FREE DOWNLOAD INFORMATION AND SELF ORGANIZATION A MACROSCOPIC APPROACH TO COMPLEX SYSTEMS

Information and Self-Organization

The widespread interest this book has found among professors, scientists and stu dents working in a variety of fields has made a new edition necessary. I have used this opportunity to add three new chapters on recent developments. One of the most fascinating fields of modern science is cognitive science which has become a meet ing place of many disciplines ranging from mathematics over physics and computer science to psychology. Here, one of the important links between these fields is the concept of information which, however, appears in various disguises, be it as Shan non information or as semantic information (or as something still different). So far, meaning seemed to be exorcised from Shannon information, whereas meaning plays a central role in semantic (or as it is sometimes called \"pragmatic\") information. In the new chapter 13 it will be shown, however, that there is an important interplay between Shannon and semantic information and that, in particular, the latter plays a decisive role in the fixation of Shannon information and, in cognitive processes, al lows a drastic reduction of that information. A second, equally fascinating and rapidly developing field for mathematicians, computer scientists and physicists is quantum information and quantum computa tion. The inclusion of these topics is a must for any modern treatise dealing with in formation. It becomes more and more evident that the abstract concept of informa tion is inseparably tied up with its realizations in the physical world.

Information and Self-organization

Complex system studies are a growing area of central importance to a wide range of disciplines, ranging from physics to politics and beyond. Adopting this interdisciplinary approach, Systems, Self-Organisation and Information presents and discusses a range of ground-breaking research in complex systems theory. Building upon foundational concepts, the volume introduces a theory of Self-Organization, providing definitions of concepts including system, structure, organization, functionality, and boundary. Biophysical and cognitive approaches to Self-Organization are also covered, discussing the complex dynamics of living beings and the brain, and self-organized adaptation and learning in computational systems. The convergence of Peircean philosophy with the study of Self-Organization also provides an original pathway of research, which contributes to a dialogue between pragmatism, semeiotics, complexity theory, and self-organizing systems. As one of the few interdisciplinary works on systems theory, relating Self-Organization and Information Theory, Systems, Self-Organisation and Information is an invaluable resource for researchers and postgraduate students interested in complex systems theory from related disciplines including philosophy, physics, and engineering.

Systems, Self-Organisation and Information

Complex systems are ubiquitous, and practically all branches of science ranging from physics through chemistry and biology to economics and sociology have to deal with them. In this book we wish to present concepts and methods for dealing with complex systems from a unifying point of view. Therefore it may be of inter est to graduate students, professors and research workers who are concerned with theoretical work in the above-mentioned fields. The basic idea for our unified ap proach sterns from that of synergetics. In order to find unifying principles we shall focus our attention on those situations where a complex system changes

its macroscopic behavior qualitatively, or in other words, where it changes its macroscopic spatial, temporal or functional structure. Until now, the theory of synergetics has usually begun with a microscopic or mesoscopic description of a complex system. In this book we present an approach which starts out from macroscopic data. In particular we shall treat systems that acquire their new structure without specific interference from the outside; i. e. systems which are self-organizing. The vehicle we shall use is information. Since this word has several quite different meanings, all of which are important for our purpose, we shall discuss its various aspects. These range from Shannon information, from which all semantics has been exorcised, to the effects of information on receivers and the self-creation of meaning.

Systems, Self-organization and Information

Complex systems are usually difficult to design and control. There are several particular methods for coping with complexity, but there is no general approach to build complex systems. In this book I propose a methodology to aid engineers in the design and control of complex systems. This is based on the description of systems as self-organizing. Starting from the agent metaphor, the methodology proposes a conceptual framework and a series of steps to follow to find proper mechanisms that will promote elements to find solutions by actively interacting among themselves.

Information and Self-Organization

Contrary to monographs on non-linear optics this book concentrates on problems of self-organization in various important contexts. The reader learns how patterns in non-linear optical systems are created and what theoretical methods can be applied to describe them. Next, various aspects of pattern formation such as associative memory, information processing, spatio-temporal instability, photo refraction, and so on are treated. The book addresses graduate students and researchers in physics and optical engineering.

