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KEY=SYNERGETICS - MAXIMO JAMIYA

Synergetics Far from Equilibrium Springer Science & Business Media **This volume gathers most of the lectures and communications presented at the meeting t held in Bordeaux from the 27th to the 29 h of September and entitled "Far from equi librium : instabilities and structures". This meeting is part of a series of seve ral other interdisciplinary conferences such as Elmau 1972, London 1974, Dortmund 1976, Elmau 1977, Tokyo 1978. The old science classification scheme proposed by Auguste Comte tends to be eve ry day a bit more blurred out: one gives here, if needed, one additional illustra tion of this trend. The three key words "far from equilibrium", "instabilities" and "structures" best illustrate the new concepts which emerge from the description of the dynamics of various systems relevant to many different research areas. Laser emission, chemical reactions, fluid motions, exhibit very particular phenomena when, under appropriate external action,they occur far from equilibrium. These proceedings include the experimental description of such phenomena as well as theoretical at tempts in understanding them. Most of the topics investigated here belong to the domains of physics and chemistry but one should be careful not to underestimate the underlying potential biological interest. If the study of simple systems (e. g. , described by a few variables) has been qui te successful for several centuries, the recent bearing of our attention on complex systems constitutes a genuine epistemological breakthrough bridging the gap which used to exist between the sciences and the humanism. Nonlinear Phenomena in Chemical Dynamics Proceedings of an International Conference, Bordeaux, France, September 7–11, 1981** Springer

Science & Business Media **An international conference. titled Nonlinear Phenomena in Chemical Dynamics was held in Bordeaux on September 7-11, 1981. The present volume contains the text of lectures and abstracts of posters presented during the meeting. This conference is part of a series of scientific multidisciplinary meetings in which chemistry is involved at various levels. Amongst the most recent ones let us mention Aachen 1979, Bielefeld 1979, New York 1979, Elmau 1981. In addition, this meeting is a direct extension of the first one that took place in Bordeaux in 1978 on the topic "Far from equilibrium: instabilities and structures," at the conclusions of which we could write (cf. Far fram Equilibrium, Springer Series in Synergetics, Vol. 3): "The three key words, far fram equilibriUm, instabilities and structuPes, best illustrate the new concepts which emerge from the description of the dynamics of various systems relevant to many different research areas. " The present proceedings show how much these remarks have remained true, even though substantial progress has been achieved during the three last years. To get a ,deeper experimental knowledge of open reacting systems, to model and simulate reaction-diffusion systems, to develop the mathematical theory of dynamical sys tems, these are the main direction~ in current investigations. Self-Organization Autowaves and Structures Far from Equilibrium** Springer Science & Business Media **According to its definition, Synergetics is concerned with systems that produce macroscopic spatial, temporal, or functional structures. Autowaves are·a specific, yet very important, case of spatio-temporal structures. The term "autowave" was coined in the Soviet Union in analogy to the term "auto-oscillator". This is - perhaps too literal - translation of the Russian word "avto-ostsillyatory" (= self oscillator) which in its proper translation means "self-sustained oscillator". These are oscillators, e. g. , clocks, whose internal energy dissipation is compensa ted by a (more or less) continuous power input. Simi larly, the term "autowaves" de notes propagation effects - including waves - in active media, which provide spa tially distributed energy sources and thus may compensate dissipation. An example which is now famous is represented by spiral or concentric waves in a chemically active medium, undergoing the Belousov-Zhabotinsky reaction. This book provides the reader with numerous further examples from physics, chem istry, and biology - e. g. , autowaves of the heart. While the Belousov-Zhabotinsky reaction is now widely known, a number of very important results obtained in the Soviet Union are perhaps less well known. I am particularly glad that this book may help to make readers outside the Soviet Union acquainted with these important exper imental and theoretical findings which are presented in a way which elucidates the common principles underlying this kind of propagation effects. Professor V. Hermann Haken: From the Laser to Synergetics A Scientific Biography of the Early Years** Springer **Hermann Haken (born 1927) is one of the “fathers” of the quantum-mechanical laser theory, formulated between 1962 and 1966, in strong competition with American researchers. Later on, he created Synergetics, the science of**

