nonlinear science 2001/2002

Dear Sir/Madam,

It is our pleasure to present to you World Scientific's **Nonlinear Science 2001/2002** Catalogue. Inside you will find a range of our Nonlinear Science textbooks, reference books, monographs, popular titles, journals and other publications.

We are proud to share with you one of our latest titles, **Smooth Dynamical Systems** (page 5). This reprint of M C Irwin's book, first published in 1980, continues to provide the basis for current research in the mathematics of dynamical systems.

We are also pleased to have recently published **The Dynamics of Patterns** by M I Rabinovich, A B Ezersky, P D Weidman (page 7). Spirals, vorticles, crystalline lattices, and other attractive patterns are prevalent in nature.
How do such beautiful pattens appear from the initial chaos? Based on the many visual experiments in physics, hydrodynamics, chemistry, and biology, this invaluable book answers those and related intriguing questions.

The Chaos Avant-Garde edited by R Abraham and Y Ueda (page 6) is an authoritative and unique reference for the history of chaos theory, told by the pioneers themselves.

This catalogue lists only a selection of our titles in Nonlinear Science. A full listing is available on the internet at:
www.worldscientific.com/books/chaos/chaos.html

Finally we would like to bring your attention to our new journals, **Fluctuation and Noise Letters**, **Advances in Complex Systems**, and **Stochastics and Dynamics**. For more details, see pages 9-11.

If you have any queries or require any assistance, please do not hesitate to e-mail us at **mkt@wspc.com.sg**

Yours sincerely,

Nonlinear Science Marketing Team

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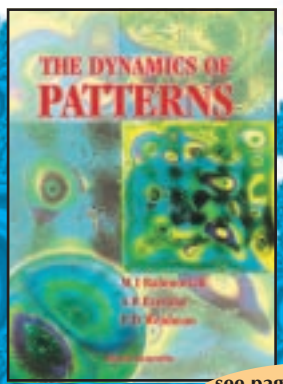
highlights



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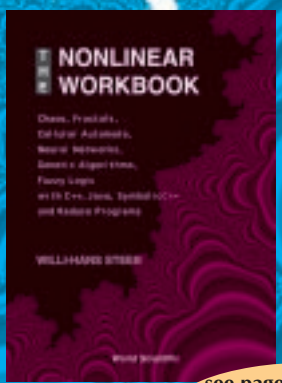
The Dynamics of Pattern



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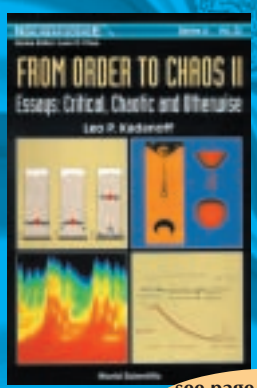

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Advanced Series in Nonlinear Dynamics

INTEGRABILITY AND NONINTEGRABILITY OF DYNAMICAL SYSTEMS

by **Alain Goriely** *(University of Arizona)*

This invaluable book examines qualitative and quantitative methods for nonlinear differential equations, as well as integrability and nonintegrability theory. Starting from the idea of a constant of motion for simple systems of differential equations, it investigates the essence of integrability, its geometrical relevance and dynamical consequences. Integrability theory is approached from different perspectives, first in terms of differential algebra, then in terms of complex time singularities and finally from the viewpoint of phase geometry (for both Hamiltonian and non-Hamiltonian systems). As generic systems of differential equations cannot be exactly solved, the book reviews the different notions of nonintegrability and shows how to prove the nonexistence of exact solutions and/or a constant of motion. Finally, nonintegrability theory is linked to dynamical systems theory by showing how the property of complete integrability, partial integrability or nonintegrability can be related to regular and irregular dynamics in phase space.

Contents: ***Introduction:*** What Is Integrability?; What Is Nonintegrability?; Integrability Theories Versus Dynamical System Theory; ***Integrability:*** A Few Definitions of Integrability; Analysis and Detection of Integrable Systems; Exact Results on Integrability; ***Nonintegrability:*** Yoshida's Analysis; Ziglin's Analysis for Hamiltonian Systems; Partial Integrability; ***Dynamical Systems and Integrability Theory:*** Normal Form Theory and Integrability; First Integrals Under Perturbation; The Melnikov Theory Revisited; On the Existence of Particular Solutions.

Readership: Mathematical and theoretical physicists and astronomers and engineers interested in dynamical systems.

436pp (approx.) **Scheduled Fall 2001**
981-02-3533-X **US$74** **£49**

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Advanced Series in Nonlinear Dynamics

WAVE COLLAPSE

edited by **Eugenii A Kuznetsov** &
Vladimir E Zakharov *(Landau Institute for Theoretical Physics, Russia)*

Wave collapse is a formation of singularity arising in an initially smooth wave field due to nonlinearity. Self-focusing of light and breaking of seawaves are classical examples of such phenomena. Another conspicuous example is the collapse of Langmuir wave in plasma.

This book is the first in scientific systematic overview of the wave collapse theory. It includes a detailed theory of collapses in the framework of the Nonlinear Schrodinger equation and its generalizations, and also applications to nonlinear optics and plasma physics. The theory of wave-breaking and vortex reconnection in hydrodynamics is also discussed.

Readership: Physicists and mathematicians.

300pp (approx.) **Scheduled Winter 2001**
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NONHOMOGENEOUS MATRIX PRODUCTS

by **D J Hartfiel** *(Texas A&M University, USA)*

This book puts together much of the basic work on infinite products of matrices, providing a primary source for such work. This will eliminate the rediscovery of known results in the area, and thus save considerable time for researchers who work with infinite products of matrices. In addition, two chapters are included to show how infinite products of matrices are used in graphics and in systems work.

Contents: Functionals; Semigroups of Matrices; Patterned Semigroups; Ergodicity; Convergence; Continuous Convergence; Paracontracting; Set Convergence; Graphics; Slowly Varying Products; Systems.

Readership: Researchers in applied mathematics, numerical and computational mathematics, industrial engineering, chaos and dynamical systems.