Design and Control of Self-organizing Systems

Complex Systems and Clouds: A Self-Organization and Self-Management Perspective provides insights into the intricate world of self-organizing systems. Large scale distributed computer systems have evolved into very complex systems and are at the point where they need to borrow self-adapting organizing concepts from nature. The book explores complexity in big distributed systems and in the natural processes in physics and chemistry, building a platform for understanding how self-organization in big distributed systems can be achieved. It goes beyond the theoretical description of self-organization to present principles for designing self-organizing systems, and concludes by showing the need for a paradigm shift in the development of large-scale systems from strictly deterministic to non-deterministic and adaptive. Analyzes the effect of self-organization applied to computer clouds Furthers research on principles of self-organization of computing and communication systems inspired by a wealth of self-organizing processes and phenomena in nature and society Presents a unique analysis of the field, with solutions and case studies

Self-Organization in Optical Systems and Applications in Information Technology

This proceedings volume contains talks and poster presentations from the International Symposium \"Self-Organization in Complex Systems: The Past, Present, and Future of Synergetics\

Complex Systems and Clouds

Suitable as a reference for industry practitioners and as a textbook for classroom use, Case Studies in System of Systems, Enterprise Systems, and Complex Systems Engineering provides a clear understanding of the principles and practice of system of systems engineering (SoSE), enterprise systems engineering (ESE), and complex systems engineering (CSE). Multiple domain practitioners present and analyze case studies from a

range of applications that demonstrate underlying principles and best practices of transdisciplinary systems engineering. A number of the case studies focus on addressing real human needs. Diverse approaches such as use of soft systems skills are illustrated, and other helpful techniques are also provided. The case studies describe, examine, analyze, and assess applications across a range of domains, including: Engineering management and systems engineering education Information technology business transformation and infrastructure engineering Cooperative framework for and cost management in the construction industry Supply chain modeling and decision analysis in distribution centers and logistics International development assistance in a foreign culture of education Value analysis in generating electrical energy through wind power Systemic risk and reliability assessment in banking Assessing emergencies and reducing errors in hospitals and health care systems Information fusion and operational resilience in disaster response systems Strategy and investment for capability developments in defense acquisition Layered, flexible, and decentralized enterprise architectures in military systems Enterprise transformation of the air traffic management and transport network Supplying you with a better understanding of SoSE, ESE, and CSE concepts and principles, the book highlights best practices and lessons learned as benchmarks that are applicable to other cases. If adopted correctly, the approaches outlined can facilitate significant progress in human affairs. The study of complex systems is still in its infancy, and it is likely to evolve for decades to come. While this book does not provide all the answers, it does establish a platform, through which analysis and knowledge application can take place and conclusions can be made in order to educate the next generation of systems engineers.

Selforganization in Complex Systems: The Past, Present, and Future of Synergetics

This book is a printed edition of the Special Issue \"Second Generation General System Theory: Perspectives in Philosophy and Approaches in Complex Systems\" that was published in Systems

Introduction to the Physics of Complex Systems

The concept of self-organization is at the heart of the theory of complex systems. It describes how order can emerge from disorder in otherwise chaotic nonlinear dynamical systems. This book investigates and surveys the role of self-organization in a wide variety of disciplines. The contributions are written by world-renowned scientists and philosophers at a level that is accessible to nonspecialists.

Case Studies in System of Systems, Enterprise Systems, and Complex Systems Engineering

This book integrates the theories of complex self-organizing systems with the rich body of discourse and literature developed in what might be called ‘social theory of cities and urbanism’. It uses techniques from dynamical complexity and synergetics to successfully tackle open social science questions.

General System Theory: Perspectives in Philosophy and Approaches in Complex Systems

This unique book offers a comprehensive and integrated introduction to the five fundamental elements of life and society: energy, information, feedback, adaptation, and self-organization. It is divided into two parts. Part I is concerned with energy (definition, history, energy types, energy sources, environmental impact); thermodynamics (laws, entropy definitions, energy, branches of thermodynamics, entropy interpretations, arrow of time); information (communication and transmission, modulation–demodulation, coding–decoding, information theory, information technology, information science, information systems); feedback control (history, classical methodologies, modern methodologies); adaptation (definition, mechanisms, measurement, complex adaptive systems, complexity, emergence); and self-organization (definitions/opinions, self-organized criticality, cybernetics, self-organization in complex adaptive systems, examples in nature). In

turn, Part II studies the roles, impacts, and applications of the five above-mentioned elements in life and society, namely energy (biochemical energy pathways, energy flows through food chains, evolution of energy resources, energy and economy); information (information in biology, biocomputation, information technology in office automation, power generation/distribution, manufacturing, business, transportation), feedback (temperature, water, sugar and hydrogen ion regulation, autocatalysis, biological modeling, control of hard/technological and soft/managerial systems), adaptation and self-organization (ecosystems, climate change, stock market, knowledge management, man-made self-organized controllers, traffic lights control).

On Self-Organization

Self-organisation, self-regulation, self-repair, and self-maintenance are promising conceptual approaches to deal with the ever increasing complexity of distributed interacting software and information handling systems. Self-organising applications are able to dynamically change their functionality and structure without direct user intervention to respond to changes in requirements and the environment. This book comprises revised and extended papers presented at the International Workshop on Engineering Self-Organising Applications, ESOA 2004, held in New York, NY, USA in July 2004 at AAMAS as well as invited papers from leading researchers. The papers are organized in topical sections on state of the art, synthesis and design methods, self-assembly and robots, stigmergy and related topics, and industrial applications.

