

Fractals and disordered systems have recently become the focus of intense interest in research. This book discusses in great detail the effects of disorder on mesoscopic scales (fractures, aggregates, colloids, surfaces and interfaces, glasses, and

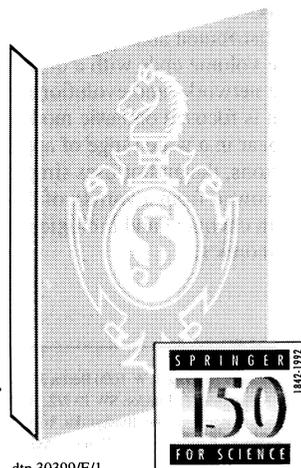
A. Bunde, University of Hamburg, FRG;
S. Havlin, Bar Ilan University, Ramat Gan, Israel (Eds.)

Fractals and Disordered Systems

1991. XIV, 350 pp.
 163 figs. 10 tabs.
 Hardcover DM 88,-
 ISBN 3-540-54070-9

polymers) and presents tools to describe them in mathematical language. A substantial part is devoted to the development of scaling theories based on fractal concepts. In 10 chapters written by leading experts in the field, including E. Stanley and B. Mandelbrot, the reader is introduced to basic concepts and techniques in disordered systems and is lead to the forefront of current research. In each chapter the connection between theory and experiment is emphasized, and a special chapter entitled "Fractals and Experiments" presents experimental studies of fractal systems in the laboratory.

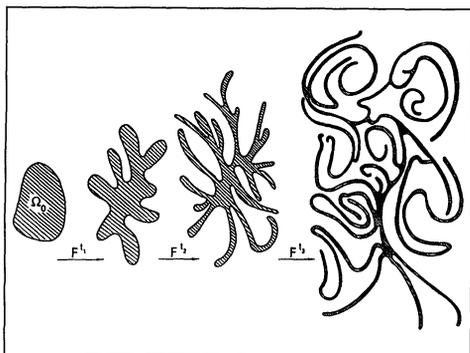
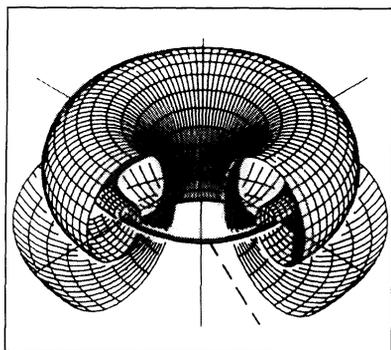
The book is written pedagogically. It can be used as a textbook for graduate students, by university teachers to prepare courses and seminars, and by active scientists who want to become familiar with a fascinating new field.



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SYNERGETICS

A.S. Mikhailov, Moscow State University

Foundations of Synergetics I ***Distributed Active Systems***

1990. X, 187 pp. 68 figs. 5 tabs. (Springer Series in Synergetics, Vol. 51) Hardcover DM 110,- ISBN 3-540-52775-3

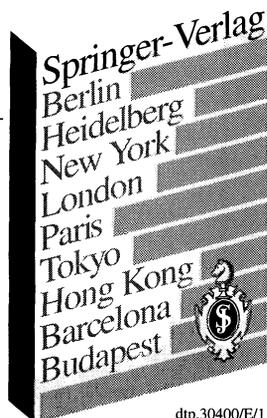
This textbook presents an introduction to the mathematical theory of cooperative behavior in active systems of various origin, both natural and artificial. This volume (the first of two) is devoted to the properties of regular self-organized patterns in distributed active systems. An analysis of pattern 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 110,- 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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dtp.30400/E/1

Statistical Physics

I M. Toda, R. Kubo, N. Saito ***Equilibrium Statistical Mechanics***

2nd ed. 1992. XVI, 252 pp. 90 figs. (Springer Series in Solid-State Sciences, Vol. 30) Softcover DM 59,- ISBN 3-540-53662-0

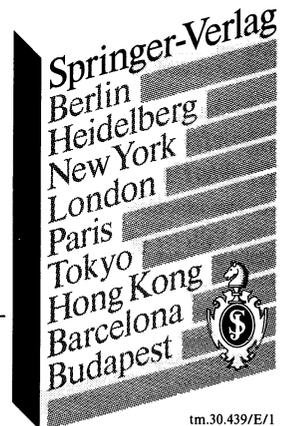
The fundamentals of equilibrium statistical mechanics are discussed in this text, which focuses on basic physical aspects. No previous knowledge of thermodynamics or the molecular theory of gases is assumed. Illustrative examples based on simple materials and photon systems elucidate the central ideas and methods.

This book not only offers an elementary introduction to statistical physics but also sets the stage for likely future developments. A fluent exposition of the general principles is given in the first half, while the second deals with two of the most fascinating subjects in this area: phase transitions and ergodic problems.

II R. Kubo, M. Toda, N. Hashitsume ***Nonequilibrium Statistical Mechanics***

2nd ed. 1991. XVI, 279 pp. 28 figs. (Springer Series in Solid-State Sciences, Vol. 31) Softcover DM 59,- ISBN 3-540-53833-X

This text, the second volume of a two-volume set, treats statistical theories of nonequilibrium states from the viewpoint of the fluctuation-dissipation theorem, mainly in the framework of linear response theory. It begins by introducing the fundamental concepts and methods of stochastic theories. The classical theory of Brownian motion is generalized into a standard theory for fluctuation, relaxation, and response. The problem of coarse graining is treated on the basis of the stochastic Liouville equation and the damping theory formalism uses the projection operator method. One chapter is devoted to phenomenological treatments of relaxation and another to linear response theory. The final chapter is an introduction to the fieldtheoretic Green's function method.



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Monte Carlo Methods

K. Binder

The Monte Carlo Method in Condensed Matter Physics

With contributions by A. Baumgärtner, K. Binder, A. N. Burkitt, D. M. Ceperley, H. De Raedt, A. M. Ferrenberg, D. W. Heermann, H. J. Herrmann, D. P. Landau, D. Levesque, W. von der Linden, J. D. Reger, K. E. Schmidt, W. Selke, D. Stauffer, R. H. Swendsen, J.-S. Wang, J.-J. Weis, A. P. Young
1992. Approx. 395 pp. 85 figs. 8 tabs. (Topics in Applied Physics, Vol. 71) Hardcover DM 99,- 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 70,- ISBN 3-540-17650-0

K. Binder

Monte Carlo Methods in Statistical Physics

2nd. ed. 1986. XVII, 411 pp. 97 figs. Softcover DM 76,- 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 49,- 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 128,- ISBN 3-540-53001-0

This book deals with Random Walk Methods for solving multidimensional 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 stochasticities 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 136,- 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 functionals of special Markov chains. Variances of these solutions are minimized by (nonlinear) "importance" functions for the determination of which the author presents an asymptotic approach.

Key points: Optimization of randomized algorithms for estimating probabilistic characteristics of equations with random parameters 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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Communications in Mathematical Physics

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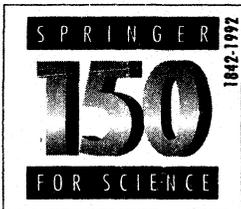
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