Markov Decision Processes and Stochastic Games II

Stream: Decision Making under Uncertainty and Environmental Applications
Invited session

Chair: Eugene Feinberg, Department of Applied Mathematics, Stony Brook University, and Statistics, 11704-3600, Stony Brook, NY, United States, eugene.feinberg@sunysb.edu

1 - Ordered Field Property in Stochastic Games
Jerzy Filar, School of Computer Science, Engineering and Mathematics, Flinders University, Sturt Road, 5042, Bedford Park, SA, Australia, jerzy.filar@flinders.edu.au

In the now classical 1953 paper "Stochastic Games", L.S. Shapley remarked that the value of these games need not lie in the same ordered field as the data defining the game. This remark generated a line of research aimed at characterizing the classes of stochastic games possessing the desirable "ordered field property" whereby the value does in the same ordered field as the underlying data. In this presentation we review some of the history of this problem and propose new results based on the algebraic theory of Groebner bases.

2 - Monotonic successive approximations in queueing
Herman Blok, Mathematical Institute, Leiden University, Niels Bohrweg 1, 2333 CA, Leiden, Netherlands, blokh1@math.leidenuniv.nl, Sandjai Bhulai, Flora Speksna

In many queueing models with arrival or departure control a policy with a switching curve is optimal. We propose a fast method for approximating such a curve in the following way. Suppose the queueing model can be modelled as a Markov decision process for which successive approximation converges. Often the iteration step has a monotonic property in the sense that the switching curve either increases or decreases in the iteration step, depending on the initialisation. This provides an increasingly tighter bound on the set of potentially optimal curves. We will discuss several applications.

3 - Cash-Flow Based Dynamic Inventory Management
Michael Katehakis, Rutgers University, 08854, Piscataway, NJ, United States, mnk@rci.rutgers.edu

We model a firm that uses its capital position to invest on a single-product inventory, in an environment that allows the firm to utilize debt to finance increased order quantities while excess cash can be deposited at a bank to earn interest. The demand is random and could be non-stationary over periods. The objective is to maximize the expected value of the capital at the end of a finite planning horizon. We show that the optimal policy is determined by a sequence of two threshold critical values. Furthermore, we derive an efficient algorithm to compute these threshold values.
Methods and Models for Supply Chain Analytics

Stream: Demand and Supply Planning in Consumer Goods and Retailing
Invited session

Chair: Michael Katehakis, Rutgers University, 08854, Piscataway, NJ, United States, mnak@rci.rutgers.edu
Chair: Apostolos Burnetas, Operations, Case Western Reserve University, 10900 Euclid Ave, 44106, Cleveland, OH, United States, ab54@weatherhead.cwru.edu

1 - Approximate solution for the inventory system with yield uncertainty and the lead time
Wen Chen, IROM, The University of Texas, United States, wen.chen@utexas.edu

The paper discusses a procurement dynamic problem. The firm can replenish its inventory from an unreliable supplier with positive leadtime (L). The problem involves a large state space of in-transit order. The paper treats two realistic versions of inventory problem, full backordering inventory system and lost-sales inventory system. We construct simple myopic approximations for both inventory systems which decompose L-dim problem to L different subproblems at every planning horizon.

2 - Investment and Pricing in a Supplier-Buyer Chain with Persistent Price Effects
Panagiotis Kyriazis, Management Science and Technology, Athens University of Economics and Business, Athens, Greece, kyriazis@kfs.gr, Apostolos Burnetas, George Ioannou

We consider a single product supplier — buyer chain where the supplier sets the wholesale price and the buyer the retail price, faced with a downward linear demand curve. We analyze the two-period pricing problem, under the assumption that the first period retail price affects the market size in the second period, and derive the equilibrium pricing policy. We also study the game where the two parties decide on individual investments in the first period, which increase the market size.

3 - Homogeneous Quasi-Skip-Free processes with "quasi" product form distribution
Dwi Ertiningiisih, Leiden University, Niels Bohrweg 1, Rijnsburgerweg 124-E17, 2333CA, Leiden, Zuid Holland, Netherlands, dwierninisingih@math.leidenuniv.nl, Flora Speksma, Laurens Smitt

We study QSF (Quasi-Skip-Free) processes, which are a generalization of QBD (Quasi-Birth-Death) processes, where jumps to higher phases are allowed. Under homogenity and irreducibility assumptions we show that the stationary distribution has a product form as a function of the phase. We will study various application such as the embedded G/M/1 and phase type batch service queues.

4 - Explicit Solutions and Other Properties of Successively Lumpable Quasi Skip Free Processes
Laurens Smitt, Leiden University, Netherlands, lsmitt@math.leidenuniv.nl, Flora Speksma

We consider quasi-skip-free processes (QSF), a generalization of the quasi-birth-death processes. We use a simple condition under which a QSF is successively lumpable (SL-QSF) and the steady state distribution can be calculated explicitly and rapidly. These processes have applications in many areas of applied probability including queuing theory, reliability and the theory of branching processes. We discuss a procedure to decompose QSFs into separate SL-QSFs and we extend the method of successive lumping to calculate discounted rewards in a QSF with a fixed policy.