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Development of Acoustic Telemetry and Autonomous Sensing Technologies to Support the Design and Operations of Environmentally Friendly Renewable Energy Systems

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Seminar Details

Friday, Feb 2, 2024
2:30pm – 4:00pm

UH Campus
Science Building
Room S105

Online via Teams
https://www.cive.uh.edu/research/beyer-distinguished-lecture

ABSTRACT

To design and operate renewable energy systems such as wind, solar, hydropower, and ocean power, for minimum ecological impact and maximum power generation, it is critical to understand the interactions between the energy systems and the aquatic/terrestrial animals. We have developed several acoustic telemetry and autonomous sensing technologies to study the nature of the physical conditions to which animals are exposed when they encounter the energy systems and to identify the locations within the structures and operations where conditions are severe enough to injure or kill them. One example is an acoustic transmitter recently developed to study juvenile American Shad. It weighs 0.05 g, only ¼ that of commercially available technologies. Another example is the Lab-on-a-Fish, the world's first biotelemetry transmitter that combines edge computing with real-time wireless sensing of in vivo physiology (electrocardiogram and electromyogram), behavior (activity level and tail beat frequency), ambient environment (temperature, pressure, and magnetic field), and location. It has a miniaturized form (mass: 2.4 g; dimensions: 5.5 mm × 6.5 mm × 37 mm) for studying small animals. Several of the technologies have been widely adopted by researchers nationally and internationally and have found commercial success. These efforts are part of my research vision to develop next-generation sensors that not only have high system performance but also are lightweight, small, and soft. These systems can be applied in all types of structures and could use humans or animals as sensing platforms to allow in situ and real-time detection and diagnosis of environmental conditions and risks, and human activities.

BIOGRAPHY

Dr. Zhiqun (Daniel) Deng is a Laboratory Fellow in the Energy & Environment Directorate at Pacific Northwest National Laboratory (PNNL) and Adjunct Professor of Naval Architecture and Marine Engineering at University of Michigan. He directs the PNNL Bio-Acoustics & Flow Laboratory, an accredited multi-disciplinary R&D laboratory, addressing a broad range of engineering and ecological issues for the development and operations of renewable energy systems. He won a 2020 Federal Laboratory Consortium Excellence in Technology Transfer Award for the Suite of Fish and Wildlife Tracking Technologies and a 2021 R&D 100 Award as for Lab-on-a-Fish. He is also a member of the Washington State Academy of Sciences. He received his PhD in Theoretical & Applied Mechanics from University of Illinois at Urbana-Champaign in 2003.