180pp (approx.) **Scheduled Winter 2001**
981-02-4628-5 **US$46** **£31**

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World Scientific Series on Nonlinear Science, Series A

NONLINEAR AND PARAMETRIC PHENOMENA

Theory and Applications in Radiophysical and Mechanical Systems

by **Vladimir Damgov** *(Bulgarian Academy of Sciences)*

The book is a broad panorama of phenomena occurring in four major classes of radiophysical and mechanical systems — linear, nonlinear, parametric, and nonlinear-parametric. An analytical technique of the broad circle of issues under consideration is developed. It is presented in a user-friendly form, allowing its further direct application in research practices.

Analytical methods are presented for investigating modulation-parametric and nonlinear systems, oscillating systems with periodic and almost periodic time-dependent parameters, effects of adaptive self-organization in coupled resonance systems and oscillating systems under the action of external forces, nonlinear with respect to the coordinates of excited systems.

Of an interdisciplinary nature, this volume can serve as a handbook for developing lecture courses such as Fundamentals of Nonlinear Dynamics and Theory of Nonlinear Oscillations, Theory of Nonlinear Circuits and Systems, Fundamentals of Radiophysics and Electronics, Theory of Signals and Theoretical Radiophysics, Theoretical Mechanics and Electrodynamics.

Contents: Principle of Reversibility of Modulation-Parametric Interaction; Controlling Equivalent Impedances of Radiophysical Systems; Nonlinear Resonance in Radiophysical Systems, Realization of Parametric One-Ports and Peculiarities of Using Semiconductor Structures in Radiophysical Devices; Chaotic Oscillations in Radiophysical Systems; Elements of the Radiophysical Systems; Oscillating Circuit with Constant Parameters; General Analysis of the Parametric Phenomena in Linear Oscillating Systems with Parameters Changing in Time; Nonlinear Oscillating Systems with Parameters Changing in Time; Grouping of Connected Oscillating Systems in Stable Electromechanical Formations; The Phenomenon of Excitation of Continuous Oscillations with Discrete Set of Stable Amplitudes under the Action of an External Nonlinear-on-the-Coordinate Periodic Force (Argument Oscillations).

Readership: Physicists, engineers, mechanicians and applied mathematicians.

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edited by **T P Leung** *(The Hong Kong Polytechnic University)* & **H S Qin** *(Academia Sinica, PRC)*

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Readership: Graduate students, researchers, designers of nonlinear control systems and controllers, and readers interested in the recent contributions to nonlinear control theory.

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SYMPLECTIC TWIST MAPS

by **C Golé** *(State University of New York, Stony Brook)*

This book concentrates mainly on the theorem of existence of periodic orbits for higher dimensional analogs of Twist maps. The setting is that of a discrete variational calculus and the techniques involve Conley-Zehnder-Morse Theory.

Contents: Introduction; Symplectic Twist Maps; Generating Functions and the Variational Setting; Examples; The Poincaré-Birkhoff Theorem; Condition of Existence of Generating Functions; Theorem of Existence of Periodic Orbits; Outline of the Proof; Construction of the Isolating Blocks; Periodic Orbits vs. Periodic Points, n+1 Periodic Orbits: The General Case; The Nondegenerate Case; Ghost Tori; The Continuation Setting; Some Remarks on Quasiperiodicity; Monotonicity of the Flow in Dimension #2; Ghost Circles; Properties of Sigma-Aubry-Mather Sets and Ghost Circles; Flux through Ghost Circles; Criterion of Nonexistence of Invariant Circles; Conley Index; Symplectic Twist Maps and Generating Phases for Lagrangians; Nonintersection of Ghost Circles.

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by **Hisashi Okamoto** *(Kyoto University)* & **Mayumi Shoji** *(Nihon University)*

This book is a self-contained introduction to the theory of periodic, progressive, permanent waves on the surface of incompressible inviscid fluid. Among many aspects of the problem, the authors focus on periodic progressive waves, which mean waves traveling at a constant speed with no change of shape.

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Readership: Students and researchers in fluid mechanics or nonlinear wave theory.

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Part 1: Acoustic Scattering and Resonances
Part 2: Propagation, Ocean Acoustics and Scattering
Part 3: Acoustic Propagation and Scattering, Wavelets and Time Frequency Analysis
edited by **Ardéshir Guran** *(Technical University of Hamburg, Germany)*, **Jean Ripoche** *(University of Le Havre, France)* & **Franz Ziegler** *(Technical University of Vienna, Austria)*

The interaction of acoustic fields with submerged elastic structures, both by propagation and scattering, is being investigated at various institutions and laboratories world-wide with ever-increasing sophistication of experiments and analysis. This book offers a collection of contributions from these research centers that represent the present state-of-the-art in the study of acoustic elastic interaction, being on the cutting edge of these investigations. This includes the description of acoustic scattering from submerged elastic objects and shells by the Resonance Scattering Theory of Flax, Dragonette and Überall, and the interaction of these phenomena in terms of interface waves. It also includes the use of this theory for the purpose of inverse scattering, i.e. the determination of the scattered objects properties from the received acoustic backscattered signals. The problem of acoustically excited waves in inhomogeneous and anisotropic materials, and of inhomogeneous propagating waves is considered. Vibrations and resonances of elastic shells, including shells with various kinds of internal attachments, are analyzed. Acoustic scattering experiments are described in the time domain, and on the basis of the Wigner–Ville distribution. Acoustic propagation in the water column over elastic boundaries is studied experimentally both in laboratory tanks, and in the field, and is analyzed theoretically. Ultrasonic nondestructive testing, including such aspects like probe modelling, scattering by various types of cracks, receiving probes and calibration by a side-drilled hole is also studied in details.

Some contributors: A Bostrom, R Carbo-Fite, T de Hoop, P P Delsanto, O Leroy, A D Pierce, J Ripoche, D Vassiliev, N Veksler, F Ziegler.

Readership: Nonlinear scientists.

