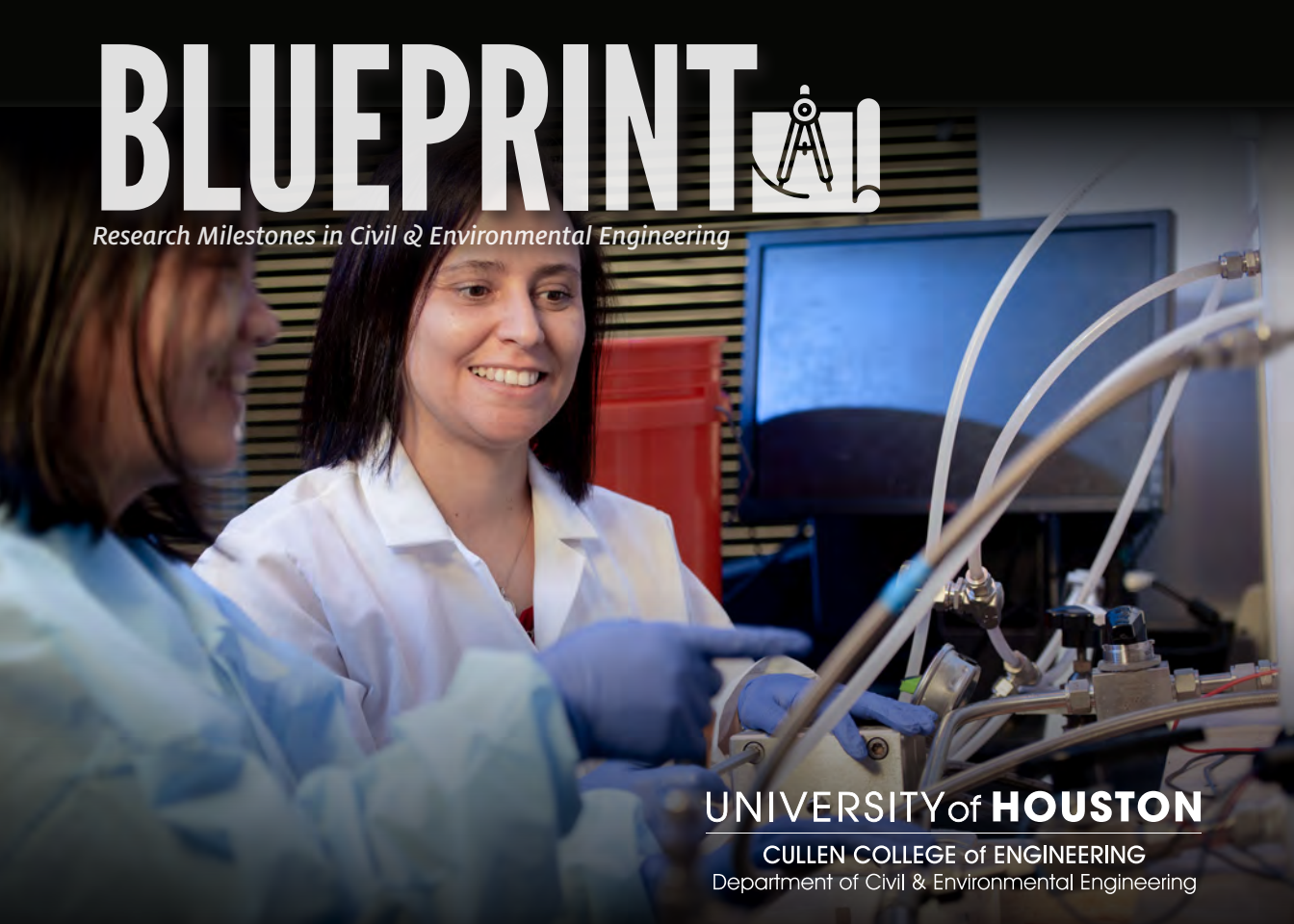
BLUEPRINT

Research Milestones in Civil & Environmental Engineering



UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

Letter from the Chair

Dear Alumni and Friends of UH CEE,

I am proud to highlight the many exciting accomplishments of the UH CEE community in this issue of Blueprint.

