

# RESEARCH MILESTONES

Mechanical Engineering • Spring 2021



## MOMENTUM

UNIVERSITY of  
**HOUSTON**

CULLEN COLLEGE of ENGINEERING  
Department of Mechanical Engineering

# Letter from the Chair



Dear Colleagues,

I hope you are well. Our department is flourishing despite ongoing challenging circumstances. Our professors and students continue to conduct impactful research, bringing in numerous grant awards and accolades to our department.

I am delighted to share some of our recent highlights with you, including some exciting research breakthroughs and newly-funded projects. If you would like to learn more about how to support a project or collaborate with our department, please do not hesitate to let me know.

Warm Regards,

**Pradeep Sharma, Ph.D**

M.D. Anderson Professor and Chair  
Mechanical Engineering  
Cullen College of Engineering  
University of Houston



ONLINE M.S. RANKED

**#16**

FOR BEST MECHANICAL  
ENGINEERING PROGRAM

AMONG THE TOP 60  
ONLINE ENGINEERING  
DEGREES

*\*Source: Intelligent*



**4** NSF CAREER AWARD-  
WINNING FACULTY



**1,072** UNDERGRADUATE  
STUDENTS

**170** GRADUATE  
STUDENTS

**1,242** TOTAL STUDENTS  
IN DEPARTMENT

*\*Student Totals are from Fall 2020*



**12.5%** OF TENURE TRACK  
FACULTY ARE WOMEN



**24** TENURE TRACK FACULTY



RECORD NUMBER OF BSME DEGREES  
AWARDED IN 2020 -

**214 TOTAL**

## **\$4.5M GIFT** SUPPORTS ENDOWED CHAIR, NEW LECTURE SERIES ON EQUITY AND SOCIAL JUSTICE

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The University of Houston has received a \$4.5 million gift from the Thomas Michael Panos Family Estate to establish an endowed chair in the Cullen College of Engineering Mechanical Engineering Department; a scholarship endowment available to students throughout the University; and an endowed lecture series focused on equity and social justice, which will reside in the College of Liberal Arts and Social Sciences.

An additional \$2 million has been matched by the University's new "\$100 Million Challenge" Aspire Fund. This is the first matched gift since the fund was established, making the total impact of the Panos Family Estate gift at least \$6.5 million. A search is underway for the endowed chair who will be a faculty member in the Department of Mechanical Engineering in the Cullen College of Engineering, with a focus in the area of sustainable energy and energy security. ⚙️





# DR. SHAILENDRA P. JOSHI

BILL D. COOK ASSISTANT PROFESSOR  
OF MECHANICAL ENGINEERING  
AT THE UNIVERSITY OF HOUSTON'S  
CULLEN COLLEGE OF ENGINEERING

WINNER OF THE



FROM THE NATIONAL SCIENCE  
FOUNDATION (NSF)



MECHANICAL ENGINEERING



## JOSHI RECEIVES CAREER AWARD FOR RECYCLABLE THERMOSET POLYMERS RESEARCH

**Dr. Shailendra P. Joshi**, the Bill D. Cook Assistant Professor of Mechanical Engineering at the University of Houston's Cullen College of Engineering, is the latest NSF CAREER award winner at the college. His research will examine recyclable thermoset polymers.

Joshi said that receiving the CAREER award, which comes with \$516,654 in funding, will allow him to pursue granular mechanics. In addition to the NSF, he has also received funding from the U.S. Army Research Lab through the Materials in Extreme Dynamic Environments (MEDE) Program. ⚙️

## UH EXPANDING INTO MICRO-CT FOR ADVANCED MATERIALS DEVELOPMENT, THANKS TO **NAVAL RESEARCH GRANT**

Professors at the University of Houston's Cullen College of Engineering have received a \$904,554 grant from the Office of Naval Research to procure equipment that will allow Micro-CT imaging, which utilizes x-rays to see inside of an object and will allow for significant improvements in the development of advanced materials. The grant, "Micro-Computed Tomography (Micro-CT) for Non-destructive Evaluation of Advanced Materials and Devices for Defense Applications," was approved in September. According to **Dr. Venkat "Selva" Selvamanickam**, the M.D. Anderson Chair Professor of Mechanical Engineering, the imaging equipment was delivered in March and installed in April. In the awarded proposal, Selva identified seven different application areas that Micro-CT equipment would help the research at the University of Houston. Some specific uses for the Micro-CT highlighted by Selva included as a characterization tool for the development of high-performance superconductor wires and high-energy density and safer lithium solid-state batteries; as an education tool for quality assurance and control manufacturing; and to optimize smart thermal sensors. ⚙️



## BANNOVA DESIGNING **MOON ROVERS, HABITATS**

Thanks to a \$50,000 grant from Boeing for a six-month lunar surface systems study, a researcher and her team at the University of Houston's Cullen College of Engineering are designing potential rovers and habitats for usage on the Moon.

