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# Advances in stochastic models of manufacturing and service operations

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**Abstract** The special issue on advances in stochastic models of manufacturing and service operations presents state-of-the art research results in the area of stochastic models for the analysis, design, coordination, and control of manufacturing and service system operations. Although the title includes both “manufacturing” and “service” operations, the main emphasis is on manufacturing. The term “service system operations” is intended to refer mainly to functions that are supportive of manufacturing system operations. The volume includes thirteen state-of-the art articles that can be classified in three categories: stochastic modeling and analysis for design and optimization of manufacturing systems; production planning, management, and control; and analytical approaches to supply chain management.

**Keywords** Stochastic models · Manufacturing and service operations · Manufacturing systems · Production lines · Production planning, management, and control · Inventory management · Markov models · Queueing models · Queueing networks

Production-inventory systems are affected by uncontrollable variation in supply and demand due to randomness that arises from various sources including machine failures, arrivals of parts, processing times, and customer demand arrivals, among others. In order to design and control manufacturing and service systems that operate effectively in this environment, analytical models that capture the effects of randomness are necessary.

This volume presents state-of-the art research results in the area of stochastic models for the analysis, design, coordination, and control of manufacturing and service system operations.

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Although the title includes both “manufacturing” and “service” operations, the main emphasis is on manufacturing. The term “service system operations” is intended to refer mainly to functions that are supportive of manufacturing system operations.

A number of new results in the thematic area of this volume were presented at the Eighth Conference on “Stochastic Models of Manufacturing and Service Operations,” Kusadası, Turkey, 28 May to 2 June 2011, which attracted leading scholars in this field. This volume is intended to disseminate these results as well as those obtained by other researchers, and all papers underwent a thorough review. We believe it will benefit both theoreticians and practitioners.

The volume includes thirteen state-of-the art articles that can be classified in three categories: stochastic modeling and analysis for design and optimization of manufacturing systems; production planning, management, and control; and analytical approaches to supply chain management.

## **1 Stochastic modeling and analysis for design and optimization of manufacturing systems**

The first category includes six articles. In the first one, Schwarz, Stoll, and Özden present a method for the performance analysis of general batch building processes in material flow systems. Next, Gebennini, Grassi, and Fantuzzi discuss a continuous time model to analyze a two-machine one buffer system with a restart policy. In the third article, Boxma, Parlar, and Perry present a method to study the steady-state buffer content of a fluid queue using the level-crossing theory. In the fourth article, Özdogru and Altıok use a continuous material flow system to describe the operation of a bulk port marine terminal and propose a decomposition method to determine steady-state performance measures. In the fifth article, Alfieri, Matta, and Pedrielli present a mathematical programming approach for joint simulation and optimization of closed queueing networks. In the last paper of this category, Roy, Krishnamurthy, Heragu, and Malmberg presents a model for a warehouse where autonomous vehicles are used for unit-load operations.

## **2 Production planning, management, and control**

The second category consists of three papers. In the first one, Smith proposes a method to determine the optimal workload allocation in closed queueing network models with finite capacity state dependent queues. In the second, Buyukkaramikli, van Ooijen, and Bertrand study the capacity flexibility problem of a maintenance service provider together with the inventory control problem to decide on the component inventory stock level and the repair shop capacity level. The article, by Turgay, Karaesmen, and Örmeci, investigates the structural properties of a finite-horizon, discrete-time single-product inventory rationing problem with random replenishment and production opportunities, and with uncertain demand and production rates.

## **3 Analytical approaches to supply chain management**

In the last category of papers, there are four papers that study various inventory management problems. In the first paper, Kang, Brisimi, and Paschalidis present a methodology to solve

linear programming problems with data uncertainty. They use this method to solve a discrete-time stochastic inventory control problem with service constraints. In the second paper, Wensing and Kuhn analyze periodic review order-up-to inventory systems with backorders when orders may crossover due to stochastic lead times. In the third paper, Alvarez, van der Heijden, and Zijm computationally investigate the option of keeping dedicated stocks at customer sites in addition to central storage to manage spare parts supply chains with service differentiation. Finally, Khmelnitsky and Singer present a model to analyze the inventory control problem of a retailer where the reputation of the retailer impacts the distribution of future demand. They provide additional clarifications and corrections of this paper regarding the optimality of the proposed policy as an Erratum.

We would like to thank the numerous anonymous referees who contributed to the review process of this volume. Finally we would like to thank Endre Boros for supporting the volume and Katie D'Agosta for her support during the process.

*Dedication* This volume is dedicated to Prof. Tayfur Altiok who passed away unexpectedly on April 14, 2012, while his paper with Özdogru was under review. Dr. Altiok, a Professor of Industrial and Systems Engineering at the School of Engineering of Rutgers University, will always be remembered for his important contributions to the area of stochastic modelling of manufacturing and service operations, and as a great friend.