At this moment, students and professors in the UH Department of Civil and Environmental Engineering (CEE) are commercializing nano-sized filters to increase global access to clean water, using advanced technologies to digitally map dangerous terrain and bringing smart cement to the market.

The engineers at the UH civil and environmental department conduct real-world, impactful research for the Houston region and the world beyond by providing the services and facilities on which modern life depends. The demand for highly-skilled civil and environmental engineers will increase significantly in coming decades, especially in the city of Houston, the Energy Capital of the world.

Thank you for being a friend of UH CEE. I look forward to hearing from you and seeing you at upcoming departmental, college and University events!

Warm regards,

Roberto Ballarini
Thomas and Laura Hsu Professor and
Department Chair Civil and
Environmental Engineering
Cullen College of Engineering
University of Houston

UH CEE

BY THE NUMBERS

BEST ENGINEERING PROGRAM OF

2020

BEST GRAD SCHOOLS
U.S.News & WORLD REPORT
RANKINGS

#72

BEST CIVIL ENGINEERING PROGRAM IN THE U.S. (SOURCE: U.S. NEWS & WORLD REPORT)

22:1

UNIVERSITY-WIDE STUDENT TO FACULTY RATIO

80%

OF UH ENGINEERING UNDERGRADS ARE EMPLOYED IN TEXAS WITHIN ONE YEAR OF GRADUATION

400

TOTAL STUDENTS IN DEPARTMENT (CIVIL | ENVIRONMENTAL | GEOSENSING

284

UNDERGRADUATE STUDENTS

116

GRADUATE STUDENTS

UH CEE Department Welcomes

NEW FACULTY MEMBER

Mostafa Momen joined the civil and environmental engineering department at the Cullen College as an assistant professor this fall. Previously, he served as an associate research scientist in the civil engineering and engineering mechanics department at Columbia University.

His research interests include studying hurricane boundary layers, urban canopies and resiliency, wind energy, reduced modeling and machine learning.

Momen has a master's degree and a Ph.D. in civil and environmental engineering from Princeton University, and served as a Ph.D. Exchange Scholar in mechanical engineering at the Massachusetts Institute of Technology (MIT). He worked as a postdoctoral researcher at Stanford University and Princeton. His bachelor's degree in civil and environmental engineering is from the Sharif University of Technology in Iran.

He is the co-inventor on a U.S. patent titled "Dynamic Models for Short-Term Wind Energy Forecasting" and has two registered inventions in the national registry of industrial ownership in Iran.

NEW FACILITIES:

UH CEE Expands to UH at Katy

Built at the confluence of I-10 and the Grand Parkway, the new 80,000-square-foot UH at Katy building stands tall against a backdrop of big Texas sky and a constant flow of traffic. This fall, the UH Cullen College of Engineering began offering high-in-demand engineering courses at the brand-new facility with state-of-the-art design studios and equipment. The move is part of a larger plan to continue strengthening the Cullen College's position as the leading source of engineering education in the Greater Houston area. The Katy Area Economic Development Council (KAEDC) estimated that the new UH at Katy facility will have an approximate $56 million economic impact over the next five years. Local leaders expect UH's presence to provide a highly skilled workforce and attract more businesses and jobs to the area.

UH Civil & Environmental Engineering will be one of the first engineering programs to make the jump to the new facility as one of the five degree paths for the new UH/HCC Engineering Academy, set to launch in fall 2020. The academy is a partnership between UH and Houston Community College (HCC), which will allow students to take their lower division classes through both institutions at the new UH at Katy facility before transitioning full-time to the UH main campus to finish their degrees.

