

# Preface

Matrix-analytic and related methods have become recognized as an important and fundamental approach to the mathematical analysis of general classes of complex stochastic models. Research in the area of matrix-analytic and related methods seeks to discover underlying probabilistic structures intrinsic in such stochastic models, develop numerical algorithms for computing functionals (e.g., performance measures) of the underlying stochastic processes, and apply these probabilistic structures or computational algorithms within a wide variety of fields including computer science and engineering, telephony and communication networks, electrical and industrial engineering, operations research, management science, financial and risk analysis, and biostatistics. These research studies provide deep insights into and understanding of the stochastic models of interest from a mathematical or applications perspective.

From 13 through 16 June 2011, the Seventh International Conference on Matrix-Analytic Methods in Stochastic Models – MAM7 – was held at Columbia University in New York, NY, USA continuing the rich tradition of previous successful MAM conferences in Flint (1995), Winnipeg (1998), Leuven (2000), Adelaide (2002), Pisa (2005), and Beijing (2008). The MAM7 conference was sponsored by the Center for Applied Probability (CAP) at Columbia University and IBM Research, as well as the Applied Probability Society of INFORMS; MAM7 also thanks ACM SIGMETRICS for financial support.

The conference brought together researchers working on the theoretical, algorithmic, and methodological aspects of matrix-analytic and related methods in stochastic models, as well as the applications of such mathematical research across a broad spectrum of fields. In particular, the conference provided an international forum for presenting recent research results on the theory, algorithms, and methodologies concerning matrix-analytic and related methods in stochastic models; presenting recent research results on the application of matrix-analytic and related methods to address problems arising within a wide variety of fields; reviewing and discussing methodologies and related algorithmic analysis; improving collaborations among researchers in applied probability, operations research,

computer science, engineering, and numerical analysis; and identifying directions for future research.

All submitted chapters were reviewed by at least 4 members of the scientific advisory committee, resulting in a total of 37 submissions being selected for presentation at the MAM7 conference and inclusion in an informal proceedings distributed at the conference. In addition, plenary talks were given by Edward Coffman, Steven Kou, Marcel Neuts, and Devavrat Shah. This book, the formal proceedings of MAM7, contains a selection of papers from the conference program, covering various aspects of matrix-analytic and related methods in stochastic models and their applications across many different fields.

In Chap. 1, Baek et al. establish the factorization properties of a MAP-modulated fluid flow model under generalized server vacations and two types of increasing fluid patterns during idle periods. Chapter 2, by Bini et al., considers quasi-birth-and-death processes with low-rank downward and upward transitions and show how this structure can be exploited to reduce the computational cost of the cyclic reduction iteration. In Chap. 3, Bladt et al. define and study the classes of bilateral and multivariate bilateral matrix-exponential distributions that have support on the entire real space and have rational moment-generating functions. In Chap. 4, Casale and Harrison propose algorithms to automatically generate exact and approximate product-form solutions for large Markov processes that cannot be solved by direct numerical methods. In Chap. 5, Hautphenne et al. consider multitype Markovian branching processes subject to catastrophes that kill random numbers of living individuals at random epochs, providing characterizations of certain cases. He et al. present in Chap. 6 majorization results for phase-type generators on the basis of which bounds for the moments and Laplace–Stieltjes transforms of phase-type distributions are obtained. In Chap. 7, Horváth and Telek propose efficient random variate generation methods to support simulation evaluation of matrix exponential stochastic models based on appropriate representations of the models. The chapter by Kobayashi and Miyazawa, Chap. 8, considers a two-dimensional skip-free reflecting random walk on a nonnegative integer quadrant and derives exact tail asymptotics for the stationary probabilities on the coordinate axis, assuming it exists. In Chap. 9, Latouche et al. consider a two-dimensional stochastic fluid model with multiple inputs and temporary assistance and derive the marginal distribution of the first buffer and bounds for that of the second buffer. Chapter 10, by Ramaswami, provides an introduction to Brownian motion and stochastic integrals using linear fluid flows on finite-state Markov chains, which can facilitate the development of algorithms for stochastic integration. In Chap. 11, Van Houdt and Pérez study a supply chain consisting of one manufacturer and two retailers, develop a GI/M/1-type Markov chain to analyze this supply chain, and exploit fast numerical methods to solve the chain.

Many people deserve thanks for the important roles they played in making the MAM7 conference a great success. We thank the plenary and regular speakers and coauthors for their presentations at and participation in the conference and express our gratitude to all other conference attendees as well. We also thank our fellow scientific advisory committee members, listed in the next section. Special thanks

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