Statistical Sciences
UNIVERSITY OF TORONTO

SEMINAR

February 8, 2016 at 3:30pm

Refreshments will be provided at 3:15pm

Sidney Smith Hall, Room 2129

Speaker: Ningyuan Chen, Yale School of Management

Host: Jamie Stafford

A partitioning algorithm for Markov decision processes with applications to market microstructure

In this talk, we propose a partitioning algorithm to solve a class of linear-quadratic Markov decision processes with inequality constraints and non-convex stagewise cost. The formulation greatly extends the classic linear-quadratic-Gaussian control and still yields a closed-form solution by our algorithm: within each region of the partitioned state space, the value function and the optimal policy have analytical quadratic and linear forms, respectively.

The algorithm is applied to two applications related to market microstructure, which concerns with how transaction occurs and its impact on future prices. In the main application, we present a model for limit order books with stochastic market depth to study the optimal order execution problem. As a feature of our model, stochastic market depth is consistent with empirical studies and necessary to accommodate various order activities, such as limit order submission at and outside the best quotes and order cancellation, which may account for a large proportion of limit order activities. The optimal execution policy obtained by the algorithm significantly outperforms that of a deterministic market depth model in numerical examples. In the second application, we use the algorithm to compute the exact optimal solution to the renewable electricity management problem, for which previously only an approximate solution is known. As a comparison, we show that the approximate solution can be quite inaccurate for some initial states and thus demonstrate the advantage of the exact solution.