Texas Tech University - Department of Mathematics and Statistics
Seminar in Applied Mathematics

Undulatory Locomotion on a Submillimeter Scale: From Hydrodynamics to Neuromuscular Control

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ABSTRACT. A millimeter-size nematode Caenorhabditis elegans is one of the most important model organisms used for investigations ranging from cellular development to genetics to neurobiology. Since the topology of neural connections of this nematode has been fully mapped out, it should be possible to reverse engineer how its nervous system functions. This great challenge requires systematic studies of biophysics of nematode locomotion in complex environments to quantify the interplay of sensing processes, control mechanisms, and mechanical interactions that include frictional, capillary, and hydrodynamic forces. In this talk we will analyze the kinematics of nematode motion, present simple models of neuromuscular control of the nematode body, and show how they can be used to elucidate chemotaxis mechanisms. Such studies, in addition to their fundamental value, are necessary for practical applications, for example to screen genes associated with neuromuscular diseases. This vast knowledge base may also be harnessed to design smart artificial crawlers.