

MECHANICAL ENGINEERING DEPARTMENT
ME/ISyE 8773-8774

Approximate Dynamic Programming for High-Dimensional Problems

by

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3:15 p.m. — Refreshments before the seminar

3:30 p.m. — Graduate Seminar

Room 1130 ME

Abstract: Stochastic resource allocation problems produce dynamic programs with state, information and action variables with thousands or even millions of dimensions, a characteristic we refer to as the "three curses of dimensionality." Classical techniques in approximate dynamic programming solve only part of the problem. Advances in approximate dynamic programming are allowing us to obtain reliable solutions to large scale stochastic resource allocation problems ranging from the management of locomotives, trucks and jets to the planning and pricing of energy resources. We solve these problems by breaking them into three basic steps involving simulation, deterministic optimization and statistical estimation. Simulation allows us to model problems at a high level of detail. Decisions are broken down over time, allowing us to use commercial solvers to optimize truly large scale problems. Finally we use recursive statistics to estimate the impact of decisions now on the future. The techniques are illustrated using several industrial projects at CASTLE Lab.

Bio: A faculty member at Princeton University since 1981, Professor Powell specializes in stochastic optimization problems arising in a variety of resource allocation problems, with applications ranging from freight transportation, military operations, energy resource management, health and finance. He founded and currently heads CASTLE Laboratory within the Department of Operations Research and Financial Engineering at Princeton where he works with major transportation companies (railroads; truckload, less-than-truckload and small package motor carriers; the Air Force and business jet operations) as well as other operational problems to develop strategic, tactical and real-time models, focusing on the problem of planning under uncertainty. He has brought in over \$10 million in research funding since the founding of CASTLE Lab in 1990. His

research includes fundamental contributions to stochastic optimization, computational advances in the solution of large-scale stochastic optimization problems, and the formulation and solution of complex resource allocation problems arising in transportation. He has authored or coauthored over 100 refereed publications, and he has recently completed a book on approximate dynamic programming. He has implemented production models at a number of the largest transportation companies in the country. His work in freight transportation has spawned two consulting firms, and he was twice a finalist in the Edelman competition. A recipient of the Informs Fellows Award, Professor Powell has served in a variety of editorial and administrative positions for Informs, including Informs Board of Directors, Area Editor for Operations Research, President of the Transportation Science Section, and numerous prize and administrative committees.

Informal Faculty Luncheon: Wednesday, October 3, 2007, 12:00 noon. Meet in 1100 ME and walk to lunch with other faculty. Prof. Warren Powell will be able to attend.