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C. Literatur-Rundschau

Tomasz Rolski, Hanspeter Schmidli, Volker Schmidt, Jozef Teugels: *Stochastic Processes for Insurance and Finance.* Wiley Series in Probability and Statistics. John Wiley and Sons, Chichester, New York, 1999, xviii + 654 pages, £ 60.–.

This book presents an overview of different types of stochastic processes and the basic concepts of stochastic modelling relevant in actuarial and financial mathematics, including recent developments in this growing area.

After some illustrative examples of applications of stochastic processes in insurance, the most frequently encountered distributions are presented; quite a few pages are devoted to heavy-tailed (especially subexponential) distributions. The next chapters discuss premium calculation principles, the ordering of risks and the computation of the distribution of the aggregate claim amount, for which recursive methods (Panjer, De Pril) and approximations are given.
The book then turns on its very topic, namely stochastic processes, with chapters on risk processes, renewal processes and random walks. A recurrent subject pervading these chapters (and indeed the whole book) is the probability of ruin, with finite as well as infinite horizon, including subexponential claim size distributions; Lundberg bounds and Pollaczek-Khinchin formulae are established.
A presentation of the theory of Markov chains is followed by a chapter devoted to Markov processes in continuous time, containing a section on phase-type distributions. As another large class of stochastic processes, martingales in discrete as well as in continuous time are treated in detail. Martingale techniques reappear in the subsequent chapters and find applications for instance in the construction of bounds for ruin probabilities or – even more important – in the area of financial mathematics.
Markov processes with possibly uncountable state space are presented with emphasis on piecewise deterministic Markov processes, i.e. processes with sample paths which are deterministic between claim arrival epochs; examples are the compound Poisson and the Sparre Andersen model. Within a general study of point processes, extensions to claim arrival processes like renewal point processes, homogeneous Poisson, compound Poisson or mixed Poisson processes are discussed.
The last chapter deals with diffusion processes. After introducing stochastic differential equations, the famous Black-Scholes model is discussed, followed by

a treatment of stochastic interest rates models and some further applications to insurance and finance.

The book is aimed at graduate students and researchers. Practitioners might be disappointed by the sparseness of applied examples; moreover, statistical aspects have been deliberately left out. Students, though, will miss exercises illustrating the theory.
It is apparent that the choice of topics was guided by actuarial rather than financial questions; diffusion models for example, in view of their growing importance not only in finance but also in insurance, could have been treated more comprehensively. But limits have to be set at some stage in such an extensive presentation.
On the other hand, this book offers a very rich panorama of a large field, including topics like subexponentiality, phase-type distributions or piecewise-deterministic Markov processes which are rarely encountered in other textbooks. The exposition is mathematically rigorous and proofs are mostly given in detail. Finally, the extensive bibliography and the bibliographical notes at the end of each section are a strength of the book, turning it into a rich reference guide.

To summarize, this book gives a thorough presentation of the classes of stochastic processes encountered in actuarial science and is a very useful source of information for everyone wishing to understand the theory underlying many modern actuarial and financial techniques.

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