Physical Mathematics Seminar

A Deterministic-Control-Based Approach to Interface Motion

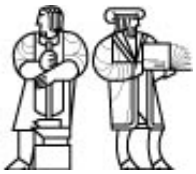
Robert V. Kohn
Courant Institute

Tuesday September 28, 2004
2:30 PM
Building 2, Room 338

Abstract

Interface motion is central to many application areas, including materials science and computer vision. Motion by curvature is a basic example, in which the normal velocity of the interface is equal to its curvature. The level-set approach, now 15 years old, represents the evolving interface as the zero-level-set of an evolving PDE. This viewpoint has been extremely successful for both simulation and analysis.

I'll discuss joint work with Sylvia Serfaty, which develops a new perspective on the level-set approach to motion by curvature and related interface motion laws. We show, loosely speaking, that the level-set PDE is the value function of a deterministic two-person game. More precisely, we give a family of discrete-time, two-person games whose value functions converge in the continuous-time limit to the solution of the motion-by-curvature PDE. This result is unexpected, because the value function of a deterministic control problem is normally a first-order Hamilton-Jacobi equation, while the level-set formulation of motion by curvature is a second-order parabolic equation.



Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139