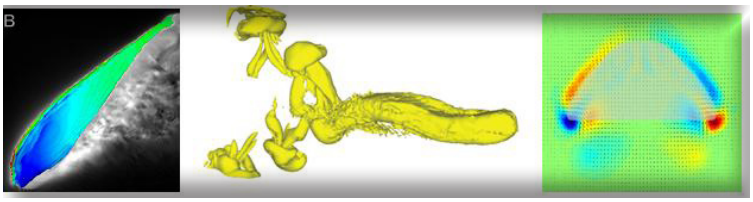
NORTHWESTERN INSTITUTE ON COMPLEX SYSTEMS PRESENTS

Wednesdays @NICO

The Influence of Hydrodynamics on the Evolution of Fish Form and the Neuromechanics of Aquatic Locomotion



Neelesh A. Patankar
Mechanical Engineering, McCormick School of Engineering

Wednesday, January 28, 2009
12:00 – 1:00 PM
Chambers Hall, 600 Foster Street, Lower Level Classroom

The talk will proceed in two parts. In the first part, a new numerical technique to simulate self–propulsion will be presented. The key idea behind the numerical technique is to assume that the entire fluid–fish domain is a 'fluid' and then to constrain the fish domain to move with prescribed deformations. The resulting solution gives the swimming velocity of the fish and the surrounding flow field. This approach has enabled, for the first time, simulation of self–propulsion of a variety of organisms including bacterial flagella, jellyfish, zebrafish, eel, blackghost knifefish, among others. The second part of the talk will focus on the application of the numerical technique to the hydrodynamics of blackghost knifefish (*Apteronotus albifrons*) studied in the laboratory of Malcolm MacIver. These fish can swim forward or backward by generating traveling waves on a long ribbon–like fin on its ventral side. It was found that several aspects of its anatomy including its body shape, fin placement, fin size, and operating conditions such as the number of waves on the ribbon fin are close to hydrodynamic optimal conditions. This strongly suggests the influence of hydrodynamics on the complex process of adaptability during evolution. This study can be extended to a variety of fish forms *in silico* using an artificial evolution paradigm based on our numerical technique for self–propulsion. Finally, Neelesh will discuss how studying hydrodynamics can help understand the control of motion by the brain, i.e., the neuromechanics of animal locomotion.

NICO Coffee Hour will follow for questions, networking, and collaboration.

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