Aug 1996	**981-02-2964-X**	
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World Scientific Series on Nonlinear Science, Series A – Vol. 5

METHODS OF QUALITATIVE THEORY IN NONLINEAR DYNAMICS

(Part II)
by **Leonid P Shilnikov**, **Andrey L Shilnikov** *(Research Institute for Applied Mathematics & Cybernetics, Russia)*, **Dmitry Turaev** *(Weizmann Institute of Science, Israel)* & **Leon O Chua** *(University of California, Berkeley)*

Bifurcation and chaos has dominated research in nonlinear dynamics for over two decades, and numerous introductory and advanced books have been published on this subject. There remains, however, a dire need for a textbook which provides a pedagogically appealing yet rigorous mathematical bridge between these two disparate levels of exposition. This book has been written to serve that unfulfilled need.

Following the footsteps of Poincaré, and the renowned Andronov school of nonlinear oscillations, this book focuses on the *qualitative* study of *high-dimensional* nonlinear dynamical systems. Many of the qualitative methods and tools presented in the book have been developed only recently and have not yet appeared in textbook form.

In keeping with the self-contained nature of the book, all the topics are developed with introductory background and complete mathematical rigor. Generously illustrated and written at a high level of exposition, this invaluable book will appeal to both the beginner and the advanced student of nonlinear dynamics interested in learning a *rigorous* mathematical foundation of this fascinating subject.

Contents: Structurally Stable Systems; Bifurcations of Dynamical Systems; The Behavior of Dynamical Systems on Stability Boundaries of Equilibrium States; The Behavior of Dynamical Systems on Stability Boundaries of Periodic Trajectories; Local Bifurcations on the Route Over Stability Boundaries; Global Bifurcations at the Disappearance of a Saddle-Node; Bifurcations of Homoclinic Loops of Saddle Equilibrium States; Safe and Dangerous Boundaries.

Readership: Engineers, students, mathematicians and researchers in nonlinear dynamics and dynamical systems.

450pp (approx.)	**Scheduled Winter 2001**	
981-02-4072-4	**US$101**	**£67**

new

CELLULAR AUTOMATA

A Discrete Universe
by **Andrew Ilachinski** *(Center for Naval Analyses, USA)*

This book provides a summary of the basic properties of cellular automata, and explores in depth many important cellular-automata-related research areas, including artificial life, chaos, emergence, fractals, nonlinear dynamics, and self-organization. It also presents a broad review of the speculative proposition that cellular automata may eventually prove to be theoretical harbingers of a fundamentally new information-based, discrete physics. Designed to be accessible at the junior/senior undergraduate level and above, the book will be of interest to all students, researchers, and professionals wanting to learn about order, chaos, and the emergence of complexity. It contains an extensive bibliography and provides a listing of cellular automata resources available on the World Wide Web.

Contents: Introduction: Preliminary Musings; Formalism; Phenomenological Studies of Generic CA; Dynamical Systems Theory Approach; Analytic Approach; Cellular Automata and Language Theory; Probabilistic CA; Generalized Models; CA Models of Fluid Dynamics; Neural Networks; Artificial Life; Is Nature, Underneath It All, a CA?

Readership: Students and researchers in chaos, computer science and applied mathematics.

840pp	**July 2001**	
981-02-4623-4	**US$112**	**£76**

new

Advanced Series in Nonlinear Dynamics – Vol. 17

SMOOTH DYNAMICAL SYSTEMS

by **M C Irwin** *(formerly of University of Liverpool, UK)*

This is a reprint of M C Irwin's beautiful book, first published in 1980. The material covered continues to provide the basis for current research in the mathematics of dynamical systems. The book is essential reading for all who want to master this area.

Contents: Some Simple Examples; Equivalent Systems; Integration of Vector Fields; Linear Systems, Linearization, Stable Manifolds; Stable Systems; and appendices.

Readership: Graduate students in mathema-tics.

272pp	**May 2001**	
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HAMILTONIAN DYNAMICS new

by **Gaetano Vilasi** *(University of Salerno, Italy)*

This is both a textbook and a monograph. It is partially based on a two-semester course, held by the author for third-year students in physics and mathematics at the University of Salerno, on analytical mechanics, differential geometry, symplectic manifolds and integrable systems.

Contents: ***Analytical Mechanics:*** The Lagrangian Coordinates; Hamiltonian Systems; Transformation Theory; The Integration Methods; ***Basic Ideas of Differential Geometry:*** Manifolds and Tangent Spaces; Differential Forms; Integration Theory; Lie Groups and Lie Algebras; ***Geometry and Physics:*** Symplectic Manifolds and Hamiltonian Systems; The Orbits Method; Classical Electrodynamics; ***Integrable Field Theories:*** *KdV* Equation; General Structures; Meaning and Existence of Recursion Operators; Miscellanea; Integrability of Fermionic Dynamics.

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Series on Advances in Mathematics for Applied Sciences – Vol. 54

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by **E N Chukwu** *(North Caroline State University, USA)*

The reader is assumed to be familiar with advanced calculus and to have a working knowledge of ordinary differential equations. The required theory of hereditary systems can be obtained from the book itself.

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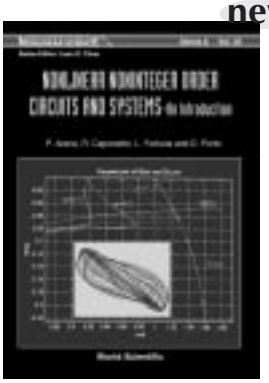

World Scientific Series on Nonlinear Science, Series A – Vol. 38

NONLINEAR NONINTEGER ORDER CIRCUITS AND SYSTEMS — AN INTRODUCTION

by **P Arena**, **R Caponetto**, **L Fortuna** & **D Porto** *(University of Catania, Italy)*

In this book, the reader will find a theoretical introduction to noninteger order systems, as well as several applications showing their features and peculiarities. The main definitions and results of research on noninteger order systems and modelling of physical noninteger phenomena are reported together with problems of their approximation. Control applications, noninteger order CNNs and circuit realizations of noninteger order systems are also presented.

Contents: Noninteger Order Circuits and Systems; Main Results on Noninteger Order Systems; Approximation of Noninteger Order Systems via Integer Order Systems; Control Problem: Noninteger Order Feedback Controllers; Noninteger Order Cellular Neural Network Systems; Circuit Design of Noninteger Order Chaotic Systems.