$1 MILLION GIFT WILL EXPAND

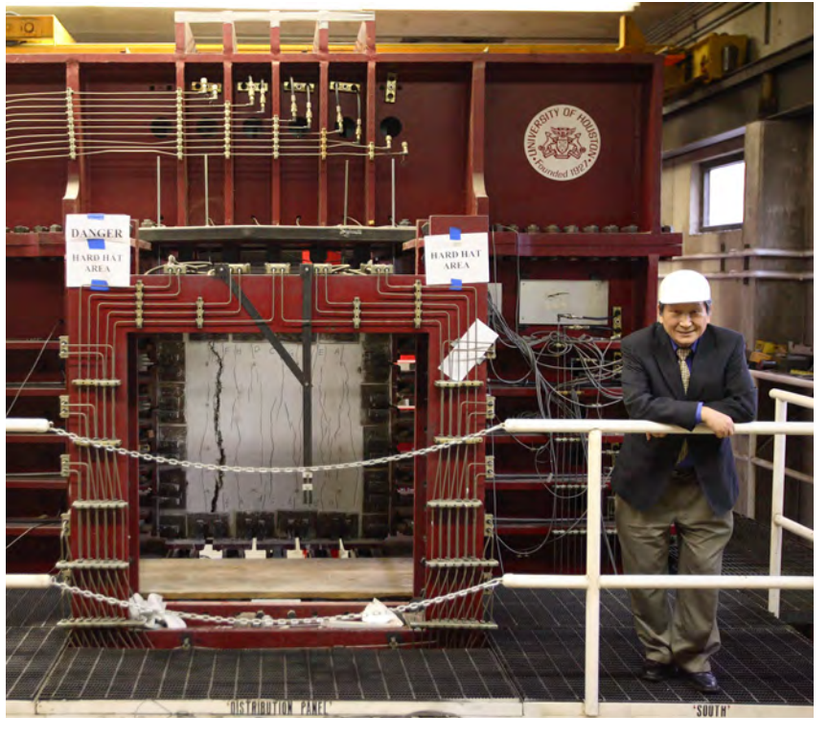
UH Structural Engineering Labs

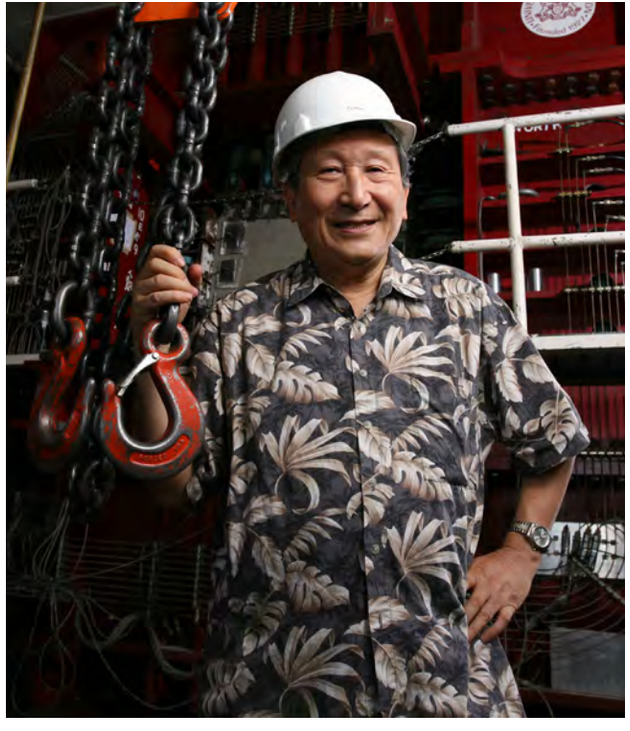
The Thomas T.C. Hsu Structural Research Laboratory, named for Moores Professor Thomas Hsu, houses the Universal Elements Tester, the world's only large-size equipment to test wall and shell elements subjected to various types of forces, notably earthquake action. The behavior of these elements, predicted from Hsu's theory, can then be integrated by high-speed computer to predict the behavior of today's infrastructure such as large buildings, highways, bridges, offshore rigs, nuclear containment structures and others.

The Universal Element Tester was designed and built at the University's South Park Annex in 1986. This equipment and lab space have been modernized over the past 30 years with more than $3 million in grants from the National Science Foundation and other public and industry sources.