Self-Organization and the City

This book presents the state-of-the-art in successfully engineered self-organizing systems. It goes further, too, to examine ways to balance design and self-organization in the context of applications. As demonstrated throughout, finding this balance helps to deal with diverse practical challenges. The case studies described illustrate the richness of the topic and provide guidance on its more intricate areas.

Energy, Information, Feedback, Adaptation, and Self-organization

Self-organisation, self-regulation, self-repair and self-maintenance are promising conceptual approaches for dealing with complex distributed interactive software and information-handling systems. Self-organising applications dynamically change their functionality and structure without direct user intervention, responding to changes in requirements and the environment. This is the first book to offer an integrated view of self-organisation technologies applied to distributed systems, particularly focusing on multiagent systems. The editors developed this integrated book with three aims: to explain self-organisation concepts and principles, using clear definitions and a strong theoretical background; to examine how self-organising behaviour can be modelled, analysed and systematically engineered into agent behaviour; and to assess the types of problems that can be solved using self-organising multiagent systems. The book comprises chapters covering all three dimensions, synthesising up-to-date research work and the latest technologies and applications. The book offers dedicated chapters on concepts such as self-organisation, emergence in natural systems, software agents, stigmergy, gossip, cooperation and immune systems. The book then explains how to engineer artificial self-organising software, in particular it examines methodologies and middleware infrastructures. Finally, the book presents diverse applications of self-organising software, such as constraint satisfaction, trust management, image recognition and networking. The book will be of interest to researchers working on emergent phenomena and adaptive systems. It will also be suitable for use as a graduate textbook, with chapter summaries and exercises, and an accompanying website that includes teaching slides, exercise solutions and research project outlines. Self-organisation, self-regulation, self-repair and self-maintenance are promising conceptual approaches for dealing with complex distributed interactive software and information-handling systems. Self-organising applications dynamically change their functionality and structure without direct user intervention, responding to changes in requirements and the environment. This is the first book to offer an integrated view of self-organisation technologies applied to distributed systems, particularly focusing on multiagent systems. The editors developed this integrated book with three aims: to explain self-organisation concepts and principles, using clear definitions and a strong theoretical background; to examine

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Engineering Self-Organising Systems

Is it possible to guide the process of self-organisation towards specific patterns and outcomes? Wouldn’t this be self-contradictory? After all, a self-organising process assumes a transition into a more organised form, or towards a more structured functionality, in the absence of centralised control. Then how can we place the guiding elements so that they do not override rich choices potentially discoverable by an uncontrolled process? This book presents different approaches to resolving this paradox. In doing so, the presented studies address a broad range of phenomena, ranging from autopoietic systems to morphological computation, and from small-world networks to information cascades in swarms. A large variety of methods is employed, from spontaneous symmetry breaking to information dynamics to evolutionary algorithms, creating a rich spectrum reflecting this emerging field. Demonstrating several foundational theories and frameworks, as well as innovative practical implementations, Guided Self-Organisation: Inception, will be an invaluable tool for advanced students and researchers in a multiplicity of fields across computer science, physics and biology, including information theory, robotics, dynamical systems, graph theory, artificial life, multi-agent systems, theory of computation and machine learning.

Advances in Applied Self-organizing Systems

Self-organization and clinical psychology signals the advent of a new paradigm in psychology. Physicists, neuroscientists and individual and grouptherapists have joined forces to elucidate the new and exciting advances that are being achieved by applying the concepts of non-linear dynamics and self-organization to the human nervous system and the mind.

Self-organising Software

Emergence and complexity refer to the appearance of higher-level properties and behaviours of a system that obviously comes from the collective dynamics of that system's components. These properties are not directly deducible from the lower-level motion of that system. Emergent properties are properties of the \"whole" that are not possessed by any of the individual parts making up that whole. Such phenomena exist in various domains and can be described, using complexity concepts and thematic knowledges. This book highlights complexity modelling through dynamical or behavioral systems. The pluridisciplinary purposes, developed along the chapters, are able to design links between a wide-range of fundamental and applicative Sciences. Developing such links - instead of focusing on specific and narrow researches - is characteristic of the Science of Complexity that we try to promote by this contribution.

