Graduate Student Research Seminar

Fall 2024

Collective Swimming Dynamics in Robotic Fish Arrays

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Monday, October 21st
3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

Group travel in animals, such as fish, often serves essential purposes like protection, survival, and endurance. Fish, in particular, face the challenge of hydrodynamic loads, prompting questions about the role of multi-body fluid-mediated interactions in collective swimming. We investigate these interactions using a rotational array of robotic fish with prescribed tail flapping motions, where the swimming speed of each robotic fish is determined by the resulting hydrodynamic effects. We examine how the collective speed of the robotic fish array is influenced by various parameters: the frequency and amplitude of tail flapping, the phase difference between the tail motions of neighboring robots, and the spacing between the fish. Additionally, we assess the cost of transport by measuring the power required to drive the flapping tails. By exploring a wide range of parameters, we identify conditions under which multi-body hydrodynamic interactions either enhance or hinder the swimming performance of the robotic fish array compared to a solo swimmer. This research provides valuable insights into the dynamics of collective swimming and the potential applications of robotic fish in understanding and replicating biological group behaviors.

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