Now 33 years later, after the directorship of **Yi-Lung Mo**, Moores Professor of civil engineering at UH, and current director **Mina Dawood**, associate professor of civil engineering, the Structural Research Lab is ready for larger space, updated equipment and resources to meet the growing and increasingly complex needs of a changing infrastructure that serves the society we live in.

A $1 million gift from the Hsu family is intended to pay it forward. The gift, eligible for a 75 percent match from the state's Texas Research Incentive Program (TRIP), would further strengthen UH's Tier One status. While Hsu's lab was originally focused on structural engineering, the new space will be designed to accommodate researchers and graduate students in a wider range of civil and environmental engineering disciplines.





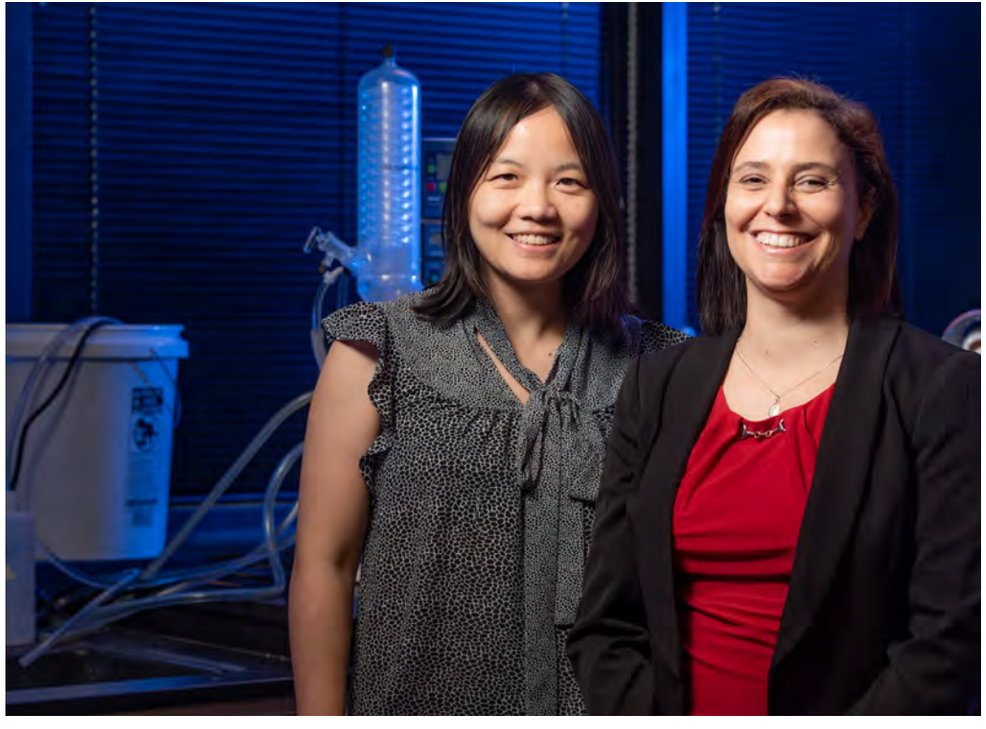
UH Cullen College Engineering Faculty Win NSF Grant

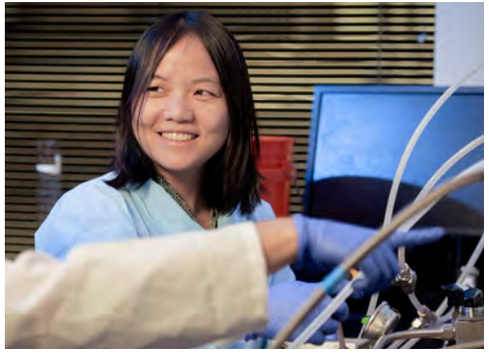
FOR WATER PURIFICATION STUDY

The National Science Foundation (NSF) recently awarded $300,008 to two UH Cullen College of Engineering professors for their research into the development of coatings designed to play a role in water purification. The award began in summer 2019 and will last three years for the project titled "Rates and Mechanisms of Biofouling and Mineral Scaling on Zwitterionic Amphiphilic Copolymer Surfaces." The researchers, **Debora Rodrigues** and **Yandi Hu**, both associate professors of civil and environmental engineering, believe the project may take longer.

