SDSU College of Engineering Mechanical Engineering

Mechanical Engineering Seminar Series

November 19, 2024, 10:00AM

Dean's Conference Room, E-203E

Title: Visual Anemometry: Functional Dependence of Leaf Fluctuating Speed on Impinging Flow

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Abstract: High-resolution, near-ground wind data is critical for improving the accuracy of weather and climate models, supporting wildfire control efforts, and ensuring safe aircraft takeoffs and landings. However, current wind sensing (anemometry) techniques rely on physical installation at specific locations and only provide single-point or line measurements, which limits their ability to offer the global coverage needed. While traditional methods like the Beaufort scale offer qualitative wind estimates based on visual cues like smoke movement and tree sway, their reliance on subjective interpretation hinders precise data collection, limiting their usefulness for robust predictions. I will present a physics-based single-camera visual anemometry method for quantifying wind speeds observed across an entire camera's field of view. This approach leverages the motion of vegetation, like trees and grasses, as natural wind sensors. Previous methods require a reference anemometer on site, but this new physics-based approach eliminates the need for the reference anemometer at wind speeds under 20 meters per second. We discover the dominant physics driving the observed vegetation fluctuations, which is used to collapse data from vastly different plants onto a single master curve. The resulting wind speed estimates approach the theoretical accuracy limit imposed by atmospheric turbulence.

Brief Bio: Dr. Roni Goldshmid is an Assistant Professor in the Aerospace Engineering Department at San Diego State University. She received her B.S. at the University of California, Berkeley and her M.S. and Ph.D. at the Technion – Israel Institute of Technology. She was named a Caltech Presidential Postdoctoral Fellow while completing her postdoctoral appointment at GALCIT and a Rising Star by the Department of Mechanical Engineering at Stanford University (2022), authored three successful grants (ONR 2023, NSF 2019, ISF 2018) and received the Grinshpen Prize for Excellent Research in Environmental Engineering and Air Quality (2016). Dr. Goldshmid's research interests and expertise include development of flow measurement techniques as well as solving fundamental and applied problems such as fluid-structure interactions, boundary layer flows, heat transfer, passive flow control, anomaly detection, complex terrain influence on fluid flow, scalar transport, and interpretation of imperfect empirical data using machine learning. Dr. Goldshmid is committed to diversity and outreach in STEM, as evidenced by her leadership roles in the Stories of Women in Fluids Initiative and more.