Colloquium

UNIVERSITY OF NOTRE DAME
Department of Mathematics

Speaker: Shuwang Li
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Wednesday, November 18, 2009
4:00 PM
117 Hayes-Healy Hall

Title: Modeling and Computation of Moving Boundaries in Fluids and Materials

Abstract:

In this talk, I will focus on the modeling and computation of two problems: Hele-Shaw flow and biomembranes. Hele-Shaw problem is a classical moving boundary problem in fluid dynamics and serves as a typical example for studying the stability of a nonequilibrium system. I will demonstrate that there exist critical conditions such that the Saffman-Taylor instabilities may be suppressed and instead yield attractive, compact selfsimilarly evolving shapes (universal shapes).

The second part is about my recent work on the modeling of a biomembrane. Membranes are composed of bilayer lipid molecules with hydrophilic heads and hydrophobic hydrocarbon chains. In an aqueous environment, membranes form encapsulating baglike shapes, called vesicles to reduce the energy of the hydrophobic edges. Because of its fluid-like nature and highly flexible structure, a vesicle adopts a wide variety of morphologies and exhibits rich shape transition behaviors. I will develop a mathematical model to describe the dynamics of a membrane, in particular, the nonlinear coupling among flow, membrane morphology and the evolution of the surface phases. We will also discuss the associated numerical methods and some preliminary results.