The study addresses two types of foulants or contaminants – chemical scales, which are the focus of Hu's research, and biofouling, which is Rodrigues' specialty. The research has the potential to help ease the global water crisis by developing water filters so efficient they far surpass current options to make water safe to drink. Industries such as petroleum and shipping are likely to benefit too from new ways to prevent unwanted foulant formation. The ultimate benefit, they explained, would be to identify a single coating whose properties have excellent abilities against both biological and mineral foulants. But in the end, specific needs may call for multiple types of coatings to be developed.

As their research findings become clear, Hu and Rodrigues plan to share the new knowledge at national and international conferences that draw attendees from utility groups, corporations and consulting firms, as well as academic researchers. More immediately, the information will be included in several graduate and undergraduate classes at UH and beyond.





UH Startup Sensytec Builds A

FOUNDATION OF WINS

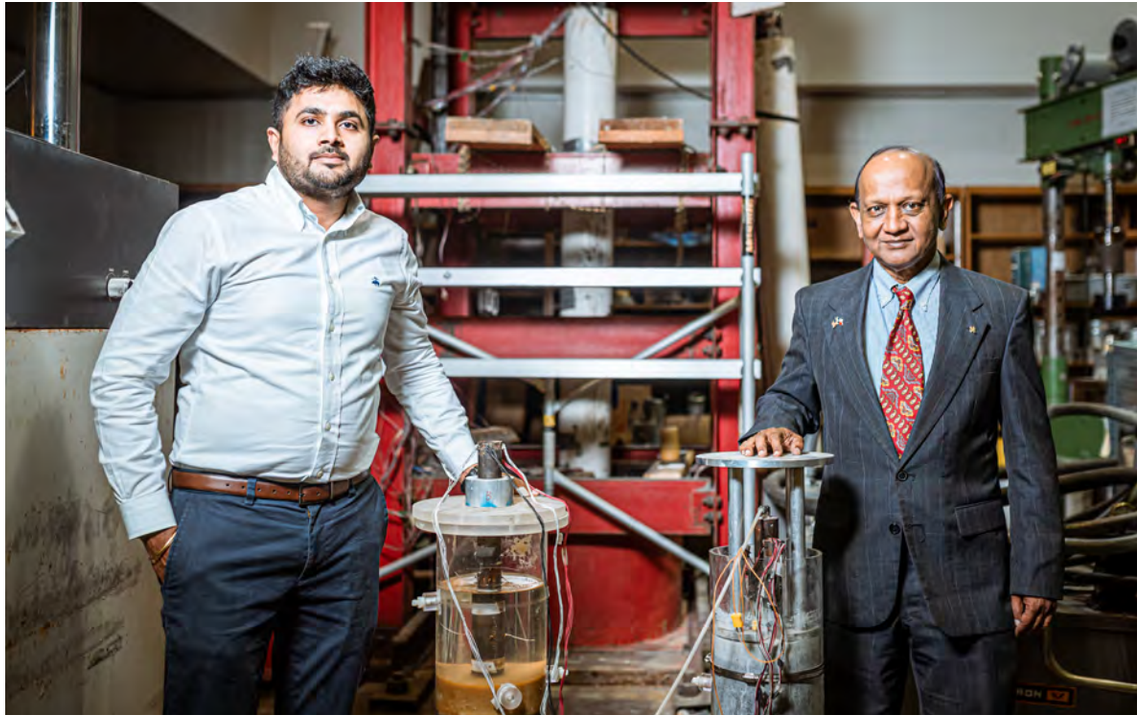
Sensytec, a UH startup, is busy cementing its reputation with its multiple recent wins. The company was chosen as one of three local winners of the inaugural Houston MassChallenge program. The Houston Angel Network – one of the oldest and most active group of angel investors in the area – also selected the company for its $40,000 investment prize at the same event. And most recently, Sensytec was recognized as one of 10 most promising companies by the Rice Alliance for Technology and Entrepreneurship.