**Dr. Olga Bannova**, a research professor in the Mechanical Engineering Department and the director of the Space Architecture Graduate Program, said that she was contacted by representatives from Boeing to do the study. Assisting her work were **Jasleen Kaur**, **Richard Spolzino** and **Vittorio Netti**.

The grant, "Design and use of a lunar terrain vehicle (rover) and mockup and simulation for a small lunar habitat," has led to a paper presentation. In October Bannova will be presenting, "Lunar surface systems architecture study to enable potential for the large-scale infrastructure development," at the 72nd International Astronautical Congress in Dubai. ⚙️

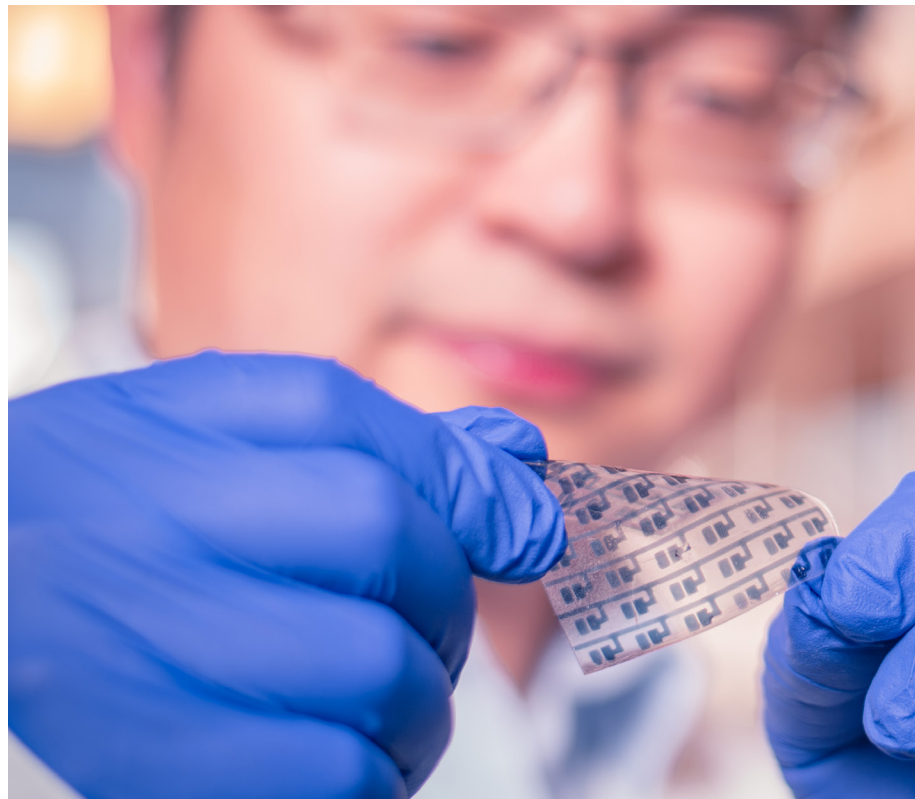


## UH ANNOUNCES FUNDING FOR **CARBON MANAGEMENT PROJECTS**



The Center for Carbon Management in Energy at the University of Houston has awarded \$275,000 in research funding for projects focused on carbon management and the energy transition.

**Dr. Hadi Ghasemi**, an associate professor of mechanical engineering, was selected as one of the recipients for his work on all-day carbon capture and sequestration through molecular and phase-change hybrid modules. ⚙️



## IMPLANTABLE DEVICE CAN **MONITOR AND TREAT HEART DISEASE**

Pacemakers and other implantable cardiac devices used to monitor and treat arrhythmias and other heart problems have generally had one of two drawbacks – they are made with rigid materials that can't move to accommodate a beating heart, or they are made from soft materials that can collect only a limited amount of information.

Researchers led by a mechanical engineer from the University of Houston have reported in *Nature Electronics* a patch made from fully rubbery electronics that can be placed directly on the heart to collect electrophysiological activity, temperature, heartbeat and other indicators, all at the same time.

