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DEPARTMENT OF OCEAN ENGINEERING

LETTER FROM THE **DEPARTMENT HEAD**



Ocean engineers are no strangers to weathering the storm and navigating uncharted waters. Adaptability and resourcefulness – be it from a natural disaster, change in tides or COVID-19 – are skills honed by former students and taught to currents students of the Department of Ocean Engineering at Texas A&M University.

Now more than ever, the versatility of an ocean engineering degree is opening doors for our students. As the field evolves with new technology in underwater robotics, vehicles and communications, offshore technology, renewable energy, air-sea interactions, and coastal and deep-sea infrastructure, our students of today are being trained to be the leaders of tomorrow in a transformative area of study.

As our students face growing challenges and opportunities, their classroom experience has evolved to include field-based learning and innovative engineering instruction and laboratory techniques. It is important for the department to be involved in fundamental research, develop technology in partnership with industry, and serve the public in ocean-related planning and policy development.

Along this same line, we are excited to offer a new Master of Science in Ocean Engineering degree program in Galveston. This 30-credit degree program can be completed by full-time students in two semesters with one five-week summer session, while also allowing working professionals to complete the program at their own pace.

Additionally, our faculty has grown on the College Station campus with the addition of Dr. Mirjam Fürth as an assistant professor and Laurrie Cordes as an assistant lecturer. They bring a passion for education and engineering as well as industry experience, giving them a unique perspective and approach to teaching and learning. To learn more about them, visit their faculty profile pages on our website.

One of our students, Patricia (Itzel) Rodriguez, said, the sea is man's last frontier, with so much left to discover and learn. The oceans connect the world – bridging continents and cultures – and now is the time for ocean engineering to use this connection to change the world for the better.

Sincerely,

Sharath Girimaji

Department Head; Holder of Wofford Cain Chair II Joint Faculty – Professor, Mechanical Engineering Chief Scientist – ASTRO Center Faculty Advisor – High Altitude Balloon Club



TEXAS A&M UNIVERSITY Department of Ocean Engineering

BY THE NUMBERS

COLLEGE OF ENGINEERING



Undergraduate Program Ranked No. 7 (Public) (U.S. News & World Report, 2021)



Graduate Program Ranked No. 8 (Public) (U.S. News & World Report, 2021)

ENROLLMENT* (FALL 2020)

169 Undergraduate **71** Graduate

FACULTY







Tenure

National Academy of Engineering Member

*preliminary

DIVERSITY

50%

Minority Students





International Students



First-Generation Students

RESEARCH AREAS

- Offshore Environment and Loading
- Coastal and Nearshore Processes
- Ocean Surface and Subsurface Robotics
- Naval Architecture
- Ocean Renewable Energy

VERSATILITY TO IMPACT THE FUTURE



Richards Sunny

Doctoral candidate Richards Sunny works alongside associate professor Dr. Juan Horrillo in Galveston to develop and improve computational fluid dynamics simulations to map, predict and research volcanic tsunamis. These models will be a vital tool in the future assessment and mitigation of submarine volcanic tsunami hazards, disaster response and planning.

"(Ocean engineering) had all the elements I wished for," said Sunny. "Challenging optimization problems, such as designing deep-water floating platforms, the potential to develop innovative ideas in the field of renewable ocean energy to help humankind, and the ability to study, analyze, model and predict natural disasters."

While the technology behind tsunami research has modernized and advanced, there are still many unknowns associated with underwater volcanic tsunamis, including the characterization of tsunami waves and the relationship between the source eruption mechanism and wave generation.

"Results from this work would help us to predict the propagation and inundation of potential underwater volcanic tsunamis and help emergency managers and agencies create evacuation plans and save lives," said Sunny.

Sebastiao Appleton Figueira

Born and raised in Portugal, Sebastiao Appleton Figueira, a junior at the College Station campus, moved to the United States with his family when he was in middle school. Coming from a largely coastal country and a family with naval and engineering roots, Figueira found a home away from home in the ocean engineering department — drawn to the versatility an ocean engineering degree would offer him.

"I could explore anything from renewable energy to ship manufacturing, naval architecture, even some electrical design," said Figueira. "And then just the prospect of what is to come in the future. Ocean levels are rising. And being part of a small group in the workforce that actually has the knowledge to solve those problems, and knowing that I'm going to be one of the most prepared to do so through this program, makes me extremely excited."





