she said. "I graduated and joined the management program at Target because it gave me an opportunity to oversee more than 50 employees at a young age in a high revenue environment. I felt like the school just gave me a lot of different opportunities."

She has continued to use her degree and the skills learned at UH with Traveler's Collective, the retail and hospitality group she owns with her husband Matthew. This includes Traveler's Table, a restaurant serving curated global cuisine in an upscale, full-service environment; Traveler's Cart, a hip, casual concept serving modern, global street food; and Foreign Fare, a travel apparel line for the stylish, modern traveler.

"We like to say we're upscale, but not uptight," Mitchell said of the company's greater aesthetic.

It was Matthew who first broached the idea of opening a restaurant, and given her background in the industry, Mitchell knew she had to be clear about what that really meant. Having worked at The Fish in Houston, and before that in her own family's restaurant, she understood firsthand the workload and challenges involved. While Thy was initially hesitant, she ultimately came on board, drawn by the opportunity to run businesses that combined their passion for food and travel.

"Customers were probably wondering why this 12-year-old was a food runner," she said, laughing, referring to her experiences at family restaurants. "Eventually, my mom taught me how to work the cash register, work the front of house and just do all the things. We even had beds in the back. If my mom was working and I was tired, and we couldn't go home yet, I could take a nap on one of those and I thought it was fun, right? Looking back now, I'm like, 'Oh, that's a little extreme,' knowing how things operate now."

The inspiration for the restaurants came from a mixture of their professional backgrounds and personal interests. After Target, Mitchell went from operations to human resources, working with Hilton. She met Matthew and they bonded over a love of international travel, which blossomed into a relationship, a marriage and then their business partnership. Their goal was an experience that was subtle and felt organic, as opposed to being like a theme park or having a flashy presentation. They wanted people to explore the world through food and drink with them.

"If we're both passionate about this, let's do it together," she said. "Let's give it a try, but I'm going to stay in my corporate job for the first few years just to make sure it works, and work at the restaurant as well. And then, eventually, we were steadily busy and we knew this was going to work, and we both went all in."

The proximity of the University of Houston to her family's home in Clear Lake was part of the appeal for Mitchell. Her family moved to the Houston metro area after her father accepted an engineering position with NASA. While her coursework provided a solid foundation in logistics, she emphasized that nothing replaces on-the-job experience, and it was through working that she quickly learned the skills that truly shaped her career.

> "...I'M OPEN TO TAKING DIFFERENT ROUTES AND TRYING OUT WHAT I LIKE AND WHAT I DON'T LIKE.' THAT MINDSET HELPED ME GET PROMOTED FASTER, TO BE MORE RESILIENT, TO LEARN FASTER."
>
> – THY MITCHELL

"Sometimes people think, 'Oh, I'm getting a degree in this, and then this is what I'm going to do right after,' and life will humble you quickly," she said. "I was always very open minded of the path. I thought to myself, 'I'm going to get there one day to the level of success that I would like, but I'm open to taking different routes and trying out what I like and what I don't like.' That mindset helped me get promoted faster, to be more resilient, to learn faster. You don't have to know everything. You just have to be a quick learner. You have to just listen to and observe things around you."

She cited **Shirley Ezell** and **Marcella Norwood**, both now with professor emeritus status, as being key in her academic development. Professionally, Robert Blom at Hilton gave her the job opportunity she doesn't forget.

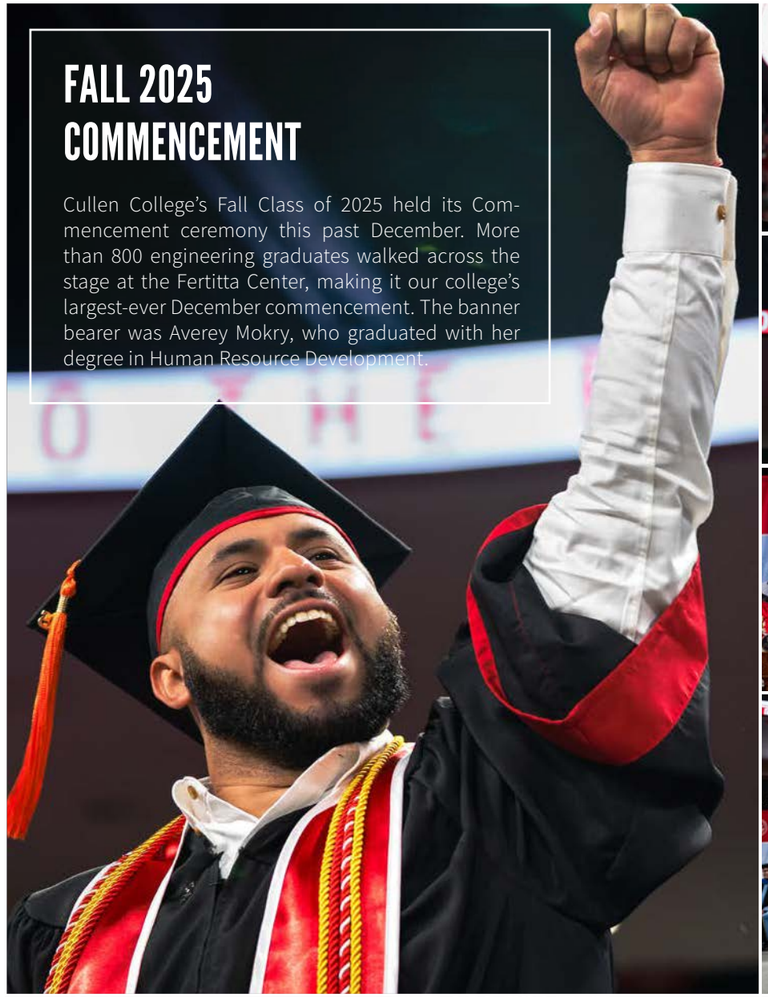
"He was my mentor and boss for my first true multi-unit position. I went from one hotel to 30 hotels," she said. "He's the first person that believed in me, that saw that I could do the job, because it's really hard to go multi-unit. It's very risky to give that job to somebody that has not done it before."

