Kaj, Ingemar

Stochastic modeling in broadband communications systems. (English) Zbl 1020.94001

SIAM Monographs on Mathematical Modeling and Computation. 8. Philadelphia, PA: Society for Industrial and Applied Mathematics (SIAM). xvi, 177 p. (2002).

The purpose of this book is to give an overview of stochastic models and mathematical techniques based on stochastic processes for application in the fields of telecommunications and computer communication networks. On the one hand the author tries to introduce people in (applied) mathematics to the application area of network modeling, on the other hand practitioners and students in the field of telecommunications with an interest in stochastics can become acquainted with relevant mathematical models and techniques.

The content of the book may be summarized as follows. First an introductory chapter presents some general background for broadband systems and the modeling thereof, including the concept of time scales, and it introduces the Poisson process as a basic arrival process. In chapters 2 and 3 the reader becomes familiar with the most important concepts from stochastic processes and queueing systems, such as Markov chains in discrete and continuous time, Jackson networks, loss and delay systems, renewal processes, $M/G/1$ and $M/G/\infty$ systems. All these concepts are presented in the context of communication systems, using a variety of examples from the field. This is well suited for students with a prime interest in the applications, but the material is probably too concise for (and not intended as) a thorough treatment for mathematics students.

The remaining chapters continue to present a wide range of stochastic models, conveniently referring to the concepts in earlier chapters when needed. The remaining topics are: cell-switching models for the $m \times m$ crossbar in chapter 4, cell and burst scale models for network traffic (including long-range dependent and self-similar traffic) in chapter 5, while the final chapter 6 is about traffic control models (admission control and access control for ATM; congestion control for TCP).

The author does not claim to be comprehensive in his selection of models, as indeed cannot be expected, but he succeeds to select a fair number of topics. The style is clear and (from a mathematical point of view) informal, with an emphasis on probabilistic reasoning rather than on formal proofs. The inclusion of exercises makes sure that this book is suitable for a course for higher-level undergraduate or PhD students with knowledge of calculus and probability.

Reviewer: W.R.W.Scheinhardt (Enschede)

MSC:

94-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to information and communication theory
60-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to probability theory
68-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to computer science
94A05	Communication theory
94C10	Switching theory, application of Boolean algebra; Boolean functions (MSC2010)
68M10	Network design and communication in computer systems
60J20	Applications of Markov chains and discrete-time Markov processes on general state spaces (social mobility, learning theory, industrial processes, etc.)
68M20	Performance evaluation, queueing, and scheduling in the context of computer systems
60K25	Queueing theory (aspects of probability theory)

Keywords:

stochastic processes; telecommunications; communication networks; time scales; Poisson process; Markov

chains; queueing; switching models; network traffic; traffic control

Full Text: DOI