Readership: Researchers and students working on automatic control areas, nonlinear system applications, chaos theory and spatiotemporal phenomena.

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World Scientific Series on Nonlinear Science, Series A – Vol. 39

THE CHAOS AVANT-GARDE

Memories of the Early Days of Chaos Theory

edited by **Ralph Abraham** *(University of California, Santa Cruz)* & **Yoshisuke Ueda** *(Kyoto University)*

This book is an authoritative and unique reference for the history of chaos theory, told by the pioneers themselves. It also provides an excellent historical introduction to the concepts. There are eleven contributions, and six of them are published here for the first time — two by Steve Smale, three by Yoshisuke Ueda, and one each by Ralph Abraham, Edward Lorenz, Christian Mira, Floris Takens, T Y Li and James A Yorke, and Otto E Rossler.

Contents: On How I Got Started in Dynamical Systems 1959–1962 *(S Smale)*; Finding a Horseshoe on the Beaches of Rio *(S Smale)*; Strange Attractors and the Origin of Chaos *(Y Ueda)*; My Encounter with Chaos *(Y Ueda)*; Reflections on the Origin of the Broken-Egg Chaotic Attractor *(Y Ueda)*; The Chaos Revolution: A Personal View *(R Abraham)*; The Butterfly Effect *(E Lorenz)*; I Gumowski and a Toulouse Research Group in the "Prehistoric" Times of Chaotic Dynamics *(C Mira)*; The Turbulence Paper of D Ruelle & F Takens *(F Takens)*; Exploring Chaos on an Interval *(T Y Li & J A Yorke)*; Chaos, Hyperchaos and the Double-Perspective *(O E Rössler)*.

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THE DYNAMICS OF PATTERNS

by **M I Rabinovich** *(University of California, San Diego)*, **A B Ezersky** *(Russian Academy of Sciences)* & **P D Weidman** *(University of Colorado)*

Contents: Patterns: Prelude to a Dynamical Description; Linear Stage of Pattern Formation; Model Equations; The Ginzburg–Landau Equation; 'Crystal' Formation; Quasicrystals; Breaking of Order; Localized Patterns; Spirals; Patterns in Oscillating Soap Films; Patterns in Colonies of Microorganisms; Spatial Disorder; Patterns in Chaotic Media; Epilogue: Living Matter and Dynamic Forms; A Short Guide to Nonlinear Dynamics; Key Experiments in Pattern Formation.

Readership: Graduate students of mathematical physics and nonlinear science.

336pp	**Nov 2000**	
981-02-4055-4	**US$94**	**£64**
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Advanced Series in Nonlinear Dynamics – Vol. 5

COMBINATORIAL DYNAMICS AND ENTROPY IN DIMENSION ONE

2nd Edition

by **Lluís Alsedà**, **Jaume Llibre** *(Universitat Autònoma de Barcelona)* & **Michal Misiurewicz** *(Indiana University)*

"As a whole, the book is carefully written and contains a very detailed account of a body of material along with some new results. The book will serve as a valuable reference for those interested in the combinatorial aspects of one-dimensional dynamical systems."

~ A Quas
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Readership: Students of applied mathematics and dynamical systems.

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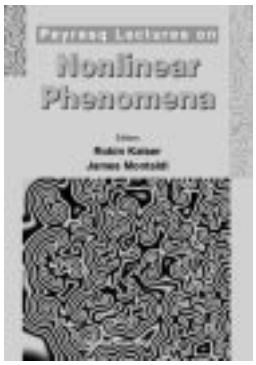

PEYRESQ LECTURES ON NONLINEAR PHENOMENA

edited by **Robin Kaiser** & **James Montaldi** *(Institut Non Linéaire de Nice, France)*

Nonlinear science has a very broad scope and the aim of this volume of lectures is to introduce different aspects of this vast domain to research students whose studies are necessarily concentrated on only one. The lectures given at summer schools in France between 1997 and 1999, describe analytical, geometrical and experimental approaches to subjects as diverse as turbulence, elasticity, physiology, classical mechanics, quantum chaos, water waves and the laser cooling of atoms.

Readership: Graduate students in chaos and dynamical systems.

296pp	**Sept 2000**	
981-02-4315-4	**US$71**	**£48**

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by **Brian Wichmann**

This collection of tiling patterns contains over 4,000 images combining the wonders of art and mathematics. It is catalogued according to the source, and indexed by the properties of each pattern.

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The accompanying 32-page booklet describes the components of the system and the means of using the material to design your own patterns.

System requirements: Any computer with an Internet browser and a CD-Rom drive.

Readership: Undergraduates in mathematics and general.

32pp	**Jun 2001**	
981-02-4619-6(pbk)	**US$25**	**£17**

VIEWS OF A PHYSICIST

Selected Papers of N G van Kampen

edited by **Paul H E Meijer** *(The Catholic University of America, Washington, DC)*

N G van Kampen is a well-known theoretical physicist who has had a long and distinguished career. His research covers scattering theory, plasma physics, statistical mechanics, and various mathematical aspects of physics. In addition to his scientific work, he has written a number of papers about more general aspects of science. An indefatigable fighter for intellectual honesty and clarity, he has pointed out repeatedly that the fundamental ideas of physics have been needlessly obscured.

Readership: Students and researchers in physics.

300pp	**Jul 2000**	
981-02-4357-X	**US$54**	**£37**

Advanced Series in Nonlinear Dynamics – Vol. 16

POSITIVE TRANSFER OPERATORS AND DECAY OF CORRELATIONS

by **Viviane Baladi** *(CNRS, Université de Paris-Sud, France)*

Although individual orbits of chaotic dynamical systems are by definition unpredictable, the average behavior of typical trajectories can often be given a precise statistical description. Indeed, there often exist ergodic invariant measures with special additional features. For a given invariant measure, and a class of observables, the correlation functions tell whether (and how fast) the system "mixes", i.e. "forgets" its initial conditions.

