STANFORD PROBABILITY SEMINAR

Kevin Ross, UNC-Chapel Hill
Monday, 3 April 2006
4:15pm (Refreshments at 4pm in the 1st Floor Lounge)
Sequoia Hall, Room 200

Numerical Schemes for Singular Control Problems with State Constraints

Abstract. Singular control is an important and challenging class of stochastic control problems. Such problems can rarely be solved explicitly and thus numerical approximation schemes are necessary. In this work we take a probabilistic approach and, using the theory of weak convergence of stochastic processes, develop convergent numerical schemes that are based on approximating the underlying state process by a suitable controlled Markov chain.

In the first part of the talk we consider a problem of optimal consumption and portfolio selection with transaction costs. One challenging feature of this problem is that the directions of singular control are tangential to the boundary of the state space. This feature, along with degeneracy in the dynamics and unboundedness of the state and control spaces, makes the convergence analysis quite delicate.

Numerical schemes for singular control problems can be computationally intensive, and thus it is of great interest to develop less expensive schemes that take advantage of specific features of the underlying dynamics. Motivated by this, we consider a two-dimensional singular control problem that arises from queueing networks. Using the special form of the dynamics, we prove rigorously an equivalence between this problem and an optimal stopping problem, and we exploit this connection in developing simple computational schemes for the singular control problem.

This is a joint work with Amarjit Budhiraja.