Sensytec, established in 2015, is based on the groundbreaking research of **Cumaraswamy "Vipu" Vipulanandan**, professor of civil and environmental engineering at the UH Cullen College of Engineering and director of the Center for Innovative Grouting Materials and Technology (CIGMAT). He invented "smart" cement, which is an innovative 3D highly sensing chemo-thermo-piezoresistive material used as an additive to cement or concrete to make construction safer by enabling monitoring, real-time data collection. Less than eight ounces of the additive is needed to produce 1,000 pounds of smart cement, which can detect earthquakes, gas leaks, cracks and curing among other things.

Sensytec has brought to market both the smart cement and the monitoring system. The company is located at the UH Technology Bridge – a research park that offers 30,000 square feet of incubator space and 700,000 square feet for laboratories and light manufacturing.

While Vipulanandan serves as an advisor, the company is run by **Ody de La Paz**, a UH graduate with bachelor's degrees in accounting and entrepreneurship, and S**ai Anudeep Reddy Maddi**, who is working on his Ph.D in civil and environmental engineering at the Cullen College. Maddi earned his master's in structural engineering at UH in 2016.

The company, which has previously won funds from the National Science Foundation, the U.S. Department of Defense and the Techstars Accelerator, has also been selected to be part of the Smart Cities Ion Accelerator Program in partnership with Microsoft, Intel and the City of Houston. Sensytec tops the list of 10 companies accepted into the program.



UH Civil and Environmental Engineering Chairman

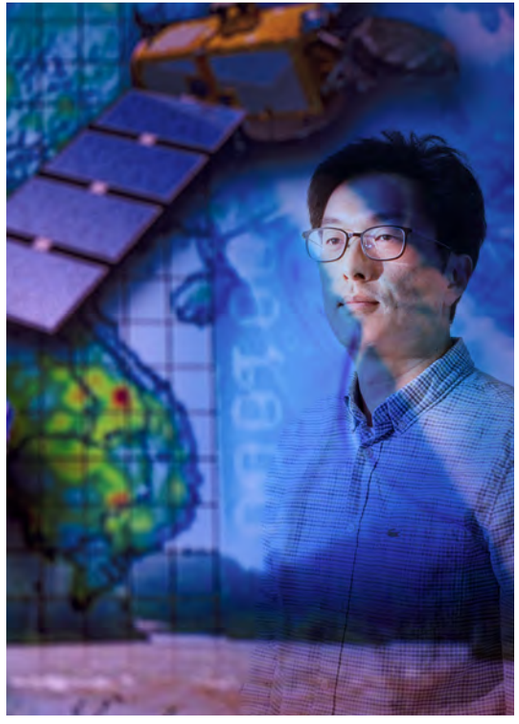
WINS 2019 MINDLIN MEDAL

Roberto Ballarini, Thomas and Laura Hsu Professor and chairman of the civil and environmental engineering department at the UH Cullen College of Engineering, is the recipient of the 2019 Raymond D. Mindlin Medal from the American Society of Civil Engineers (ASCE).

Established in 2008, the award recognizes outstanding research contributions to applied solid mechanics. The ASCE's Engineering Mechanics Institute (EMI) selected Ballarini for "the application of elasticity and fracture mechanics to problems in numerous disciplines and at multiple length scales, and for seminal contributions to experiments for measuring the mechanical properties of materials and structures at micro and nano length scales."

The medal is named for Raymond D. Mindlin, who was a professor at Columbia University and is best known for his pioneering contributions to applied mechanics.

Ballarini earned his bachelor's degree in civil engineering from the City College of New York, and his master's and doctoral degrees – also in civil engineering – from Northwestern University. Although his primary background is in the mechanics of materials and structures, Ballarini's research spans a wide range of topics, including advanced composites, microeletromechanical systems, natural and synthetic nanostructures, biological structures, aerostructures, applied mathematics and prosthetics.