Going forward, Mitchell said it was important for her to stay hungry, figuratively and literally. Her parents always encouraged her to excel in her studies and her work, and it is something that has carried over to this day. She is always trying out new restaurants – enjoying bites at Casa Kenji and Lena's Asian Kitchen recently – and traveling when as much as she can.

"I try to do two long distance international trips a year," she said. "If my husband, Matt, and I can't go together, sometimes I go with a friend or family member, or even solo. I went to Vietnam solo and I met up my family members halfway into the trip. It works for us because we both encourage each other to travel and decompress. It really helps with inspiration in general, when it comes to our restaurants."

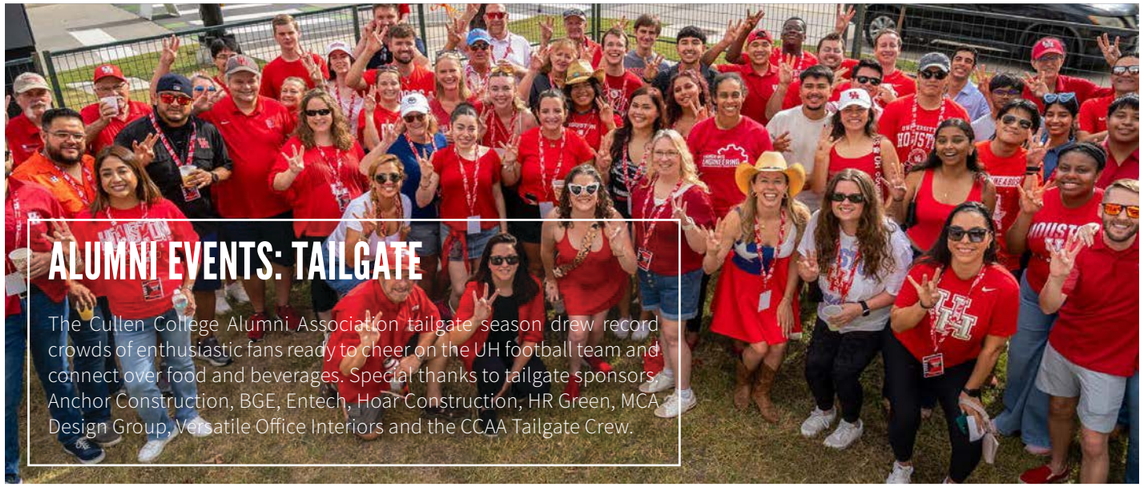
FALL 2025 COMMENCEMENT

Cullen College's Fall Class of 2025 held its Commencement ceremony this past December. More than 800 engineering graduates walked across the stage at the Fertitta Center, making it our college's largest-ever December commencement. The banner bearer was Averey Mokry, who graduated with her degree in Human Resource Development.



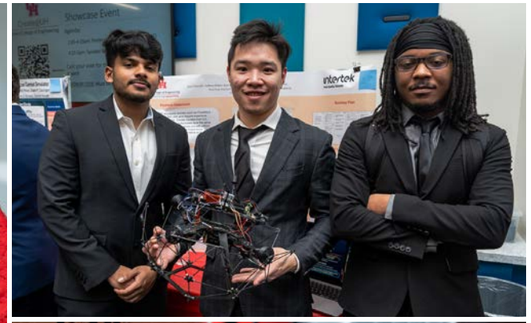
ALUMNI EVENTS: TAILGATE

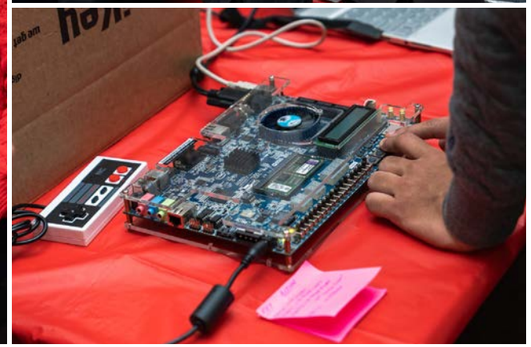
The Cullen College Alumni Association tailgate season drew record crowds of enthusiastic fans ready to cheer on the UH football team and connect over food and beverages. Special thanks to tailgate sponsors Anchor Construction, BGE, Entech, Hoar Construction, HR Green, MCA Design Group, Versatile Office Interiors and the CCAA Tailgate Crew.