cooperation in multicomponent systems. The book concentrates on the development of his scientific work during the first thirty-five years of his career. In 1970 he and his doctoral student Robert Graham were able to show that the laser is an example of a nonlinear system far from thermal equilibrium that shows a phase-transition like behavior. Subsequently, this insight opened the way for the formulation of Synergetics. Synergetics is able to explain, how very large systems show the phenomenon of self-organization that can be mathematically described by only very few order parameters. The results of Haken's research were published in two seminal books Synergetics (1977) and Advanced Synergetics (1983). After the year 1985 Haken concentrated his research on the macroscopic foundation of Synergetics. This led him towards the application of synergetic principles in medicine, cognitive research and, finally, in psychology. A comprehensive bibliography of Hermann Haken's publications (nearly 600 numbers) is included in the book. Imagery Synergetics Science of Cooperation Springer Nature **Mathematical Models of Chemical Reactions Theory and Applications of Deterministic and Stochastic Models** Manchester University Press **Patterns and Interfaces in Dissipative Dynamics** Springer Science & Business Media **Spontaneous pattern formation in nonlinear dissipative systems far from equilibrium occurs in a variety of settings in nature and technology, and has applications ranging from nonlinear optics through solid and fluid mechanics, physical chemistry and chemical engineering to biology. This book explores the forefront of current research, describing in-depth the analytical methods that elucidate the complex evolution of nonlinear dissipative systems. Patterns, Defects and Materials Instabilities** Springer Science & Business Media **Understanding the origin of spatio-temporal order in open systems far from thermal equilibrium and the selection mechanisms of spatial struc tures and their symmetries is a major theme of present day research into the structures of continuous matter. The development of methods for pro ducing spatially ordered microstructures in solids by non-equilibrium methods opens the door to many technological applications. It is also be lieved that the key to laminar/turbulence transitions in fluids lies in the achievement of spatio-temporal order. Let us also emphasize the fact that the idea of self-organization in it self is at the origin of a reconceptualisation of science. Indeed, the appear ance of order which usually has been associated with equilibrium phase transitions appears to be characteristic of systems far from thermal equi librium. This phenomenon which was considered exceptional at first now the rule in driven systems. The chemical oscillations obtained appears to be in the Belousov-Zhabotinskii reaction were initially considered to be ther modynamically impossible and were rejected by a large number of chemists. Now these oscillations and related phenomena (waves, chaos, etc.) are the subject of intensive research and new classes of chemical oscil lators have been recently discovered. Even living organisms have long been considered as the result of chance rather than necessity. Such points of view are now abandoned under the**

overwhelming influence of spatio-tem poral organization phenomena in various domains ranging from physics to biology via chemistry, nonlinear optics, and materials science . Dynamic Decision Theory Applications to Urban and Regional Topics Springer Science & Business Media **Choice processes appear in all spheres of society. Hitherto ruling paradigms in the modelling of choice problems have presumed a competitive general equi librium which, however, proves insufficient for dynamic processes. This contribution aims at providing a general coherent and closed frame work for the dynamic modelling of decision processes. It was one of my main interests to build a bridge between the pure model building concepts and their practical applications. Therefore all given examples are related to empirical work. Solution algorithms for the estimation of trend parameters as well as the numerical simulation in concrete applications therefore playa central role in this contribution. Friendly relations with a number of colleagues from many universities in Europe, and the U.S. have emerged during the different applications. I wish to thank all of them. The international cooperations were mainly initiated and supported by conferences and workshops organized and financed by the International Institute for Applied Systems Analysis (IIASA), the Istituto Ricerche Economico-Sociali Del Piemonte (I RES). the Institut National D 'Etudes De'mographiques (I NED), the Centre for Regional Science Research UmeJ. (CERUM) and the Projets de Cooperation et D'Echange avec France (Procop>' Special thanks go to the Volkswagen Stiftung for financial support of this work over the years. Thanks also go in particular to my friend and mentor Prof. W. Weidlich for his encouragement and for the many suggestions he made in fruitful discus sions and common work that have taken place over the years. Non-Equilibrium Dynamics in Chemical Systems Proceedings of the International Symposium, Bordeaux, France, September 3–7, 1984** Springer Science & Business Media **Markedly apart from elementary particle physics, another current has been building up and cont i nuous ly growi ng within contemporary phys i cs for severa 1 decades, and even expanding into many other disciplines, especially chemistry, biology and, quite recently, economics. Several reasons account for this: presumably the most impor tant one lies in the fact that, whatever the specific problem, model or material concerned, the same basic mathematical features are always involved. In this way, a general phenomenology has emerged which, unlike thermodynamics, is no longer depen dent upon the details or specifics: what largely prevails is the nonlinear charac ter of the underlying dynamics. Perhaps we are witnessing the emergence of a "non linear physics"--In a way similar to the birth of "quantum physics" in the twen ties - a physics which deals with the general behaviour of systems, whatever they are or may be. Over the past fifteen years, chemical systems evolving sufficiently far from equilibrium have proved to be particularly well fitted to experimental research on nonlinear behaviour: oscillation, multistability, birhythmicity, chaotic evolution, spatial self-organization and hysteresis are displayed by**