This book, addressed to mathematicians and mathematical (or mathematically inclined) physicists, shows how the powerful technology of transfer operators, imported from statistical physics, has been used recently to construct relevant invariant measures, and to study the speed of decay of their correlation functions, for many chaotic systems. Links with dynamical zeta functions are explained.

Contents: Subshifts of Finite Type: A Key Symbolic Model; Smooth Uniformly Expanding Dynamics; Piecewise Expanding Systems; Hyperbolic Systems.

Readership: Physicists, mathematicians, interdisciplinary scientists and social scientists.

324pp	**Jul 2000**	
981-02-3328-0	**US$71**	**£48**

Progress in Neural Processing – Vol. 12

DISORDER VERSUS ORDER IN BRAIN FUNCTION

Essays in Theoretical Neurobiology
edited by **Peter Århem** *(Nobel Institute of Neurophysiology, Sweden)*, **Clas Blomberg** & **Hans Liljenström** *(Royal Institute of Technology, Sweden)*

The main aim of this book is to raise and clear up the intriguing problems of noise and chaos in the nervous system. What functional role do fluctuations in neural systems play? Are there chaotic processes in the brain? What is the neural code, and how robust is it towards noise? Are there mechanisms that can control noise and chaos?

Contents: Disorder versus Order in Brain Function — An Introduction *(P Århem et al.)*; A Primer on Noise and Chaos *(C Blomberg)*; Molecular Background to Neural Fluctuations: An Introduction to Ion Channel Kinetics *(P Århem)*; What Causes Ion Channel Proteins to Open and Close? *(L Liebovitch & A Todorov)*; Noise in Neural Computation *(D Smetters)*; Do Neurons Recognize Patterns or Rates? One Example *(F Moss & H Braun)*; A Physicist's View of Brain Functioning: Coherence, Chaos, Pattern Formation, Noise *(H Haken)*; Fluctuations in the Coordination Dynamics of Brain and Behavior *(S Kelso)*; Brains Create Macroscopic Order from Microscopic Disorder by Neurodynamics in Perception *(W Freeman)*; Some Randomness Benefits a Model of Hippocampal Function *(W Levy & X-B Wu)*; Consciousness, Schemata and Language *(R Cotterill)*.

Readership: Graduate students, academics and research scientists in chaos/dynamical systems and neuroscience.

284pp	**Jun 2000**	
981-02-4008-2	**US$71**	**£48**

Advanced Series in Nonlinear Dynamics – Vol. 15

textbook

METHODS IN EQUIVARIANT BIFURCATIONS AND DYNAMICAL SYSTEMS

by **Pascal Chossat** *(CNRS, Nice)* &
Reiner Lauterbach *(University of Hamburg)*

This invaluable book presents a comprehensive introduction to bifurcation theory in the presence of symmetry, an applied mathematical topic which has developed considerably over the past twenty years and has been very successful in analysing and predicting pattern formation and other critical phenomena in most areas of science where nonlinear models are involved, like fluid flow instabilities, chemical waves, elasticity and population dynamics.

Contents: Symmetries in ODE's and PDE's; Equivariant Bifurcations, A First Look; Invariant Manifolds and Normal Forms; Linear Lie Group Actions; The Equivariant Structure of Bifurcation Equations; Reduction Techniques for Equivariant Systems; Relative Equilibria and Relative Periodic Orbits; Bifurcations in Equivariant Systems; Heteroclinic Cycles; Perturbation of Equivariant Systems.

Readership: Students of applied mathematics and nonlinear dynamics.

420pp	**Mar 2000**	
981-02-3828-2	**US$68**	**£46**

Advanced Series in Nonlinear Dynamics – Vol. 14

TOPICS IN NONLINEAR TIME SERIES ANALYSIS

With Implications for EEG Analysis
by **Andreas Galka** *(Christian-Albrechts-University of Kiel, Germany)*

This book provides a thorough review of a class of powerful algorithms for the numerical analysis of complex time series data which were obtained from dynamical systems.

Contents: Dynamical Systems, Time Series and Attractors; Linear Methods; State Space Reconstruction: Theoretical Foundations; State Space Reconstruction: Practical Application; Dimensions: Basic Definitions; Lyapunov Exponents and Entropies; Numerical Estimation of the Correlation Dimension; Sources of Error and Data Set Size Requirements; Monte Carlo Analysis of Dimension Estimation; Surrogate Data Tests; Dimension Analysis of the Human EEG; Testing for Determinism in Time Series.

Readership: Graduates and scientists in physics, applied mathematics, neurology, theoretical biology, economics, meteorology and neuroinformatics.

360pp	**Feb 2000**	
981-02-4148-8	**US$83**	**£56**

VIBRATIONAL MECHANICS

Nonlinear Dynamic Effects, General Approach, Applications
by **Iliya I Blekhman** *(Russian Academy of Sciences, St. Petersburg)*

"I think this new book has no real competitors. It should be of interest to university teachers and researchers in vibrations and mathematics, industrial vibration specialists and researchers, and university and company bookstores and libraries. It could even make up a textbook for one or more specialized courses in vibrations for graduate and postgraduate university classes."

~Jon Juel Thomsen
Technical University of Denmark

This important book deals with vibrational mechanics — the new, intensively developing section of nonlinear dynamics and the theory of nonlinear oscillations. It offers a general approach to the study of the effect of vibration on nonlinear mechanical systems.

Contents: Fundamentals of Theory of Vibrational Mechanics; Vibrational Mechanics of Machines; Mechanisms and Pendulum Devices; Vibrational Mechanics of Processes (Vibrational Displacement and Shift); Vibrorheology; Some Other Problems .

Readership: Researchers in theoretical and applied mechanics, nonlinear dynamics and nonlinear oscillation theory; engineers, researchers and inventors dealing with the application of useful vibration and the elimination of harmful vibration; mathematicians who are specialists in differential equations.

