Talk 102

An Integrated Locomotion Model for Lamprey Swimming

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Locomotion is the product of neural output acting on muscles driving a mechanically complex body in an unpredictable environment. Interactions within and among these elements permit adaptive movement. The lamprey is a simple, well-studied and relatively tractable vertebrate model with which to probe this neuromechanical system. We propose to achieve an integrated understanding of lamprey swimming through exploitation of neural and mechanical studies within a set of models, both computational and mechanical (P-RAY), that will encapsulate our knowledge of the locomotor system. Our aim is to produce an integrated computational model, LAMPREYCOMP, that will accurately simulate the central pattern generator (CPG), muscle, body, environment, and relevant feedback paths.

To achieve these goals we have assembled a team of biologists, mathematicians and fluid dynamicists. I will present the core of the program through films of the mechanical lamprey, and some of our results as we approximate the fluid mechanical reality of LAMPREYCOMP, the full-blown model of the lamprey swimming. I will also present some of the physiological data that is being collected on the sensory systems that interact with the spinal cord during swimming. This overview will illustrate the flavor of the approach, and explain how we expect to proceed.

Project (or PI) Website

http://www.life.umd.edu/biology/faculty/cohen/index.html

Publications

1. T. McMillen and P. Holmes (2006) J. Math. Biol. (in review). An elastic rod model for anguilliform swimming.

2. T.L. Williams, G. Bowtell and N.A. Curtin (1998) J. Exp. Biol. 201,869-875. Predicting force generation by lamprey muscle during applied sinusiodal movement using a simple dynamic model.

3. J.H.J. Buchholz and A.J. Smits. On the evolution of the wake structure produced by a low-aspect-ratio pitching panel. J. Fluid Mech., 546:433-443, 2006.

4. R.P. Clark and A.J. Smits. Thrust production and wake structure of a batoid-inspired oscillating fin. Accepted to J. Fluid Mech., 2006.