chemical reactions whose number is growing each year. In this volume are collected the lectures, communica tions and posters (abstracts) presented at an international meeting entitled: "Non-Equilibrium Dynamics in Chemical Systems", held in Bordeaux (France), Septem ber 3 rd-lth, 1984. Concepts and Models of a Quantitative Sociology The Dynamics of Interacting Populations Springer Science & Business Media **While the volumes hitherto published in the Springer Series in Synergetics have been devoted almost exclusively to the self-organized formation of structures in physics, chemistry and biology, the present monograph by Weidlich and Haag deals with the formation of "structures" (or "patterns") in society. At first glance it would seem a daring enterprise to deal with the complex processes in society using concepts and methods first developed in physics. But over the past decade it has been shown that there is a large class of phenomena in a variety of fields to which unifying concepts can be applied. This is particulary true of situations in which a system composed of many parts or individuals acquires a new structure on macroscopic scales. Indeed, this is the definition of synergetics which I formulated more than a decade ago, and which formed the basis of my survey on the profound analogies in the behaviour of complex systems, includ ing those of sociology (H. Haken: Synergetics. An Introduction, Volume 1 of this series). As I have pointed out on many occasions, the universal validity of these concepts is neither accidental nor is it caused by a mere extension of physical rules to other fields, but is instead a consequence of deep-rooted struc tural properties of systems of interacting parts which are due to rigorous mathe maticallaws. Generally speaking, concepts and methods originally used in physics can be applied to sociological phenomena in two ways. Numerical Methods in the Study of Critical Phenomena Proceedings of a Colloquium, Carry-le-Rouet, France, June 2–4, 1980** Springer Science & Business Media **This volume contains most of the lectures presented at the meeting held in Carry-le nd Rouet from the 2 to the 4th June 1980 and entitled "Numerical Methods in the Study of Critical Phenomena". Scientific subjects are becoming increasingly differentiated, and the number of journals and meetings devoted to them is continually increasing. Thus it has become very difficult for the non-specialist to approach subjects with which he is not familiar. Hence the purpose of our meeting was to bring together scientists from different disciplines to study a common subject and to stimulate discussion' between participants. We hope this goal was reached. The lectures are grouped in five chapters and, inside the first and the second chapter, under two headings. In each group they are classified in alphabetical order by author. We are pleased to publish these Proceedings in a series whose multidisciplinary character has been emphasized from the beginning. We are indebted to all who provided us with their help, particularly to Mrs. A. Litman of the Centre International de Rencontres Mathematiques at Luminy (C.I.R.M.) whose kindness and efficiency are well known; from the practical point of view, the meetings were organized within the scientific framework of the G.I.S. No.19**

(C.N.R.S.), with the participation of the University of Grenoble. Chemical Oscillations, Waves, and Turbulence Springer Science & Business Media **Tbis book is intended to provide a few asymptotic methods which can be applied to the dynamics of self-oscillating fields of the reaction-diffusion type and of some related systems. Such systems, forming cooperative fields of a large num of interacting similar subunits, are considered as typical synergetic systems. ber Because each local subunit itself represents an active dynamical system function ing only in far-from-equilibrium situations, the entire system is capable of showing a variety of curious pattern formations and turbulencelike behaviors quite unfamiliar in thermodynamic cooperative fields. I personally believe that the nonlinear dynamics, deterministic or statistical, of fields composed of similar active (Le., non-equilibrium) elements will form an extremely attractive branch of physics in the near future. For the study of non-equilibrium cooperative systems, some theoretical guid ing principle would be highly desirable. In this connection, this book pushes for ward a particular physical viewpoint based on the slaving principle. The dis covery of tbis principle in non-equilibrium phase transitions, especially in lasers, was due to Hermann Haken. The great utility of this concept will again be dem onstrated in tbis book for the fields of coupled nonlinear oscillators. Bibliography on Chaos** World Scientific **This volume is a collection of more than 7000 full titles of books and papers related to chaotic behaviour in nonlinear dynamics. Emphasis has been made on recent publications, but many publications which appeared before 1980 are also included. Many titles have been checked with the authors. The scope of the Bibliography is not restricted to physics and mathematics of chaos only. Applications of chaotic dynamics to other branches of natural and social sciences are also considered. Works related to chaotic dynamics, e.g., papers on turbulence dynamical systems theory and fractal geometry, are listed at the discretion of the author or the compiler. This Bibliography is expected to be an important reference book for libraries and individual researchers. Synergetics Introduction and Advanced Topics** Springer Science & Business Media **This book is an often-requested reprint of two classic texts by H. Haken: "Synergetics. An Introduction" and "Advanced Synergetics". Synergetics, an interdisciplinary research program initiated by H. Haken in 1969, deals with the systematic and methodological approach to the rapidly growing field of complexity. Going well beyond qualitative analogies between complex systems in fields as diverse as physics, chemistry, biology, sociology and economics, Synergetics uses tools from theoretical physics and mathematics to construct an unifying framework within which quantitative descriptions of complex, self-organizing systems can be made. This may well explain the timelessness of H. Haken's original texts on this topic, which are now recognized as landmarks in the field of complex systems. They provide both the beginning graduate student and the seasoned researcher with solid knowledge of the basic concepts and mathematical tools. Moreover, they admirably convey the spirit of the pioneering work by the founder of**