536pp	**Jan 2000**	
981-02-3890-8	**US$97**	**£66**

PHYSICS OF NONLINEAR OPTICS

textbook

by **Guang S He** *(State University of New York, Buffalo)* & **Song H Liu** *(South China Normal University)*

"It is an excellent handbook that can be used by research scientists and engineers working in optics, laser technology, opto-electronics, photonics, chemistry, and a number of other multidisciplinary fields... The book is well referenced and has a good table of contents. I would recommend it as a must for any optics library."
Optics & Photonics News, 2000

Contents: Introduction to Nonlinear Optics; Fundamental Knowledge of Nonlinear Polarization; Second-Order Nonlinear Wave Mixing; Third-Order Nonlinear Wave Mixing; Intense Light Induced Refractive-Index Changes; Photorefractive Effects; Self-Focusing, Self-Phase-Modulation, and Spectral Self-Broadening; Stimulated Scattering of Intense Light; Optical Phase-Conjugation; Optical Coherent Transient Effects; Nonlinear Spectroscopic Effects; Optical Bistability; Optical Limiting, Stabilization, and Reshaping; Vigorous Theory of Nonlinear Susceptibilities.

Readership: Graduate students and research scientists/engineers who work in optics, electro-optics, laser technology, opto-electronics, quantum electronics, photonics, engineering, chemistry and other multi-disciplinary fields.

576pp	**Jan 2000**	
981-02-3319-1	**US$81**	**£55**

Advanced Series in Nonlinear Dynamics – Vol. 12

LOCALIZATION AND SOLITARY WAVES IN SOLID MECHANICS

edited by **A R Champneys** *(University of Bristol)*, **G W Hunt** *(University of Bath)* & **J M T Thompson** *(University College London)*

This book is a collection of recent reprints and new material on fundamentally nonlinear problems in structural systems which demonstrate localized responses to continuous inputs. It has two intended audiences. For mathematicians and physicists it should provide useful new insights into a classical yet rapidly developing area of application of the rich subject of dynamical systems theory. For workers in structural and solid mechanics it introduces a new methodology for dealing with structural localization and the related topic of the generation of solitary waves.

Contents: The Strut on an Elastic Foundation; Numerics and Discretization; Twisted Rods; Cylindrical Shells; Other Buckling Problems; Solitary Waves.

Readership: Researchers in mathematics and engineering.

396pp	**Dec 1999**	
981-02-3915-7	**US$64**	**£40**

Advanced Series in Nonlinear Dynamics – Vol. 13

TIME REVERSIBILITY, COMPUTER SIMULATION, AND CHAOS

by **William Graham Hoover** *(University of California, Davis)*

A small army of physicists, chemists, mathematicians, and engineers has joined forces to attack a classic problem, the "reversibility paradox", with modern tools. This book describes their work from the perspective of computer simulation, emphasizing the author's approach to the problem of understanding the compatibility, and even inevitability, of the irreversible second law of thermodynamics with an underlying time-reversible mechanics.

Contents: Time Reversibility, Computer Simulation, Chaos; Time-Reversibility in Physics and Computation; Gibbs' Statistical Mechanics; Irreversibility in Real Life; Microscopic Computer Simulation; Macroscopic Computer Simulation; Chaos, Lyapunov Instability, Fractals; Resolving the Reversibility Paradox; Afterword — A Research Perspective.

Readership: Students of statistical physics and engineering.

280pp	**Nov 1999**	
981-02-4073-2	**US$44**	**£28**

DYNAMICAL MODELING OF THE ONSET OF WAR

by **Alvin M Saperstein** *(Wayne State University, Detroit, Michigan, USA)*

Physical science and technology (engineering) are fundamentally linked by the possibility of predictions: science tests itself and grows by making and checking predictions; technology relies on predictions and thus furthers the growth of the associated science. The political science of international relations is similarly associated with the "technology" of policy making by governments and elites: the growth of the science is dependent upon its applicability for useful policy making. This book explores the applicability of predictability — based upon dynamical modeling, and the related concepts of chaos and complexity — to the understanding of international relations, with the hope that this will lead to insights into policy making and hence the growth of the science of international relations.

Contents: Predictive Structure Building — Static and Dynamic; Predictive Modeling of Arms Races: Static and Dynamic; Dynamical Concepts; Chaos and International Stability — Modeling War Initiation; Combined Models: Capabilities and Intentions; Past and Future Research.

Readership: Political and physical scientists, and others interested in the application of modern physical dynamical ideas, such as chaos and complexity, to the evolution and stability of the international systems.

148pp	**Sept 1999**	
981-02-4064-3	**US$44**	**£28**

Nonlinear Time Series and Chaos – Vol. 4

NONLINEAR TIME SERIES ANALYSIS

Methods and Applications

by **Cees Diks** *(University of Kent)*

Methods of nonlinear time series analysis are discussed from a dynamical systems perspective on the one hand, and from a statistical perspective on the other. After giving an informal overview of the theory of dynamical systems relevant to the analysis of deterministic time series, time series generated by nonlinear stochastic systems and spatio-temporal dynamical systems are considered. Several statistical methods for the analysis of nonlinear time series are presented and illustrated with applications to physical and physiological time series.

Contents: Nonlinear Dynamical Systems; Stochastic Time Series; A Test for Reversibility; Detecting Differences between Reconstruction Measures; Estimating Invariants of Noisy Attractors; The Correlation Integral of Noisy Attractors; Spiral Wave Tip Dynamics; Spatio-Temporal Chaos: A Solvable Model.

Readership: Students and researchers with an interest in time series analysis.

220pp	**Aug 1999**	
981-02-3505-4	**US$28**	**£18**

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JOURNAL

Fluctuation and Noise Letters

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THE NONLINEAR WORKBOOK textbook

Chaos, Fractals, Cellular Automata, Neural Networks, Genetic Algorithms, Fuzzy Logic with C++, Java, SymbolicC++ and Reduce Programs
by **Willi-Hans Steeb** *(Rand Afrikaans University, South Africa)*

This book provides all the techniques and methods used in nonlinear dynamics. All the concepts are discussed in detail. The numerical and symbolic methods are implemented using C++, Java, SymbolicC++ and Reduce.

Contents: Nonlinear and Chaotic Maps; Time Series Analysis; Autonomous Systems in the Plane; Nonlinear Hamilton Systems; Nonlinear Dissipative Systems; Nonlinear Driven Systems; Controlling and Synchronization of Chaos; Fractals; Cellular Automata; Solving Differential Equations; Neural Networks; Genetic Algorithms; Fuzzy Sets and Fuzzy Logic.

