



Electrical and Computer Engineering
Newsletter SPRING 2025

THE FUTURE IS WHAT WE DO

ENGINEERED FOR
WHAT'S NEXT.



Cullen College of Engineering
UNIVERSITY OF HOUSTON

STUART LONG RECEIVES DISTINGUISHED ACHIEVEMENT AWARD FROM IEEE

Moore's Professor of Electrical and Computer Engineering and Associate Dean of Undergraduate Research and the Honors College **Dr. Stuart Long** was recently awarded the Institute of Electrical and Electronics Engineers (IEEE) Antennas and Propagation Society (AP-S) Distinguished Achievement Award for the introduction and development of the dielectric resonator antenna and the early development of the micro strip patch antenna.

This award honors outstanding career technical achievements in the fields of antennas and propagation and is the highest recognition given by the society.

"I was most honored to receive the 2024 IEEE AP-S Distinguished Achievement Award," said Long. "I thank those who have mentored me over my career, my colleagues at the University of Houston, and my former students, all of whom have contributed toward this accomplishment."

The development of the two classes of antenna that distinguished Long for this award – the micro strip patch antenna and the dielectric resonator antenna – span decades.

The former was developed with a grant from the U.S. Army in the 1970s in response to the need for a rugged, conformal antenna that could be used on artillery shells; now, nearly any portable device intended to facilitate wireless communications – such as laptops and cell phones – has at least one such antenna.

The latter is a response to the need for an antenna capable of high-efficiency transmission at high frequencies. As most antennas are made of metal, and metal is an imperfect conductor, increasing losses are incurred at high frequencies. The dielectric resonator antenna contains no such conductors, making it much more efficient at higher frequencies which are required, for example, for some military applications and for the newest communications systems like 5G.

In addition to his work with IEEE AP-S, Long has also led programs with the university to engage young women in exploring potential STEM careers, involve public high school teachers in research initiatives, and pair Ph.D. students with science and math classes across the Greater Houston Area to further promote K-12 STEM education and engagement. ⚙️



Stuart Long
*Moore's Professor
Associate Dean for Undergraduate
Research and the Honors College*

