Center for Fluid Mechanics, Division of Applied Mathematics
Fluids, Thermal and Chemical Processes Group, School of Engineering
Joint Seminar Series

Guidance, Navigation, and Control Challenges of Aerial Microrobotics

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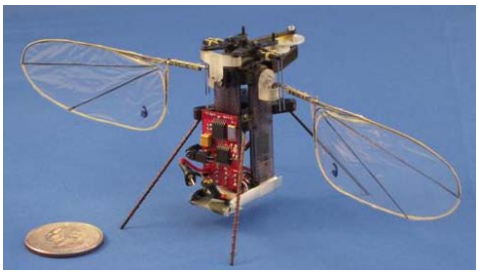

Successful realization of insect-based aerial microrobotic vehicles faces significant hurdles due to fast dynamics, small payload capacities, and the absence of a quantitative reduced-order description of the flight mechanics. Moreover, the stringent size, weight, and power (SWaP) constraints render traditional sensing and processing approaches unusable. Insect nervous systems, which function under similar constraints, offer a promising alternative. In these small organisms, spatially distributed arrays of simple sensors that pool localized measurements are processed in parallel by sensory interneurons that converge onto relatively small numbers of motor neurons responsible for controlling locomotion. In addition to this unique approach for rapid extraction of information for stability augmentation and navigation, behavioral analysis and measurements from high speed videography indicate that insects leverage passive aerodynamic mechanisms attendant to flapping motions to further minimize sensing and feedback requirements. This talk will address (a) a control- and information-theoretic framework in which to analyze the advantages of this unique sensorimotor architecture; (b) reduced order models of flapping flight dynamics and analysis of high speed videography of insect gust response to understand the passive aerodynamic stability mechanisms; and (c) hardware implementations of insect-inspired sensors and the development of a 10g flapping micro air vehicle.

Tuesday October 5, 2010
3:00 PM
Barus & Holley Room 190