**Dr. Cunjiang Yu**, Bill D. Cook Associate Professor of Mechanical Engineering at UH and corresponding author for the paper, said the device marks the first time bio-electronics have been developed based on fully rubbery electronic materials that are compatible with heart tissue, allowing the device to solve the limitations of previous cardiac implants, which are mainly made out of rigid electronic materials. ⚙️



## HOW DO SNAKES ‘SEE’ IN THE DARK?

RESEARCHERS HAVE AN ANSWER



Certain species of snake – think pit vipers, boa constrictors and pythons, among others – are able to find and capture prey with uncanny accuracy, even in total darkness. Now scientists have discovered how these creatures are able to convert the heat from organisms that are warmer than their ambient surroundings into electrical signals, allowing them to “see” in the dark.

The work, led by **Pradeep Sharma**, chairman of the Department of Mechanical Engineering at the University of Houston, and published in the journal *Matter*, provides a new explanation for how that process works, building upon the researchers’ previous work to induce pyroelectric qualities in soft materials, allowing them to generate an electric charge in response to mechanical stress. This work was part of the Ph.D. dissertation of **Faezeh Darbaniyan**, first author on the paper. Additional researchers on the project include **Kosar Mozaffari**, a student at UH, and Professor Liping Liu of Rutgers University. ⚙️

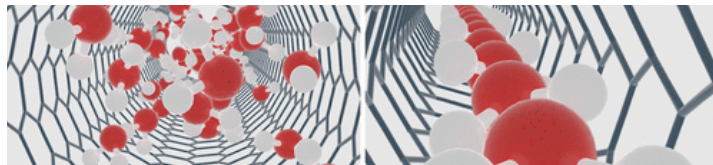


## WEARABLE EYE MOVEMENT SENSORS

FOR MEDICAL DIAGNOSIS

**Dr. Jae-Hyun Ryou**, Associate Professor of Mechanical Engineering, and his research group recently developed a wearable eye movement sensor for fatigue and sleep monitoring and diagnosis of brain-related diseases.

The work was published in the journal *Advanced Functional Materials*. The article, titled “Highly-Sensitive Skin-Attachable Eye-Movement Sensor Using Flexible Nonhazardous Piezoelectric Thin Film” features Ryou as a corresponding author, and presents a practical solution for continuous sensing of human eye blinking and eyeball motion as a critical part of personal health-care, safety, and entertainment systems. ⚙️



REVIEW ARTICLE FROM GHASEMI

## MAGNIFIES NANOENGINEERING DEVELOPMENTS

Seeing a need in the current literature, a professor from the University of Houston's Cullen College of Engineering led his colleagues in authoring a review article on developments in the field of nanoengineering.

**Dr. Hadi Ghasemi**, an associate professor of Mechanical Engineering, is a lead author of "Transport Phenomena in Nano/Molecular Confinements," which was published in *ACS Nano* on Nov. 30. His co-authors from the University of Houston are **Masoumeh Nazari** and postdoctoral fellow **Ali Davoodabadi**. Two additional authors were from Notre Dame – Dr. Tengfei Luo of the Department of Chemical and Biomolecular Engineering, and Dezhao Huang of the Department of Aerospace and Mechanical Engineering at Notre Dame. ⚙️

MECHANICAL ENGINEERING



## MEDICAL ROBOTIC HAND?

RUBBERY SEMICONDUCTOR MAKES IT POSSIBLE



A medical robotic hand could allow doctors to more accurately diagnose and treat people from halfway around the world, but currently available technologies aren't good enough to match the in-person experience.

Researchers reported in *Science Advances* that they have designed and produced a smart electronic skin and a medical robotic hand capable of assessing vital diagnostic data by using a newly invented rubbery semiconductor with high carrier mobility.

**Dr. Cunjiang Yu**, Bill D. Cook Associate Professor of Mechanical Engineering at the University of Houston and corresponding author for the work, said the rubbery semiconductor material also can be easily scaled for manufacturing, based upon assembly at the interface of air and water. ⚙️

University of Houston | Cullen College of Engineering




## FACULTY

### ACCOLADES



**2021 SENIOR MEMBER OF  
THE NATIONAL ACADEMY OF INVENTORS**

**Dr. Gangbing Song**, Moores Professor of Mechanical Engineering, was elected to the NAI Senior Member Class of 2021. He is among 61 academic inventors from around the country chosen for the prestigious honor for their remarkable innovation-producing technologies and growing success in patents, licensing and commercialization. In his Smart Materials and Structures Laboratory at UH, professor Song researches the development of actuator systems for aerospace, biomedical and oil exploration applications as well as sensor systems for biomedical research, oil exploration and structural health monitoring. The lab has also developed fiber optics-based displacement sensors for orthopedic research and fiber optic sensors for dynamic measurements.