Readership: Undergraduates and researchers in software engineering and programming, as well as computer programmers.

604pp	**Aug 1999**	
981-02-4025-2	**US$78**	**£49**
981-02-4026-0(pbk)	**US$38**	**£24**

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World Scientific Series on Nonlinear Science, Series A – Vol. 26

VISIONS OF NONLINEAR SCIENCE IN THE 21ST CENTURY

Festschrift Dedicated to Leon O Chua on the Occasion of His 60th Birthday
edited by **Jose L Huertas** *(Centro Nacional de Microelectronica, Spain)*, **Wai-Kai Chen** *(University of Illinois, Chicago)* & **Rabinder N Madan** *(Office of Naval Research, Arlington)*

Authoritative and visionary, this festschrift features 12 highly readable expositions of virtually all currently active aspects of nonlinear science. It has been painstakingly researched and written by leading scientists and eminent expositors, including L Shilnikov, R Seydel, I Prigogine, W Porod, C Mira, M Lakshmanan, W Lauterborn, A Holden, H Haken, C Grebogi, E Doedel and L Chua; each chapter addresses a current and intensively researched area of nonlinear science and chaos, including nonlinear dynamics, mathematics, numerics and technology. Handsomely produced with high resolution color graphics for enhanced readability, this book has been carefully written at a high level of exposition and is somewhat self-contained.

Each chapter includes a tutorial and background information, as well as a survey of each area's main results and state of the art. Of special interest to both beginners and seasoned researchers is the identification of future trends and challenging yet tractable problems that are likely to be solved before the end of the 21st century. The visionary and provocative nature of this book makes it a valuable and lasting reference.

Contents: Chua's Circuit and the Qualitative Theory of Dynamical Systems *(C Mira)*; Nonlinear Science and the Laws of Nature *(I Prigogine)*; Visions of Synergetics *(H Haken)*; Mathematical Problems of Nonlinear Dynamics: A Tutorial *(L Shilnikov)*; Experimental Nonlinear Physics *(W Lauterborn et al.)*; Nonlinear Physics: Integrability, Chaos and Beyond *(M Lakshmanan)*; Nonlinear Science: The Impact of Biology *(A V Holden)*; Nonlinear Computation *(R Seydel)*; Nonlinear Numerics *(E Doedel)*; Some Historical Aspects of Nonlinear Dynamics: Possible Trends for the Future *(C Mira)*; Control and Applications of Chaos *(C Grebogi et al.)*; Quantum Dot Devices and Quantum-Dot Cellular Automata *(W Porod)*; CNN: A Paradigm for Complexity *(L O Chua)*.

Readership: Nonlinear scientists.

872pp	**Jul 1999**	
981-02-3337-X	**US$138**	**£86**

FUNDAMENTAL CONCEPTS IN MODERN ANALYSIS

by **Vagn Lundsgaard Hansen** *(Technical University of Denmark)*

Many advanced mathematical disciplines, such as dynamical systems, calculus of variations, differential geometry and the theory of Lie groups, have a common foundation in general topology and calculus in normed vector spaces. In this book, mathematically inclined engineering students are offered an opportunity to go into some depth with fundamental notions from mathematical analysis that are not only important from a mathematical point of view but also occur frequently in the more theoretical parts of the engineering sciences. The book should also appeal to university students in mathematics and in the physical sciences.

Contents: Basic Concepts in Topology; Differentiation in Normed Vector Spaces; The Inverse Function Theorem; Differentiable Manifolds; An Introduction to Singularity Theory; An Introduction to Geometric Variational Problems.

Readership: Lecturers and students in pure mathematics, theoretical engineering and the physical sciences.

248pp	**Jun 1999**	
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JOURNAL

Advances in Complex Systems (ACS)

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Advances in Complex Systems is a quarterly journal that aims to provide a unique medium of communication for multidisciplinary approaches, either empirical or theoretical, to the study of complex systems. It intends to promote the cross-fertilization of ideas among all the scientific disciplines having to deal with their own complex systems, including biology, physics, engineering, economics, cognitive science and the social sciences.

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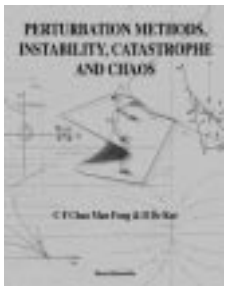

PERTURBATION METHODS, INSTABILITY, CATASTROPHE AND CHAOS

by **C F Chan Man Fong** & **D De Kee** *(Tulane University, USA)*

This important book introduces perturbation and qualitative methods for differential equations in terms understandable to students with only a basic knowledge of calculus and ordinary linear differential equations.

Contents: ***Qualitative Theory:*** Two-Dimensional Linear Systems; Two-Dimensional Almost Linear Systems; Existence and Non-Existence of Periodic Solutions; Floquet's Theorem; ***Perturbation Methods:*** Regular and Singular Perturbation; Method of Multiple Scales; Method of Averaging; Matched Asymptotic Expansions; ***Stability:*** Definitions; Liapunov's Direct Method — Autonomous System; Liapunov's Direct Method — Non-Autonomous System; Hydrodynamic Stability; ***Bifurcation and Catastrophe:*** Examples of Bifurcation in One Dimension; Two-Dimensional Problems; Discrete Systems; Elementary Catastrophe; ***Chaos:*** Criteria for Chaos; Routes to Chaos.

Readership: Undergraduates and graduates in applied mathematics, biomedical engineering, chemical engineering, chaos and dynamical systems.

