Graduate Student Research Seminar

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A vibration driven slender elastic swimmer

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3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

In recent times, there has been a surge of interest in bio-inspired approaches to underwater locomotion. Birds and fish are known to flap their wings or tails in patterns to move the fluid around their bodies to generate motion. To replicate such a fluid-structure coupling researchers have considered using heaving flexible panels to determine specific traits for optimal performance. As a result, some favorable conditions such as fluid-structure resonance, modulus of elasticity, flexibility, etc. have been identified to improve efficiency of underwater locomotion. This has led to the design of aquatic robots with passive appendages that are actuated with an internal rotor. However, such rotor driven robots have lacked the maneuverability, agility and efficiency found in fish. This work presents a novel method of underwater propulsion that involves using an internally driven unbalanced rotor that excites oscillations in a flexible tail, which in turn generates thrust. Continuous rotation of an unbalanced rotor induces high frequency oscillations in the body which are in practice small high frequency circular motions. Coupling this high frequency circular motion with an elastic sheet excites multiple modes of oscillation in the elastic sheet. We design such a robot and explore different gaits of the robot and investigate the dynamics of the system. We also explore different modes of actuation and their resulting gaits.

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