WHERE THE OCEAN MEETS THE SKY

The sea-surface microlayer that separates the sky and sea is tiny — only one millimeter at its thickest — yet it plays a major role in weather prediction and the relationship between the air and ocean.

While the sea-surface layer has been known about for decades, the dynamics and greater implications of it are largely unknown. To remedy this, Dr. Aarthi Sekaran and Dr. Noushin Amini are taking a deeper look into the flow instabilities of this sea-surface microlayer.

Sekaran explained that, with the increasing incidence of extreme weather conditions, it becomes more essential to understand the sea-surface microlayer. Focusing on the heat and mass transfer, the researchers are exploring fundamental processes of the microlayer and how it impacts weather prediction and other systems.

"My research aims at using state-of-theart computer simulations to unearth the role of flow instabilities, coherent structure dynamics and other related processes on the development of the sea-surface microlayer," said Sekaran.

Hydrodynamic instabilities - the study of fluids in motion and how their flow can be disrupted look at how such instabilities

cause large-scale dynamic changes in systems (such as weather patterns). Applying this to ocean engineering, Sekaran discovered that distinct flow patterns and instabilities could be simulated in the sea-surface microlayer, opening a door for fundamental processes to be discovered.

"The science that is hidden in this microlayer is both fascinating and challenging since we see large variations of properties like temperature, salinity and organic matter composition," said Sekaran. "Essentially, a lot happening over a small thickness, which is an exciting fluid dynamical setup."



Dr. Aarthi Sekaran



DIVING INTO DEEPFAKES

Deepfake images of people are used largely by bots to spread fake news and sway opinion. While they look real, everything about them is synthetic — just a series of codes that come together to form an image of a person who doesn't exist. This global and interdisciplinary issue begs the question: Is seeing really believing?

As Dr. Freddie Witherden and doctoral student Tarik Dzanic discovered, the falsified faces are not without fault.

Witherden explained real photographs have a noise pattern associated with their pixels. The human eye cannot notice this noise, so the bots that generate deepfake images do not pay attention to that detail when creating the images. They only focus on the big picture and recognizable features of a face, such as a mouth, nose and eyes. Witherden's algorithm detects this noise to identify deepfake images.

"(The bots) are not concerned about the minutia associated with the noise and, so, they don't make any effort to try to get that noise profile correct," said Witherden. "By doing some very simple signal processing, we can identify these discrepancies and thus discriminate between real or fake images."



Witherden was named in the 2020 Forbes' 30 Under 30 list for Europe in the science and health care category.

"We are delighted, but not surprised, that Dr. Witherden was mentioned in this prestigious list," said department head Dr. Sharath Girimaji. "It is a fitting recognition of his incredible talent and hard work. We have an excellent group of young faculty members, and I look forward to exciting times ahead for the ocean engineering department."

GALVESTON INTRODUCING NEW MASTER OF SCIENCE PROGRAM

The department has established a new Master of Science in ocean engineering degree program offered exclusively in Galveston – highlighting the unique waterfront location and resources of the campus.

This non-thesis, 30-credit program provides students with a unique education and career preparation filled with hands-on experience, direct access to the coast, on-the-water field data collection adventures, industry collaboration, proximity to Houston and world-class resources.

Ideal for students and professionals with an undergraduate degree or equivalent international degree in any engineering field, the thorough curriculum covers a variety of ocean engineering topics and offers the opportunity to specialize in specific areas. This degree program is adaptable and versatile for the ever-growing fields of coastal and ocean engineering. One of the highlights of the course is a ship cruise for handson learning through ocean engineering experiments and oceanographic field measurements.

"Ocean engineering is a multidisciplinary field evolving continually to meet the challenges arising from engineering in extreme coastal and ocean environments," said department head Dr. Sharath Girimaji. "To keep up with this fast-paced field, we are offering a new M.S. program that can be designed to suit the needs of industry and the interests of the students."

Interested students can enroll now. The required 30 credits can be taken in two main semesters (fall and spring) and an additional five-week Summer I session.

For more information, visit tx.ag/GalvestonMS





TEXAS A&M UNIVERSITY Department of Ocean Engineering

engineering.tamu.edu/ocean

DEPARTMENT OF OCEAN ENGINEERING AREAS OF FOCUS

Offshore environment & loading

Coastal & offshore processes

Ocean surface and subsurface robotics

Naval architecture

Ocean renewable energy