RESEARCH ADVANCEMENTS

THE UNIVERSITY OF HOUSTON TEAM

BOOSTING CLEAN ENERGY WITH AI-POWERED CATALYSTS AND MICROWAVE PLASMA TECHNOLOGIES

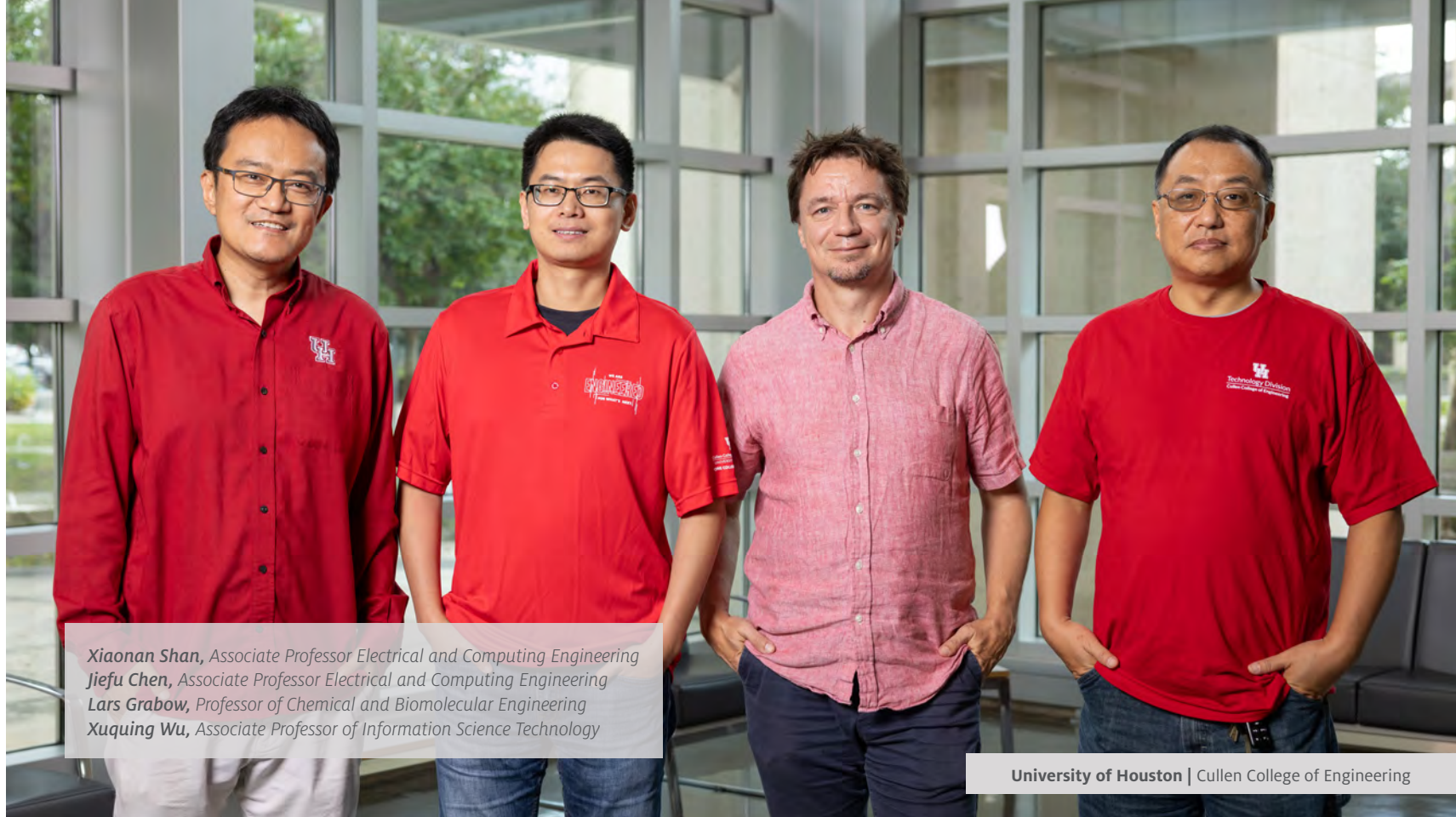
As the world races to combat environmental degradation and climate challenges, transitioning to renewable energy has become a top priority. However, the inconsistent nature of wind, solar and other renewable sources poses a significant challenge to maintaining a stable energy supply, which has slowed the transition.

An interdisciplinary team of scientists is collaborating to find a workable solution by harnessing the power of artificial intelligence and microwave plasma, and blending knowledge from chemistry, materials science and engineering.

The National Science Foundation awarded a \$1 million grant to this project, titled “Multidisciplinary High-Performance Computing and Artificial Intelligence Enabled Catalyst Design for Micro-Plasma Technologies in Clean Energy Transition.”

This project aims to leverage machine learning for catalyst discovery and develop new characterization methods for studying chemical reactions under extreme conditions such as plasma, one of the four states of matter, which is an ionized state consisting of positively charged ions and negatively charged electrons. The goal is to improve the efficiency of catalysts in hydrogen generation, carbon capture and energy storage. ⚙️

ELECTRIAL AND COMPUTER ENGINEERING



*Xiaonan Shan, Associate Professor Electrical and Computing Engineering
Jiefu Chen, Associate Professor Electrical and Computing Engineering
Lars Grabow, Professor of Chemical and Biomolecular Engineering
Xuqing Wu, Associate Professor of Information Science Technology*

University of Houston | Cullen College of Engineering

C-VISER SEES THE FUTURE OF AI IN STRUCTURAL ENGINEERING

CAN ARTIFICIAL INTELLIGENCE TRANSFORM THE PRACTICE OF STRUCTURAL ENGINEERING?