ALUMNI EVENTS: LUNCHEON

The UH Civil & Environmental Alumni Luncheon drew an energetic audience spanning six decades of alumni on Wednesday, September 26 at The Ballroom at Tanglewood. Guests heard valuable updates on local infrastructure from guest speakers Grady Mapes, P.E., Texas Department of Transportation and Vedhus Hoskere, Ph.D., UH Assistant Professor.





CREATE@UH SHOWCASE EVENTS

Our Create@UH Showcase events, held in the fall and spring, provide an opportunity to highlight engineering undergraduate students' remarkable work on their course-based projects. On December 8, more than 300 students, faculty and industry representatives gathered at the Houston and Sugar Land campuses to view the work of nearly 100 student projects. Many of these teams spent the last few semesters investigating design problems posed by industry sponsors. The events partnered with the National Academy of Engineering Grand Challenges Summit, and the students got to hear Cullen professor emeritus and NAE member John Lienhard's talk, "Facing Our Grandest Challenges."

INSPIRATION FOUND UNDER THE BIG TOP

The Engines of our Ingenuity

I'm thinking about new faculty beginning the adventure of university teaching and research. And, as I do, I remember back when I was just 14. I got up at four in the morning and bicycled out to the fairgrounds where the circus had come to town. They snatched me up – put me to work setting up bleachers. I finally limped home that afternoon with free passes for the evening show.

What I saw that day was magical, even before the performance. A tutorial on applied mechanics. First, seeing six men with sledgehammers, circling an anchor post – six men raining down blows with machine-gun rhythm. Sinking each post in seconds.

Then the erection of a two-hundred-foot-high tent with tensioned ropes. This could never've been done without delicately balancing huge forces. The synchronization. The cooperation. It was a ballet performance. And all that was just preamble. That night, tired and achy, I watched the show!

Again, it was discipline and applied physics. You know what I mean. You've all seen trapeze artists, high wire acts, stilt walkers, the athletic antics of clowns. All making the impossible seem easy. Their mathematical precision coupled discipline and danger. The penalty for error is severe.

Fast forward: No longer 14, I'm 25 and teaching machine design at a university. Each day I need to have complex ideas under control. Then I must make them understandable. If I fail, the students won't overlook it. I need to stay on my own tightrope.There's more: Teaching is where we hone our balance, but without ever shortchanging our students. Then, a serious high wire act comes when we put our own newly forged ideas before the most critical audience: The judgement of our new ideas by our peers. A lapse of logic or a lazy idea means a serious fall from our own trapeze.

Of course, there's also the delight in having shared knowledge – whether it's already known, or new knowledge that we've created. The delight in having done so and succeeded. Our students tell us when we've managed to ride that bicycle across the wire. Not by applause, but by understanding. Our peers tell us if we've really created new knowledge. Not by gasps of excitement, but by making use of our work.

I'm sure you'll find your own metaphor for the academic life. But mine began taking shape during my labors that day, over 80 years ago. A time when a wildly varied group of focused people turned a dusty field into a lecture on our capacity for creating magic. It was a moment when I saw how expertise, and mutual trust, lets us achieve that which did not, at first, seem possible.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

John Lienhard

The Engines of Our Ingenuity is a nationally recognized radio program authored and voiced by John Lienhard, professor emeritus of mechanical engineering and history at the University of Houston and a member of the National Academy of Engineering. The program first aired in 1988, and since then more than 3,000 episodes have been broadcast. For more information about the program, visit www.uh.edu/engines.

Watch this edition of Engines Of Our Ingenuity on our YouTube Channel:

@UHEngineering

Cullen College of Engineering
UNIVERSITY OF HOUSTON

UH Cullen College of Engineering
Office of Communications
Engineering Building 2
4222 Martin Luther King Blvd, Suite E311
Houston, Texas 77204-4009

@UHEngineering

10.22.2026 | Hilton Americas, Houston, TX

CULLEN GALA

LEGACY IN MOTION

A night to celebrate Cullen alumni and support the bold ideas moving UH toward Top-50 distinction.

TABLE SPONSORSHIPS NOW AVAILABLE

Contact Cathy Brown, Director of Relations at cmbrow31@central.uh.edu