268pp	**Jun 1999**	
981-02-3726-X	**US$58**	**£36**
981-02-3727-8(pbk)	**US$30**	**£19**

Studies of Nonlinear Phenomena in Life Science – Vol. 8

DYNAMICS, SYNERGETICS, AUTONOMOUS AGENTS

Nonlinear Systems Approaches to Cognitive Psychology and Cognitive Science
edited by **W Tschacher** *(University of Bern)* & **J P Dauwalder** *(University of Lausanne)*

Contents: ***Theory and Concepts:*** Synergetics and Some Applications to Psychology *(H Haken)*; Defending the Dynamical Hypothesis *(T van Gelder)*; From Continuous Dynamics to Symbols *(H Jaeger)*; On Measures for Order and Its Relation to Complexity *(J Shiner et al.)*; Synergetics of Human Creativity *(H Knyazeva & H Haken)*; ***Dynamical Concepts in Cognitive Psychology:*** Situated Cognition, Ecological Perception, and Synergetics: A Novel Perspective for Cognitive Psychology? *(W Tschacher & J-P Dauwalder)*; Attitudes and the Self as Self-Organising Systems *(R Eiser)*; An Affect-Centered Model of the Psyche and Its Consequences for a New Understanding of Nonlinear Psychodynamics *(L Ciompi)*; Formation and Adaptation of Schemata *(T Bröcker & J Kriz)*; Simulations of Stagewise Development with a Symbolic Architecture *(F Gobet)*; ***Autonomous Agents:*** The Embodied Cognitive Science Approach *(C Scheier & R Pfeifer)*; A Computational Model of Spatial Development *(K Hiraki et al.)*; Societies of Autonomous Agents and Their Reorganization *(N Glaser & P Morignot)*; Investigations into Internal and External Aspects of Dynamic Agent-Environment Couplings *(K Dautenhahn)*; A Formal Theory of Collective Intelligence *(W Sulis)*; ***Empirical Studies:*** The Detection of Catastrophe Flags in Personally Relevant Decisions *(M Coulson & S Nunn)*; Synergetic Organization in Speech Rhythm *(F Cummins)*; Exploring the Dynamics of Personality Change with Time Series Models *(F Keller et al.)*; Hierarchical Dynamics Affecting Work Performance in Organizations *(S J Guastello)*.

Readership: Psychologists, cognitive scientists, computer scientists, philosophers and biologists.

336pp	**May 1999**	
981-02-3837-1	**US$68**	**£43**

World Scientific Series on Nonlinear Science, Series A – Vol. 32
Series A: Monographs and Treatises

FROM ORDER TO CHAOS II

Essays: Critical, Chaotic and Otherwise
by **Leo P Kadanoff** *(University of Chicago)*

"World Scientific has made available a collection of Leo's reviews, essays columns and commentaries which is a feast in several senses: the strategy and tactics of science, the science itself, the history of several important developments in science, and as a bonus a beautifully illustrated collection of essays on computational science. The average reader may find this, the final section of the book, most interesting, but for me the account of his discovery of scaling, for which, inexplicably, he did not receive the Nobel prize, is most intriguing. Leo's combination of verve, frankness and insight makes this a very good read."

~ P W Anderson
Princeton Univ.

"Publication of this volume will be very useful, especially for young readers. The papers disseminated over many journals acquire a new quality by being collected together. Readers not only can see a result in its final form, but also can trace its evolution."

~ J Fluid Mechanics, 1994

This book is a compilation of the review papers, expositions and some of the technical works of Leo Kadanoff, a theoretical physicist. The objective is to put together a group of not-too-technical writing in which he discusses some issues in condensed matter physics, hydrodynamics, applied mathematics and national policy.

This expanded edition is divided into five sections. The first section contains review papers on hydrodynamics, condensed matter physics and field theory. Next is a selection of papers on scaling and universality, particularly as applied to phase changes. A change of pace is provided by a series of papers on the critical analysis of simulation models of urban economic and social development. The book concludes with a series of recent papers on complex patterns. Each major section has an introduction designed to tie the work together and to provide perspective on the subject matter.

Contents: Fundamental Issues in Hydrodynamics, Condensed Matter and Field Theory; Scaling and Phase Transitions; Simulations, Urban Studies, and Social Systems; Turbulence and Chaos; Complex Patterns.

Readership: Condensed matter physicists, applied mathematicians and computer scientists.

768pp	**Mar 1999**	
981-02-3433-3	**US$99**	**£62**
981-02-3434-1(pbk)	**US$64**	**£40**

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JOURNAL

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International Statistical Institute

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Mathematical Reviews

"The author's choice of material is outstanding and well worth the time and effort it will require to get through … For anyone interested or working in the field and who have a good mathematical background, this book will be a valuable resource and a rich and stimulating source of intellectual pleasure."

Journal of Applied Mathematics and Stochastic Analysis, 2000

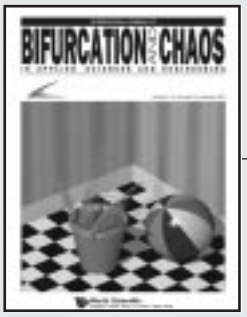
This important book provides information necessary for those dealing with stochastic calculus and pricing in the models of financial markets operating under uncertainty; introduces the reader to the main concepts, notions and results of stochastic financial mathematics; and develops applications of these results to various kinds of calculations required in financial engineering. It also answers the requests of teachers of financial mathematics and engineering by making a bias towards probabilistic and statistical ideas and the methods of stochastic calculus in the analysis of market risks.

Contents: ***Facts. Models:*** Main Concepts, Structures, and Instruments. Aims and Problems of Financial Theory and Financial Engineering; Stochastic Models. Discrete Time; Stochastic Models. Continuous Time; Statistical Analysis of Financial Data; ***Theory:*** Theory of Arbitrage in Stochastic Financial Models. Discrete Time; Theory of Pricing in Stochastic Financial Models. Discrete Time; Theory of Arbitrage in Stochastic Financial Models. Continuous Time; Theory of Pricing in Stochastic Financial Models. Continuous Time.

Readership: Undergraduates and researchers in probability and statistics; applied, pure and financial mathematics; economics; chaos.

852pp **Jan 1999**
981-02-3605-0 **US$113** **£71**

Journals



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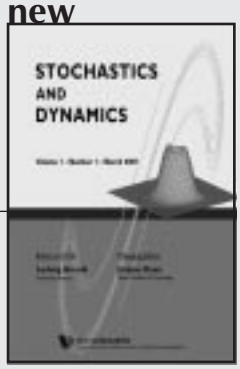

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