Synergetics through the essential applications contained herein that have lost nothing of their paradigmatic character since they were conceived. Thermodynamics and Pattern Formation in Biology Walter de Gruyter GmbH & Co KG **Stochastic Nonlinear Systems in Physics, Chemistry, and Biology Proceedings of the Workshop Bielefeld, Fed. Rep. of Germany, October 5–11, 1980** Springer Science & Business Media **This book contains the invited papers of the interdisciplinary workshop on "Stochastic Nonlinear Systems in Physics, Chemistry and Biology" held at the Center for Interdisciplinary Research (ZIF), University of Bielefeld, West Germany, October 5-11, 1980. The workshop brought some 25 physicists, chemists, and biologists - who deal with stochastic phenomena - and about an equal number of mathematicians - who are experts in the theory of stochastic processes - together. The Scientific Commitee consisted of L. Arnold (Bremen), A. Dress (Bielefeld), W. Horsthemke (Brussels), T. Kurtz (Madison), R. Lefever (Brussels), G. Nicolis (Brussels), and V. Wihstutz (Bremen). The main topics of the workshop were the transition from deterministic to stoch astic behavior, external noise and noise induced transitions, internal fluctuations, phase transitions, and irreversible thermodynamics, and on the mathematical side, approximation of stochastic processes, qualitative theory of stochastic systems, and space-time processes. The workshop was sponsored by ZIF, Bielefeld, and by the Universities of Bremen and Brussels. We would like to thank the staff of ZIF and H. Crauel and M. Ehrhardt (Bremen) for the perfect organization and their assistance. In addition, our thanks go to Professor H. Haken for having these Proceedings included in the Se ries in Synergetics. Bremen and Brussels L. Arnold and R. Lefever December 1980 v Contents Part I. Introduction: From Deterministic to Stochastic Behavior On the Foundations of Kinetic Theory By B. Misr~ and I. Prigogine (With 1 Figure) ..... . Nonlinear Physics for Beginners Fractals, Chaos, Solitons, Pattern Formation, Cellular Automata and Complex Systems** World Scientific Publishing Company **Almost all real systems are nonlinear. For a nonlinear system the superposition principle breaks down: The system's response is not proportional to the stimulus it receives; the whole is more than the sum of its parts. The three parts of this book contains the basics of nonlinear science, with applications in physics. Part I contains an overview of fractals, chaos, solitons, pattern formation, cellular automata and complex systems. In Part II, 14 reviews and essays by pioneers, as well as 10 research articles are reprinted. Part III collects 17 students projects, with computer algorithms for simulation models included. The book can be used for self-study, as a textbook for a one-semester course, or as supplement to other courses in linear or nonlinear systems. The reader should have some knowledge in introductory college physics. No mathematics beyond calculus and no computer literacy are assumed. Request Inspection Copy Lasers and Synergetics A Colloquium on Coherence and Self-organization in Nature** Springer Science & Business Media **Lasers and Synergetics, written to honour Hermann Haken on his 60th birthday, is concerned with the two**