Imagine a future where structural engineers not only rely on their own knowledge and experience, computational tools, or evaluation equipment, but also utilize powerful AI assistants to significantly boost their productivity. This vision is becoming a reality through a groundbreaking collaboration between the University of Houston and Purdue University, supported by the National Science Foundation (NSF).

The newly planned Center for Visual Structural Expertise for Resilience (C-ViSER) aims to develop and equip engineers with cutting-edge AI and machine learning tools, transforming traditional workflows. This center is an Industry-University Cooperative Research Center (IUCRC) — a partnership structure designed to generate breakthrough research by enabling close and sustained engagement between industry innovators, world-class academic teams and government agencies.

The new center spans two sites: Purdue University and the University of Houston. A University of Houston workshop scheduled for October 21-22 of this year will disseminate the

goals of the center, including fostering the new partnerships between industry and academia mentioned above, and will engage prospective center members in discussions around C-ViSER's focus, value propositions and potential research projects to develop a research road map that aligns with the needs and interests of industry.

"My team at UH and I have been developing deep learning, computer vision, and artificial intelligence solutions for varied structural engineering problems over the past decade," said Director of the Structures and Artificial Intelligence Lab **Vedhus Hoskere**, assistant professor of civil and environmental engineering (CEE) and electrical and computer engineering (ECE).

Hoskere currently leads projects with the Texas Department of Transportation on developing digital twins of bridges and the U.S. Navy for improving structural inspections, and leads research on Large Language Models as part of the university's recent Department of Defense contract to revolutionize U.S. Army decision-making. ⚙️



Vedhus Hoskere
Assistant Professor of Civil and Environmental Engineering

AI DRIVES DEVELOPMENT OF CANCER FIGHTING SOFTWARE

\$2.5 MILLION FAST-TRACK GRANT TO DEVELOP ANALYSIS OF SINGLE CELLS

University of Houston researchers and their students are developing a new software technology, based on artificial intelligence, for advancing cell-based immunotherapy to treat cancer and other diseases.

CellChorus Inc., a spin off from the University of Houston, is commercializing the UH-developed Time-lapse Imaging Microscopy In Nanowell Grids™ platform for dynamic single-cell analysis with label-free analysis. Now they've received a \$2.5 million grant from the National Center for Advancing Translational Sciences of the National Institutes of Health to fast-track the development of an advanced "label-free" version of this technology in partnership with the University of Houston.

Badri Roysam, Hugh Roy and Lillie Cranz Cullen University Professor of Electrical and Computer Engineering at the University of Houston, is collaborating with **Navin Varadarajan** on the project. Varadarajan is an M.D. Anderson Professor, Chemical and Biomolecular Engineering also at UH and co-founder of CellChorus.

"This is an opportunity to leverage artificial intelligence methods for advancing the life sciences," Roysam said. "We are especially excited about its applications to advancing cell-based immunotherapy to treat cancer and other diseases."

TIMING™ is a specialized tool for studying single cells over time. Because it is a video-array-based technology, it observes cell interactions and produces tens of thousands of videos. Analyzing these massive video arrays requires automated computer vision systems.

"By combining AI, microscale manufacturing, and advanced microscopy, the label-free TIMING platform will yield deep insight into cellular behaviors that directly impact human disease and new classes of therapeutics," said Rebecca Berdeaux, chief scientific officer at CellChorus and co-Principal Investigator on the grant. "The generous support of NCATS enables our development of computational tools that will ultimately integrate single-cell dynamic functional analysis of cell behavior with intracellular signaling events. ⚙️"



Badri Roysam
Hugh Roy and Lillie Cranz Cullen University Professor



Navin Varadarajan
M.D. Anderson Professor

UNIVERSITY OF HOUSTON JOINS DOE'S NEW ENERGY INNOVATION HUB TO ADVANCE BATTERY TECHNOLOGY

The U.S. Department of Energy recently announced \$125 million for the creation of two Energy Innovation Hubs to provide the scientific foundation needed to address the nation's most pressing battery challenges and encourage next generation technological developments, including safety, high-energy density and long-duration batteries made from inexpensive, abundant materials. University of Houston — The Energy University — is part of one of the national hubs, the Energy Storage Research Alliance (ESRA).