SATELLITES AND VILLAGES:

Working With NASA And Mekong River Stakeholders To Address Critical Issuest

Hyongki Lee, associate professor of civil and environmental engineering at the UH Cullen College of Engineering, has a lot of experience using data collected by Earth-observing technologies (such as satellites) for solving water management issues on Earth.

With his latest grant, Lee is diving deeper into addressing critical concerns such as land subsidence, flood forecasting and groundwater management in the Mekong region of Southeast Asia.

Principal investigator Lee and his co-investigator Faisal Hossain of the University of Washington recently won their second NASA SERVIR program grant. The three-year project, titled "Operational Services for water, disaster and hydropower applications for lower Mekong populations using NASA earth observations and models," received $661,443 in funding. It's one of 20 projects selected this round.

The project will use satellite data and feedback from local stakeholders in the Lower Mekong River basin to develop customized software tools to provide missing pieces of information on the real-time availability of water for the entire area.

UH Civil Engineering Online Master's Program

RANKED AMONG THE NATION'S BEST

The Master of Science in Civil Engineering (MS) program prepares students to solve current and future challenges found in the present day professional civil engineering practice in industry. As a nationally recognized leader in education and research, the civil engineering graduate program connects structural engineering with the disciplines of geotechnical engineering, hydrosystems engineering, environmental engineering, geosensing and geoinformatics, mechanical engineering, and subsea engineering.

In 2019, UH Engineering's program was ranked #21 for Best Online Master's in Civil Engineering by **OnlineSchoolsReport.com (OSR)**. The program was also ranked #12 on the "Best Online Master's in Civil Engineering Programs of 2019" list recently published by BestColleges. The BestColleges ranking methodology focuses on academics and learner support, affordability and online programming. Information is collected from the Integrated Postsecondary Education Data System (IPEDS) and College Navigator, both of which are hosted by the National Center for Education Statistics. OSR aims to provide students with information on quality programs that are accountable to students. Areas considered for rankings include program quality, student satisfaction, online presence, affordability and earning potential, as well as acceptance and retention rates. It pulls data from U.S. News and World Report, the National Center for Education Statistics and PayScale.

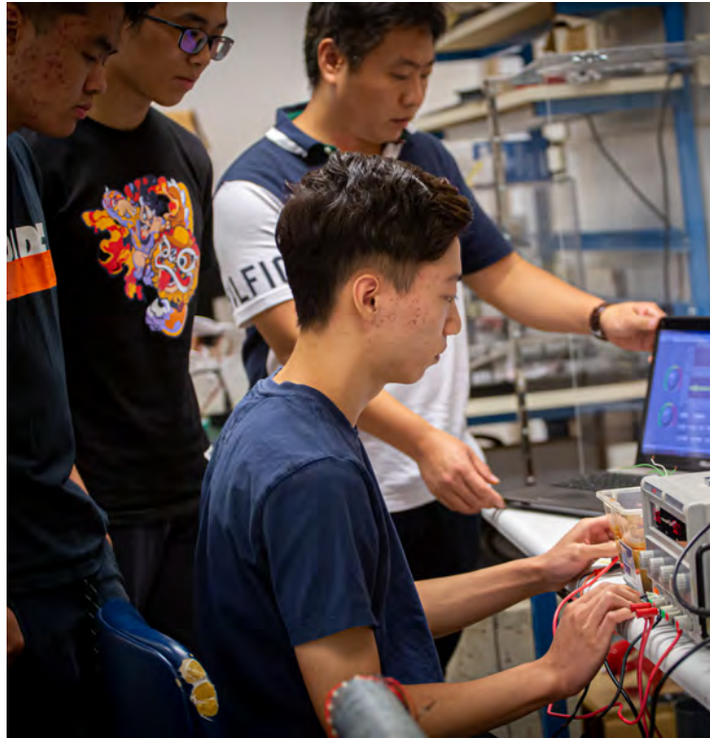
EXPANDING BORDERS:

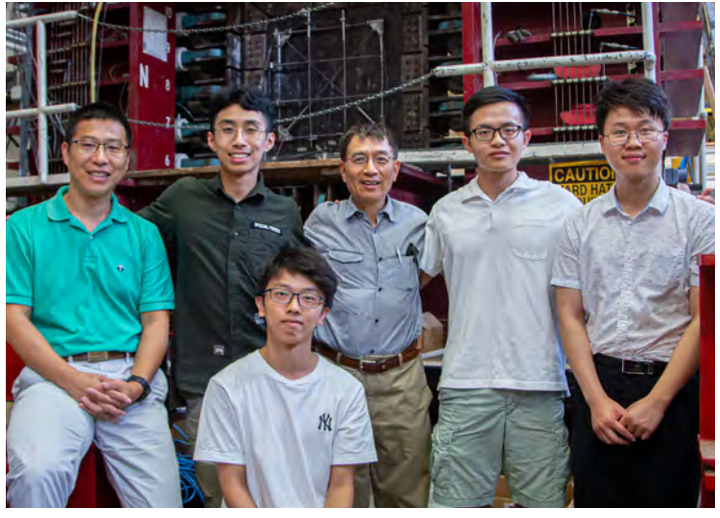
UH Hosts International Workshop On Resilient Civil Infrastructure

The CEE department at the Cullen College of Engineering recently hosted over 40 college students from the South China University of Technology for the first-ever, three-week resilient civil infrastructure summer workshop.

The program led by **Yi-Lung Mo**, John and Rebecca Moores Professor of civil and environmental engineering, and **Gangbing Song**, John and Rebecca Moores Professor of mechanical engineering, provided students an inside look into college life at the University of Houston. Students attended course lectures concentrated on two areas, civil infrastructures and structural health monitoring. Mo stressed the importance of sharing knowledge of structural health monitoring with other universities. There are many rural areas around the globe that do not have access to modernized infrastructure, leaving them especially prone to damage caused by earthquakes and other natural disasters. Creating a larger base of knowledge for better monitoring and preparing building structures could have the potential to alleviate damage and save countless lives in the future.

Song and Mo plan to grow the program over the coming years. In addition to increasing the number of attendees/participants, they also hope expand their research beyond the lab and to use the program as a platform to work directly with communities in developing countries. Additionally, the program will encourage students from South China University of Technology (SCUT), along with other foreign universities, to pursue graduate studies at the University of Houston.





MISSION POSSIBLE:

Mapping Dangerous Terrain

Ensuring military forces have up-to-date information about a potentially hostile region offers obvious advantages, but current methods for doing that – especially along shorelines, where underwater mines and other hazards can pose serious risks – all have drawbacks. It is especially difficult if keeping the technology out of enemy hands is a priority.

Engineers from the University of Houston are addressing the challenge as part of a $1 million project led by **Craig Glennie**, associate professor of civil engineering and an investigator with the National Center for Airborne Laser Mapping, or NCALM.

The work is part of a larger effort, funded by Office of Naval Research and led by Northeastern University. Megan Robertson, UH associate professor of chemical and biomolecular engineering, and Aaron Becker, UH assistant professor of electrical and computer engineering, are working with Glennie on the project.

One phase involves the design of self-guided "packages," small containers made of a biodegradable material and filled with sensors to map the coastline and sea bottom. Glennie said the goal is for the devices to be about the size of a water bottle and to dissolve upon reaching shore. The sensors ultimately could have a number of applications, ranging from military and law enforcement to environmental monitoring. Early versions of the project will involve the use of cameras, sonar and sensors to measure temperature and pressure, said Glennie, whose work with NCALM involves mapping with unmanned aerial vehicles and using lasers for mapping through shallow water.

The University of Houston
Cullen College of Engineering

The University of Houston Cullen College of Engineering addresses key challenges in energy, health care, infrastructure and the environment by conducting cutting-edge research and graduating hundreds of world-class engineers each year. With research expenditures topping $30 million and increasing each year, we continue to follow our tradition of excellence in spearheading research that has real, direct impact in the Houston region and beyond.

UNIVERSITY of HOUSTON | ENGINEERING

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