main areas of research to which Prof. Haken has made fundamental contributions. In fact, the two areas are interrelated since the development of the interdisciplinary science synergetics has been closely connected with the emergence of laser theory. Synergetics deals with complex systems that possess the fundamental property of spontaneous selforganization of their macroscopic behaviour. The book summarizes basic ideas, important concepts and principles used to describe selforganizing systems from a unified viewpoint. Special attention is paid to lasers, nonlinear optics and to coherence phenomena in other physical, biological and sociological systems. Some surveys of historical developments are presented, but most space is devoted to the publication of recent results and the description of current research work. Nonlinear Dynamics and Pattern Formation in the Natural Environment Taylor & Francis **This Research Note aims to provide an insight into recent developments in the theory of pattern formation. In the last decade there has been considerable progress in this field, both from a theoretical and a practical point of view. Recent mathematical developments concern the study of the nonlinear stability of systems at near-critical conditions by an appropriate system of modulation equations. The complexity of the original problem can be reduced drastically by this approximation. Moreover, it provides unifying point of view for a wide range of problems. New applications of the theory arise in a multitude of scientific areas such as hydrodynamics, reaction-diffusion problems, oceanography, meteorology, combustion, geophysical and biological morphodynamics and semi-conductors.This book is intended to show the interactions between the mathematical theory of nonlinear dynamics and the study of pattern generating phenomena in the natural environment. There is an intimate relationship between new insights in the mathematical aspects of nonlinear pattern formation and the comprehension of such phenomena. Therefore there are two partly overlapping main themes: one in which the emphasis is on generally applicable mathematical theories and techniques and one in which the phenomenology of pattern evolution in various areas is discussed.The book comprises 19 contributions by experts in the field. Although the emphasis changes considerably from paper to paper, in each contribution the same two themes are present; all the authors have aimed to achieve a suitable balance between the mathematical theory and the physical phenomena. Holography in Medicine and Biology Proceedings of the International Workshop, Münster, Fed. Rep. of Germany, March 14–15, 1979** Springer **The International Workshop on Holography in Medicine and Biology was held in MUnster, Federal Republic of Germany, on March 14th and 15th, 1979, at the Clinic of Otorhinolaryngology of the Westfalische Wilhelms-Universitat within the frame of the Symposium 79 of the Sonderforschungsbereich 88 "Teratology and Rehabilitation of Patients with Multiple Handicaps'' of the Deutsche Forschungsgemeinschaft. In fact, this workshop was not the first meeting dealing exclusively with biomedical applications of holography and related techniques. The very first symposium in this field was organized by**

Prof. P. Greguss and took place in New York in 1973. A second one was held in MUnster in 1976 with the objec tive to improve the communication among the at that time rather isolatedly working groups in this research domain. The great response to that meeting gave encouragement to the organization of another one in MUnster, this time on a more extended international base. Thus, this workshop attracted 85 scientists from 13 countries, i.e. Austria, Brazil, Czechoslovakia, Fed. Rep. of Germany, France, Great Britain, Hungary, Japan, Norway, Sweden, The Netherlands, USA, Yugoslavia. Instabilities, Bifurcations, and Fluctuations in Chemical Systems University of Texas Press **Twentieth-century research in the field of chemical pattern formation saw extraordinary progress due to the pathbreaking contributions of Nobel laureate Ilya Prigogine and his co-workers. Evidence exists that the dissipative structures studied by Prigogine and his colleagues may play a dominant role in the processes of self-organization of biological systems, the fundamental phenomena that govern all life forms. Brought together in this valuable volume are topical papers from the this research. Important aspects of nonlinear chemical pattern formation—dissipative structures—in chemical, biochemical, and geological systems are surveyed by leading scientists in the field of nonlinear chemistry. Topics covered include experimental observations of pattern formation in a variety of systems, bifurcation theory and analysis of nonlinear chemical rate equations, and the stochastic theory of nonlinear chemical reactions. Of particular interest are the studies of the effects of electric fields on the determination of nonequilibrium states of chemical systems. Nonlinear Nonequilibrium Thermodynamics II Advanced Theory** Springer Science & Business Media **This two-volume work gives the first detailed coherent treatment of a relatively young branch of statistical physics - nonlinear nonequilibrium and fluctuational dissipative thermodynamics. This area of research has taken shape rather recently: its de~elopment began in 1959. The earlier theory - linear nonequilibrium ther modynamics - is in principle a simple special case of the new theory. Despite the fact that the title of the book includes the word 'nonlinear', it also covers the results of linear nonequilibrium thermodynamics. The presentation of the linear and nonlinear theories is done within a common theoretical framework that is not subject to the linearity condition. The author hopes that the reader will perceive the intrinsic unjty of this dis cipline, the uniformity and generality of its constituent parts. This theory has a wide variety of applications in various domains of physics and physical chemistry, enabling one to calculate thermal fluctuations in various nonlinear systems. The book is divided into two volumes. Fluctuation-dissipation theorems (or relations) of various types (linear, quadratic and cubic, classical and quantum) are considered in the first volume. There one encounters the Markov and non-Markov fluctuation-dissipation theorems (FDTs), theorems of the first, second and third kinds. Nonlinear FDTs are less known than their linear counterparts. The present second volume of the book deals with the advanced theory. It consists of**