“It is quite an honor to be a senior member of NAI. I am proud the inventions of Smart Materials and Structures Laboratory have been recognized,” Song said. “UH offers a fertile ground for research and invention to grow. I appreciate the contributions from my past and current students, postdoc associates, academic and industrial collaborators, and visiting scholars to my lab.” 

## FACULTY

### ACCOLADES



**DIVERSITY ADVOCATE TO THE  
JOURNAL *APPLIED MECHANICS REVIEWS*  
EDITORIAL BOARD**

**Dr. Yashashree Kulkarni**, Bill D. Cook Professor of Mechanical Engineering, was appointed to the journal *Applied Mechanics Reviews* editorial board as a Diversity Advocate for a two-year term. As a diversity advocate, Kulkarni will focus on the following priorities:

- Developing strategies for attracting, mentoring, and retaining women, persons of color, persons with disabilities, and veterans on the AMR editorial board;
- Ensuring that conversations about diversity are prominent in AMR editorial content and AMR-sponsored events; and
- Recruiting manuscripts for possible publication in AMR from members of traditionally underrepresented groups. ⚙️

## STUDENT

### SUCCESS

FOR THE THIRD YEAR IN A ROW, THE CULLEN COLLEGE'S ANNUAL OUTSTANDING SENIOR AND JUNIOR HAVE BEEN STUDENTS NAMED IN THE MECHANICAL ENGINEERING DEPARTMENT. UH ME IS PROUD TO BE THE COLLEGE'S LEADER IN REMARKABLE STUDENT SUCCESS.



#### OUTSTANDING SENIOR

Building on his already robust academic achievements from previous years at the University of Houston, Cullen College of Engineering student **Benjamin Estefano Diaz Villa** was recognized for his accomplishments and chosen as the Outstanding Senior for the 2020-21 academic year.



#### OUTSTANDING JUNIOR

**Yonatan Mascorro**, an undergraduate studying Mechanical Engineering at the University of Houston's Cullen College of Engineering, was named the recipient of the 2020 Mayor's Hispanic Heritage Youth Activist Award, in addition to being chosen as the Cullen College's Outstanding Junior. ⚙️



#### ME STUDENT RECEIVES BARRY GOLDWATER SCHOLARSHIP

**Javi Solano**, a Mechanical Engineering undergraduate, was awarded the prestigious Barry Goldwater Scholarship, which recognizes the most outstanding STEM students in the country. He is the first engineering student at UH to achieve this honor in 15 years. ⚙️



## ME, SPACE ARCHITECTURE GRADUATE LOPEZ MAKING HIS **INTERSTELLAR MARK**



For University of Houston graduate and native Houstonian **Javier Lopez Jr.**, it was repeated visits to the Space Center Houston with his parents and twin sister Cynthia that kindled a lifelong interest in the stars. Lopez, a first-generation Mexican American graduate, has done his best to make that dream a reality, with hard work in high school – researching what degrees astronauts had and what majors were hired by NASA – followed by two years at Lone Star Community College, before transferring to UH.

Lopez graduated with his B.S. in Mechanical Engineering from the Cullen College of Engineering in Spring 2019. He followed this up by earning a Master's in Space Architecture in Fall 2020 and completing numerous internships at NASA, and now, he works full-time with Lunar Resources, Inc., a space industrial company pioneering space manufacturing and off-Earth resource extraction. ⚙️



## CULLEN COLLEGE GRAD SERVES AS MENTOR FOR ARMY **EDUCATIONAL OUTREACH PROGRAM**



**Vijay Ramesh**, a 2020 Cullen College of Engineering graduate in mechanical engineering, recently added another thing to his impressive list of accomplishments – serving as a mentor for the interns involved in the Army Educational Outreach Program (AEOP).

Ramesh completed the Army's Undergraduate Research Apprentice Program (URAP) in 2019, with his work on strain rates of alloyed magnesium with different textures being done from May through August of that year. His advisor for that project, **Dr. Shailendra Joshi**, recommended him for a mentorship position this year. Joshi is the Bill D. Cook Assistant Professor of Mechanical Engineering at the University of Houston. ⚙️

# CULLEN

## 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 \$35 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.



# UNIVERSITY of **HOUSTON** | ENGINEERING

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Research   
**MILESTONES**