Progress in energy storage and batteries is crucial for a clean energy future. It would enhance grid reliability, optimize renewable energy usage, reduce emissions and support the growth of electric transportation and other clean energy technologies.

ESRA brings together nearly 50 world-class researchers from three national laboratories and 12 universities, including UH, to push the boundaries of energy storage

science to drive technological innovation and strengthen U.S. economic competitiveness.

Yan Yao, the Hugh Roy and Lillie Cranz Cullen Distinguished Professor at the UH Cullen College of Engineering and principal investigator at the Texas Center for Superconductivity, is the deputy lead of the soft matter scientific thrust and the principal investigator for UH's portion of the project.

"This is a once in a lifetime opportunity," said Yao. "To collaborate with world-class experts to understand and develop new science and make discoveries that will lead to the next generation of batteries and energy storage concepts, and potentially game changing devices is exciting. It's also a great opportunity for our students to learn from and work with top scientists in the country and be part of cutting-edge research."

This project is led by Argonne National Laboratory and co-led by Lawrence Berkeley National Laboratory and Pacific Northwest National Laboratory. ⚙️

Yan Yao

Professor, Department of Electrical and Computer Engineering

CANEPA PART OF INTERNATIONAL TEAM WORKING TO MAKE SODIUM BATTERIES BETTER

While lithium-ion batteries have been the go-to technology for everything from smartphones and laptops to electric cars, there are growing concerns about the future because lithium is relatively scarce, expensive and difficult to source, and may soon be at risk due to geopolitical considerations. Scientists around the world are working to create viable alternatives.

An international team of interdisciplinary researchers, including the Canepa Research Laboratory at the University of Houston, has developed a new type of material for sodium-ion batteries that could make them more efficient and boost their energy performance — paving the way for a more sustainable and affordable energy future.

“Sodium is nearly 50 times cheaper than lithium and can even be harvested from seawater, making it a much more sustainable option for large-scale energy storage,” said **Pieremanuele Canepa**, Robert Welch assistant professor of electrical and computer engineering at UH and lead researcher of the Canepa Lab. “Sodium-ion batteries could be cheaper and easier to produce, helping reduce reliance on lithium and making battery technology more accessible worldwide.” ⚙️



Pieremanuele Canepa
Robert A. Welch Assistant Professor

UH BRAIN CENTER, FDA COLLABORATE ON NSF PROGRAM

A three-year National Science Foundation program is underway at the University of Houston's Industry-University Cooperative Research Center for Building Reliable Advances and Innovations in Neurotechnology Center. The Research Experiences for Undergraduates, or REU site, is focused on safe and effective human-device interaction to help an ailing body move again.

The REU site will prepare students for future careers in regulatory science and medical device development. Regulatory science is the science of developing new tools, standards, methods, and approaches to assess the safety, efficacy, quality and performance of FDA-regulated products.

It's the first REU Site focused on regulatory science. **Jose Contreras-Vidal** is the site's program director and faculty mentor, as well as the director of the UH IUCRC BRAIN Center.

"The program will address best design and engineering practices, computing tools and new computational methods to support early-stage medical device development and their evaluation so that as a nation, we can keep up with the accelerated pace of technology development and innovation," he said.