four chapters. The connection and interdependence of the material in the various chapters of both volumes are illustrated in the accompanying diagram. Limits of Predictability Springer Science & Business Media **One of the driving forces behind much of modern science and technology is the desire to foresee and thereby control the future. In recent years, however, it has become clear that, even in a deterministic world, there is alimit to the accuracy with which we can predict the future. This book details, in a largely nontechnical style, the extent to which we can predict the future development of various physical, biological and socio-economic processes. Foundations of Synergetics II Chaos and Noise** Springer Science & Business Media **The second edition of this volume has been extensively revised. A different version of Chap. 7, reflecting recent significant progress in understanding of spatiotempo ral chaos, is now provided. Much new material has been included in the sections dealing with intermittency in birth-death models and noise-induced phase transi tions. A new section on control of chaotic behavior has been added to Chap. 6. The subtitle of the volume has been changed to better reflect its contents. We acknowledge stimulating discussions with H. Haken and E. Scholl and are grateful to our colleagues M. Bar, D. Battogtokh, M. Eiswirth, M. Hildebrand, K. Krischer, and V. Tereshko for their comments and assistance. We thank M. Lubke for her help in producing new figures for this volume. Berlin and Moscow A. s. Mikhailov April 1996 A. Yu. Loskutov Preface to the First Edition This textbook is based on a lecture course in synergetics given at the University of Moscow. In this second of two volumes, we discuss the emergence and properties of complex chaotic patterns in distributed active systems. Such patterns can be produced autonomously by a system, or can result from selective amplification of fluctuations caused by external weak noise. From Cells to Societies Models of Complex Coherent Action** Springer Science & Business Media **Using simple models this book shows how we can gain insights into the behavior of complex systems. It is devoted to the discussion of functional self-organization in large populations of interacting active elements. The authors have chosen a series of models from physics, biochemistry, biology, sociology and economics, and systematically discuss their general properties. The book addresses researchers and graduate students in a variety of disciplines. Dynamics of Synergetic Systems Proceedings of the International Symposium on Synergetics, Bielefeld, Fed. Rep. of Germany, September 24–29, 1979** Springer Science & Business Media **This book contains the invited papers of an international symposium on Synergetics which was held at ZIF (Center for interdisciplinary research) at Bielefeld. Fed. Rep. of Germany. Sept. 24. -29 . • 1979. In keeping with our previous meetings. this one was truly interdisciplinary. Synergetic systems are those that can produce macroscopic spatial. temporal or functional structures in a self-organized way. I think that these proceedings draw a rather coherent picture of the present status of Synergetics, emphasizing this time theoretical aspects, although the proceedings contain also important con tributions from the**

experimental side. Synergetics has ties to many quite different disciplines as is clearly mirrored by the following articles. Out of the many ties I pick here only one example which is alluded to in the title of this book. Indeed, there is an important branch of mathematics called dynamic systems theory for which the problems of Synergetics might become an eldorado. While, undoubtedly, a good deal of dynamic systems had been motivated by mechanics, such as celestial and fluid dynamics, theory Synergetics provides us with a wealth of related problems of quite different fields, e. g. , lasers or chemical reaction processes. In order to become adequately applicable, in quite a number of realistic cases dynamic systems theory must be developed further. This is equally true for a number of other approaches. Nonlinear Electromagnetics Elsevier **Nonlinear Electromagnetics is a collection of research papers from different areas of study related to the nonlinear phenomena in electromagnetism. The book, after giving a short introduction to some mathematical techniques for nonlinear problems, covers related topics such as the history of particle physics; a physical description of the spectral transform; solitons in randomly inhomogenous media; and localized wave fields in nonlinear dispersive media. Also covered in this book are topics such as non-linear plasma-wave interaction; Lagrangian methods; electromagnetic problems in composite materials in linear and nonlinear regimes; and stationary regimes in passive nonlinear methods. The text is recommended for physicists and engineers interested in the development and applications of nonlinear electromagnetic and the mathematical expressions behind it. Noise-Induced Transitions Theory and Applications in Physics, Chemistry, and Biology** Springer Science & Business Media **The study of phase transitions is among the most fascinating fields in physics. Originally limited to transition phenomena in equilibrium systems, this field has outgrown its classical confines during the last two decades. The behavior of far from equilibrium systems has received more and more attention and has been an extremely active and productive subject of research for physicists, chemists and biologists. Their studies have brought about a more unified vision of the laws which govern self-organization processes of physico-chemical and biological sys tems. A major achievement has been the extension of the notion of phase transi tion to instabilities which occur only in open nonlinear systems. The notion of phase transition has been proven fruitful in apphcation to nonequilibrium ins- bihties known for about eight decades, like certain hydrodynamic instabilities, as well as in the case of the more recently discovered instabilities in quantum optical systems such as the laser, in chemical systems such as the Belousov-Zhabotinskii reaction and in biological systems. Even outside the realm of natural sciences, this notion is now used in economics and sociology. In this monograph we show that the notion of phase transition can be extend ed even further. It apphes also to a new class of transition phenomena which occur only in nonequilibrium systems subjected to a randomly fluctuating en vironment. Neural and Synergetic Computers Proceedings of the**

