Center for Environmental & Applied Fluid Mechanics

"Leveraging Flexibility and Flow Unsteadiness: From Underwater Propellers to Energy Harvesters"

Cecilia Huertas Cerdeira
University of Maryland
College Park

The use of flexible structures and unsteady fluid phenomena significantly increases the performance of many biological mechanisms. Yet, these properties have been historically avoided in engineering due, in part, to the complexity of characterizing the mechanics of the resulting systems. In this talk, I will show two examples of how flexibility and flow unsteadiness can be leveraged to advance technologies used by autonomous systems. First, a bio-inspired propeller for underwater autonomous vehicles will be presented. A caudal fin capable of generating large rotations around all three axes is proposed as a combined propulsive and maneuvering system. The analysis will delve into the experimental optimization of the three-dimensional motion to be performed by the fin. Second, an inverted-flag piezoelectric energy harvester for remote sensors will be considered. In this mechanism the resonance between flag motion and fluid forcing generates large-amplitude unsteady deformations of the structure that can be exploited for energy harvesting. The flag's dynamics will be discussed, and effect of its orientation to the flow will be examined in detail.

Fall 2022 CEAFM Seminar Series

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https://wse.zoom.us/j/93762992307

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