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Khoshnevisan, Davar

Multiparameter processes. An introduction to random fields. (English) Springer Monographs in Mathematics. New York, NY: Springer. xix, 584 p. EUR 94.95 (net); sFr 157.50; £66.50; \$ 79.95 (2002).

This book aims to construct a general framework for the analysis of a large class of random fields, also known as multiparameter processes. A great part of one-parameter theory is also included, with the goal to keep the book self-contained. The book is divided into two parts, devoted to discrete-parameter and continuous-parameter random fields, respectively. Part I also contains the results that allow for the transition from discrete-time processes to continuous-time processes.

Part I starts with discrete-time one-parameter martingales and continues with multiparameter orthomartingales. Maximal inequalities, convergence notions, topological convergence and reversed orthomartingales are studied. In general, a lot of attention is paid to the topological aspects. The multiparameter martingales and their connections to orthomartingales are considered, in the spirit of famous works of Cairoli and Walsh. Applications to N-dimensional Haar systems and differentiation theorems for N-parameter integrals are presented. Two sections devoted to random walks include intersection probabilities for several one-parameter walks, the strong law of large numbers and the law of iterated logarithm for multiparameter random walks in \mathbb{R}^d . Continuity of random variables are considered as the limits of random walks in \mathbb{R}^d . Continuity of random processes indexed by a totally bounded pseudometric space is established and applied to Gaussian processes (Dudley's theorem). Standard Brownian sheet on \mathbb{R}^N is also studied. Limit theorems concerning weak convergence in C and invariance principle are given.

Part II describes continuous N-parameter martingales that "abound", in the author's terminology. One-parameter Markov processes, connected semigroups, and probabilistic potential theory serve as extent introduction to the theory of multiparameter Markov processes, additive stable processes, and α -regular Gaussian random fields. Polar sets for the range of the Brownian sheet, codimension of level sets, and local times conclude Part II.

The book contains a lot of supplementary exercises, extended theoretical appendices and is useful both for highly qualified specialists and for advanced graduate students.

Yu.S.Mishura (Kyïv)

Keywords : random fields; multiparameter martingales; random walks; Gaussian random variables; limit theorems; one- and multiparameter Markov processes; potential theory; Brownian sheet random walks

Classification:

*60-02 Research monographs (probability theory)

- 60G60 Random fields
- 60G15 Gaussian processes
- 60G44 Martingales with continuous parameter
- 60F17 Functional limit theorems

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60G50 Sums of independent random variables60J25 Markov processes with continuous parameter60J45 Probabilistic potential theory60J65 Brownian motion