International Symposium at Schloß Elmau, Bavaria, June 13–17, 1988 Springer Science & Business Media **Neural and Synergetic Computers deals with basic aspect of this rapidly developing field. Several contributions are devoted to the application of basic concepts of synergetics and dynamic systems theory to the constructionof neural computers. Further topics include statistical approaches to neural computers and their design (for example by sparse coding), perception motor control, and new types of spatial multistability in lasers. Interfacial Wave Theory of Pattern Formation Selection of Dendritic Growth and Viscous Fingering in Hele-Shaw Flow** Springer Science & Business Media **For the last several years, the study of interfacial instability and pattern formation phenomena has preoccupied many researchers in the broad area of nonlinear science. These phenomena occur in a variety of dynamical sys tems far from equilibrium. In many practically very important physical sys tems some fascinating patterns are always displayed at the interface between solid and liquid or between two liquids. Two prototypes of these phenomena are dendrite growth in solidification and viscous fingering in a Hele-Shaw cell. These two phenomena occur in completely different scientific fields, but both are described by similar nonlinear free boundary problems of partial differential-equation systems; the boundary conditions on the interface for both cases contain a curvature operator involving the surface tension, which is nonlinear. Moreover, both cases raise the same challenging theoretical is sues, interfacial instability mechanisms and pattern selection, and it is now found that these issues can be solved by the same analytical approach. Thus, these two phenomena are regarded as special examples of a class of nonlinear pattern formation phenomena in nature, and they are the prominent topics of the new interdisciplinary field of nonlinear science. This research monograph is based on a series of lectures I have given at McGill University, Canada (1993-1994), Northwestern Poly technical In stitute, China (1994), Aachen University, Germany (1994), and the CRM summer school at Banff, Alberta, Canada (1995). Nonlinear Dynamics of Chaotic and Stochastic Systems Tutorial and Modern Developments** Springer Science & Business Media **We present an improved and enlarged version of our book Nonlinear - namics of Chaotic and Stochastic Systems published by Springer in 2002. Basically, the new edition of the book corresponds to its ?rst version. While preparingthiseditionwemadesomeclari?cationsinseveralsectionsandalso corrected the misprints noticed in some formulas. Besides, three new sections have been added to Chapter 2. They are “Statistical Properties of Dynamical Chaos,” “E?ects of Synchronization in Extended Self-Sustained Oscillatory Systems,” and “Synchronization in Living Systems.” The sections indicated re?ect the most interesting results obtained by the authors after publication of the ?rst edition. We hope that the new edition of the book will be of great interest for a widesectionofreaderswhoarealreadyspecialistsorthosewhoarebeginning research in the ?elds of nonlinear oscillation and wave theory, dynamical**

chaos, synchronization, and stochastic process theory. Saratov, Berlin, and St. Louis V.S. Anishchenko November 2006 A.B. Neiman T.E. Vadiavasova V.V. Astakhov L. Schimansky-Geier Preface to the First Edition Thisbookisdevotedtotheclassicalbackgroundandtocontemporaryresults on nonlinear dynamics of deterministic and stochastic systems. Considerable attentionisgiventothee?ectsofnoiseonvariousregimesofdynamicsystems with noise-induced order. On the one hand, there exists a rich literature of excellent books on n- linear dynamics and chaos; on the other hand, there are many marvelous monographs and textbooks on the statistical physics of far-from-equilibrium andstochasticprocesses.Thisbookisanattempttocombinetheapproachof nonlinear dynamics based on the deterministic evolution equations with the approach of statistical physics based on stochastic or kinetic equations. One of our main aims is to show the important role of noise in the organization and properties of dynamic regimes of nonlinear dissipative systems. Molecular Electronic Devices II CRC Press **Brain Function and Oscillations Volume II: Integrative Brain Function. Neurophysiology and Cognitive Processes** Springer Science & Business Media **Neuroscience is ripe for a paradigm change as Freeman and Mountcastle describe. Brain Oscillations provide an important key to this change. In this book the functional importance of the brain's multiple oscillations is treated with an integrative scope. According to the author, neurophysiology and cognition demand integrative approaches similar to those of Galilei and Newton in physics and of Darwin in biology. Not only the human brain but also lower brains and ganglia of invertebrates are treated with electrophysical methods. Experiments on sensory registration, perception, movement, and cognitive processes related to attention, learning, and memory are described. A synopsis on brain functions leads to a new neuron assemblies doctrine, extending the concept of Sherrington, and new trends in this field. The book will appeal to scientists and graduate students. Nonlinear Physics for Beginners Fractals, Chaos, Solitons, Pattern Formation, Cellular Automata, Complex Systems** World Scientific Publishing Company Incorporated **Almost all real systems are nonlinear. For a nonlinear system the superposition principle breaks down: The system's response is not proportional to the stimulus it receives; the whole is more than the sum of its parts. The three parts of this book contains the basics of nonlinear science, with applications in physics. Part I contains an overview of fractals, chaos, solitons, pattern formation, cellular automata and complex systems. In Part II, 14 reviews and essays by pioneers, as well as 10 research articles are reprinted. Part III collects 17 students projects, with computer algorithms for simulation models included.The book can be used for self-study, as a textbook for a one-semester course, or as supplement to other courses in linear or nonlinear systems. The reader should have some knowledge in introductory college physics. No mathematics beyond calculus and no computer literacy are assumed. Dissipative Systems in Quantum Optics Resonance Fluorescence,**