"The National Science Foundation's REU Site program leadership is excited by the unique opportunity for program participants to work at both a research institution and a government agency (FDA) as part of the program," said Patricia Simmons, associate program director at the National Science Foundation. ⚙️



Jose Contreras-Vidal
Hugh Roy and Lillie Cranz Cullen
Distinguished Professor

ECE FACULTY PARTNER WITH HARRIS COUNTY ON VISION FOR SUSTAINABLE ENERGY FUTURE

In a collaborative project between the Harris County Office of County Administration's Sustainability Office and the University of Houston, researchers, county staff and the Harris County energy management team within the Sustainability Office are working together to develop a comprehensive baseline of energy use and energy use intensity for County assets. This baseline will enable programs aimed at reducing total energy consumption, maximizing savings and increasing the use of renewable and resilient energy sources for County-owned buildings and operations.

As a first step of this ambitious project, Harris County Sustainability Team and UH research intern **Xidan "Delia" Zhang**, UH Cullen College of Engineering Assistant Professor of Engineering Technology and Electrical and Computer Engineering **Jian Shi**, and Moores Professor of Electrical and Computer Engineering **Zhu Han** have spent the past year working closely with County energy managers **Glen Rhoden** and **Yas Ahmadi**.

"Over the past two years, Harris County has made significant strides in its energy initiatives, focusing on reducing greenhouse gas emissions, enhancing resilience, and achieving cost savings. The County's first Climate Action Plan has implemented various energy efficiency measures, such as retro-commissioning, demand response programs, and optimizing building automation systems. These efforts have led to substantial cost savings and emission reductions," said Harris County Director of Sustainability **Lisa Lin**. ⚙️



Pictured: University of Houston researchers, county staff and the Harris County energy management team

INDUSTRY LEADER, ECE ALUM KELVIN KING TO SPEAK AT UPCOMING EAA RECEPTION

In honor of Engineer's Week 2025, the UH Engineering Alumni Association (EAA) will host their Industry Awards Night program on Tuesday, February 18, 2025. The E-Week reception celebrates National Engineer's Week by recognizing top-achieving current UH Engineering students and connecting them to corporate and community sponsors through selected awards.

Cullen graduate and Chief Delivery Officer for Gaine Technology, LLC **Kelvin King** will present the reception's keynote address.

As a native Houstonian and first-generation college graduate, having "a top-tier engineering school close to home" made attending the University of Houston an "easy decision" for King.

"I chose electrical engineering because I had a passion to learn more about software. The engineer in me decided that it would be better to understand the internals of computing that make software work, so the computer engineering option within Cullen's Electrical and Computer Engineering department seemed like the perfect fit," he said.

"I had a great experience overall at UH. My participation in NSBE and PROMES was foundational to my success and enjoyment of the undergraduate experience."

King now oversees onboarding, implementation, and support for Gaine's products and services as Chief Delivery Officer, with his team focusing on understanding their customers' business requirements and helping them leverage Gaine's health data management platform solutions for optimal value.

"I ultimately view myself as a builder, so helping companies scale from early-stage development to become significant industry players gives me a lot of fulfillment. It's the perfect combination of solving a puzzle and knowing you've done something that makes the world a better place," he said.

Since the inception of the Engineer's Week Reception, the EAA has raised over \$480,000 in scholarship awards for UH Engineering students and largely credits this success to the generous support of corporate and community sponsors. ⚙️



*Kelvin King, Cullen graduate
Chief Delivery Officer for Gaine Technology, LLC*

CULLEN

COLLEGE

The University of Houston Cullen College of Engineering

The University of Houston Cullen College of Engineering addresses key challenges in energy, healthcare, infrastructure, and the environment by conducting cutting-edge research and graduating hundreds of world class engineers each year. With research expenditures topping \$40 million and increasing each year, we continue to follow our tradition of excellence in spearheading research that has a real, direct impact in the Houston region and beyond.



ENGINEERED FOR
WHAT'S NEXT.



Cullen College of Engineering

UNIVERSITY OF HOUSTON

UH Cullen College of Engineering
Department of Biomedical Engineering
Science & Engineering Research Center
3517 Cullen Blvd, Room 2027
Houston, TX 77204-5060



@UHEngineering



The Future
IS WHAT WE DO