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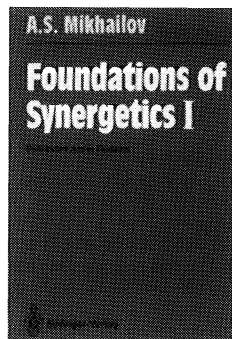
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Foundations of Synergetics I

Distributed Active Systems

1990. X, 187 pp. 68 figs. 5 tabs.
(Springer Series in Synergetics, Vol. 51)
Hardcover DM 114,-
ISBN 3-540-52775-3

This textbook presents an introduction to the mathematical theory of cooperative behavior in active systems of various origin, both natural and artificial. This volume (the first of two) is devoted to the properties of regular self-organized patterns in distributed active systems. An analysis of pattern formation and self-supported wave propagation in active media is followed by a description of the properties of neural networks and their possible applications in the field of distributed analog information processing. The volume ends with a discussion of reproductive networks and evolutionary systems. Attention is focused on basic models which might appear in a wide range of applications. As illustrations, the author uses simplified examples borrowed from a variety of disciplines ranging from chemical and biological physics to market economics.
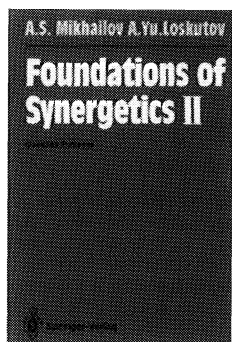
A.S. Mikhailov, A.Yu. Loskutov, Moscow State University

Foundations of Synergetics II

Complex Patterns

1991. VIII, 210 pp. 98 figs. (Springer Series in Synergetics, Vol. 52) Hardcover DM 114,- ISBN 3-540-53448-2

This book is the second of two volumes that together give a comprehensive introduction to the theory of cooperative behavior in active systems. This volume is devoted to the properties of the complex chaotic patterns that can arise in distributed active systems. The reader will encounter strange attractors, fractals, discrete maps, spatio-temporal chaos..., and will learn how these phenomena relate to the emergence of complex and chaotic patterns. Examples treated in detail include population explosion and extinction in fluctuating distributed media, and fluctuation effects in binary annihilation.

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K. Binder

The Monte Carlo Method in Condensed Matter Physics

With contributions by numerous experts

1992. XVI, 392 pp. 83 figs. 8 tabs. (Topics in Applied Physics, Vol. 71) Hardcover DM 103,–
ISBN 3-540-54369-4

The "Monte Carlo method" is a method of computer simulation of a system with many degrees of freedom, and thus it has widespread applications in science. It takes its name from the use of random numbers to simulate statistical fluctuations in order to numerically generate probability distributions (which cannot otherwise be known explicitly, since the systems considered are so complex). The Monte Carlo method then yields numerically exact information on "model systems". Such simulations serve two purposes: one can check the extent to which a model system approximates a real system; or one may check the validity of approximations made in analytical theories.
This book summarizes recent progress obtained in the implementation of this method and with the general analysis of results, and gives concise reviews of recent applications. These applications include simulations of growth processes far from equilibrium, interfacial phenomena, quantum and classical fluids, polymers, quantum problems on lattices, and random systems.

K. Binder

Applications of the Monte-Carlo Method in Statistical Physics

2nd. ed. 1987. XVI, 341 pp. 90 figs. Softcover DM 73,–
ISBN 3-540-17650-0

K. Binder

Monte Carlo Methods in Statistical Physics

2nd. ed. 1986. XVII, 411 pp. 97 figs.
Softcover DM 79,– ISBN 3-540-16514-2

K. Binder, D. W. Heermann

Monte Carlo Simulation in Statistical Physics

An Introduction

1988. VIII, 127 pp. 34 figs. (Springer Series in Solid-State Sciences, Vol. 80) Hardcover DM 54,–
ISBN 3-540-19107-0

K. K. Sabelfeld

Monte Carlo Methods in Boundary Value Problems

1991. XII, 283 pp. 62 figs. (Springer Series in Computational Physics) Hardcover DM 133,–
ISBN 3-540-53001-0

This book deals with Random Walk Methods for solving multi-dimensional boundary value problems. Monte Carlo algorithms are constructed for three classes of problems: (1) potential theory, (2) elasticity, and (3) diffusion.
Some of the advantages of our new methods as compared to conventional numerical methods are that they cater for stochasti-cities in the boundary value problems and complicated shapes of the boundaries.

G. A. Mikhailov

Optimization of Weighted Monte Carlo Methods

Translated from the Russian by K. K. Sabelfeld

1992. XI, 228 pp. 9 tabs. (Springer Series in Computational Physics) Hardcover DM 141,–
ISBN 3-540-53005-3

Weighted Monte Carlo algorithms are extremely useful when direct simulation techniques are inapplicable or ineffective. The methods presented in this book help to minimize computer time and memory required in constructing statistical models for systems described by integral equations. Approximate solutions of integral and differential equations serve as weighted func-tionals of special Markov chains. Variances of these solutions are minimized by (nonlinear) "importance" functions for the deter-mination of which the author presents an asymptotic approach.
Key points: Optimization of randomized algorithms for estimat-ing probabilistic characteristics of equations with random para-meters and applications; computational models for random fields and numerical simulations; vector Monte Carlo algorithms for solving systems of integral equations; a special approach to the application of perturbation theory based on this method.

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