Optical Bistability, Superfluorescence Springer Science & Business Media **In studying the radiation-matter interaction, one can take two different approaches. The first is typical of spectroscopy: one considers the interaction between radi ation and a single atom, i. e. , one studies those phenomena in which the presence of other atoms is irrelevant. The other attitude consists, in contrast, in studying those phenomena which arise just from the simultaneous presence of many atoms. In fact, all the atoms interact with the same electromagnetic field; under suitable conditions, this situation creates strong atom-atom correlations, which in turn give rise to a cooperative behavior of the system as a whole. Cooperative means that the overall behavior is quite different from the superposition of the effects arising from single atoms and is completely unpredictable if one neglects the coup ling between the atoms induced by their common electromagnetic field. This book contains five complete and up-to-date contributions on the theory and experiments of three coherence effects in radiation-matter interaction: resonance fluorescences, optical bistability, and superfluorescence. They have raised in creasing interest in recent years from both a fundamental and an applicative view point. Even if their phenomenology appears completely different, these effects be long in the same book because they are striking examples of open systems driven far from thermal equilibrium, as those considered in Haken's synergetics and in Prigogine's theory of dissipative structures. This aspect is discussed in the in troducting chapter, in which we outline the basic physics and the essential features which unify these three effects. Profiting from Chaos Using Chaos Theory for Market Timing, Stock Selection, and Option Valuation** Tonis Vaga **Finally, a book that not only explains the relationship between investing and chaos theory--the cutting-edge dicipline that Business Week says will "revitalize the money-management industry"--but also shows readers how to use the theory to master the financial markets. Illustrated. Modelling the Dynamics of Biological Systems Nonlinear Phenomena and Pattern Formation** Springer Science & Business Media **The development of a proper description of the living world today stands as one of the most significant challenges to physics. A variety of new experimental techniques in molecular biology, microbiol ogy, physiology and other fields of biological research constantly expand our knowledge and enable us to make increasingly more detailed functional and structural descriptions. Over the past decades, the amount and complexity of available information have multiplied dramatically, while at the same time our basic understanding of the nature of regulation, behavior, morphogenesis and evolution in the living world has made only modest progress. A key obstacle is clearly the proper handling of the available data. This requires a stronger emphasis on mathematical modeling through which the consistency of the adopted explanations can be checked, and general princi ples may be extracted. As an even more serious problem, however, it appears that the proper physical concepts for the development of a theoretically oriented biology have not hitherto been available.**

Classical mechanics and equilibrium thermody namics, for instance, are inappropriate and useless in some of the most essen tial biological contexts. Fortunately, there is now convincing evidence that the concepts and methods of the newly developed fields of nonlinear dynam ics and complex systems theory, combined with irreversible thermodynamics and far-from-equilibrium statistical mechanics will enable us to move ahead with many of these problems. Ambiguity in Mind and Nature Multistable Cognitive Phenomena Springer Science & Business Media **Ambiguity in Mind and Nature is the result of cognitive multistability, the phenomenon in which an unchanging stimulus, usually visual, gives rise in the subject to an oscillating perceptual interpretation. The vase/face picture is one of the most famous examples. In this book scientists from many disciplines including physics, biology, psychology, maths and computer science, present recent progress in this fascinating area of cognitive science. Using the phenomenon of multistability as a paradigm they seek to understand how meaning originates in the brain as a consequence of cognitive processes. New advances are achieved by applying concepts such as self-organization, chaos theory and complex systems to the latest results of psychological and neurophysical experiments. Comprehensive Human Physiology From Cellular Mechanisms to Integration** Springer Science & Business Media **Comprehensive Human Physiology is a significantly important publication on physiology, presenting state-of-the-art knowledge about both the molecular mechanisms and the integrative regulation of body functions. This is the first time that such a broad range of perspectives on physiology have been combined to provide a unified overview of the field. This groundbreaking two-volume set reveals human physiology to be a highly dynamic science rooted in the ever-continuing process of learning more about life. Each chapter contains a wealth of original data, clear illustrations, and extensive references, making this a valuable and easy-to-use reference. This is the quintessential reference work in the fields of physiology and pathophysiology, essential reading for researchers, lecturers and advanced students.**