Guided Self-Organization: Inception

This special issue reviews state-of-the-art approaches to the biophysical roots of cognition. These approaches appeal to the notion that cognitive capacities serve to optimize responses to changing external conditions. Crucially, this optimisation rests on the ability to predict changes in the environment, thus allowing

organisms to respond pre-emptively to changes before their onset. The biophysical mechanisms that underwrite these cognitive capacities remain largely unknown; although a number of hypotheses has been advanced in systems neuroscience, biophysics and other disciplines. These hypotheses converge on the intersection of thermodynamic and information-theoretic formulations of self-organization in the brain. The latter perspective emerged when Shannon’s theory of message transmission in communication systems was used to characterise message passing between neurons. In its subsequent incarnations, the information theory approach has been integrated into computational neuroscience and the Bayesian brain framework. The thermodynamic formulation rests on a view of the brain as an aggregation of stochastic microprocessors (neurons), with subsequent appeal to the constructs of statistical mechanics and thermodynamics. In particular, the use of ensemble dynamics to elucidate the relationship between micro-scale parameters and those of the macro-scale aggregation (the brain). In general, the thermodynamic approach treats the brain as a dissipative system and seeks to represent the development and functioning of cognitive mechanisms as collective capacities that emerge in the course of self-organization. Its explicanda include energy efficiency; enabling progressively more complex cognitive operations such as long-term prediction and anticipatory planning. A cardinal example of the Bayesian brain approach is the free energy principle that explains self-organizing dynamics in the brain in terms of its predictive capabilities – and selective sampling of sensory inputs that optimise variational free energy as a proxy for Bayesian model evidence. An example of thermodynamically grounded proposals, in this issue, associates self-organization with phase transitions in neuronal state-spaces; resulting in the formation of bounded neuronal assemblies (neuronal packets). This special issue seeks a discourse between thermodynamic and informational formulations of the self-organising and self-evidencing brain. For example, could minimization of thermodynamic free energy during the formation of neuronal packets underlie minimization of variational free energy?

Self-Organization and Clinical Psychology

Complexity, Cognition and the City aims at a deeper understanding of urbanism, while invoking, on an equal footing, the contributions both the hard and soft sciences have made, and are still making, when grappling with the many issues and facets of regional planning and dynamics. In this work, the author goes beyond merely seeing the city as a self-organized, emerging pattern of some collective interaction between many stylized urban \"agents\" – he makes the crucial step of attributing cognition to his agents and thus raises, for the first time, the question on how to deal with a complex system composed of many interacting complex agents in clearly defined settings. Accordingly, the author eventually addresses issues of practical relevance for urban planners and decision makers. The book unfolds its message in a largely nontechnical manner, so as to provide a broad interdisciplinary readership with insights, ideas, and other stimuli to encourage further research – with the twofold aim of further pushing back the boundaries of complexity science and emphasizing the all-important interrelation of hard and soft sciences in recognizing the cognitive sciences as another necessary ingredient for meaningful urban studies.

From System Complexity to Emergent Properties

As information handling systems get more and more complex, it becomes increasingly difficult to manage them using traditional approaches based on centralized and pre-defined control mechanisms. Over recent years, there has been a significant increase in taking inspiration from biology, the physical world, chemistry, and social systems to more efficiently manage such systems - generally based on the concept of self-organisation; this gave rise to self-organising applications. This book constitutes a reference and starting point for establishing the field of engineering self-organising applications. It comprises revised and extended papers presented at the Engineering Self-Organising Applications Workshop, ESOA 2003, held at AAMAS 2003 in Melbourne, Australia, in July 2003 and selected invited papers from leading researchers in self-organisation. The book is organized in parts on applications, natural metaphors (multi-cells and genetic algorithms, stigmergy, and atoms and evolution), artificial interaction mechanisms, middleware, and methods and tools.

Self-Organization in the Nervous System

This book is an introduction to the dynamics of reaction-diffusion systems, with a focus on fronts and stationary spatial patterns. Emphasis is on systems that are non-standard in the sense that either the transport is not simply classical diffusion (Brownian motion) or the system is not homogeneous. A important feature is the derivation of the basic phenomenological equations from the mesoscopic system properties. Topics addressed include transport with inertia, described by persistent random walks and hyperbolic reaction-transport equations and transport by anomalous diffusion, in particular subdiffusion, where the mean square displacement grows sublinearly with time. In particular reaction-diffusion systems are studied where the medium is in turn either spatially inhomogeneous, compositionally heterogeneous or spatially discrete. Applications span a vast range of interdisciplinary fields and the systems considered can be as different as human or animal groups migrating under external influences, population ecology and evolution, complex chemical reactions, or networks of biological cells. Several chapters treat these applications in detail.

Complexity, Cognition and the City

This book is a printed edition of the Special Issue \"Complexity, Criticality and Computation (C³)\" that was published in Entropy

Engineering Self-Organising Systems

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.

Reaction-Transport Systems

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.

Complexity, Criticality and Computation (C³)

This book addresses a large variety of models in mathematical and computational neuroscience. It is written for the experts as well as for graduate students wishing to enter this fascinating field of research. The author studies the behaviour of large neural networks composed of many neurons coupled by spike trains. An analysis of phase locking via sinusoidal couplings leading to various kinds of movement coordination is included.

Nonlinear Dynamics of Chaotic and Stochastic Systems

As the leadership field continues to evolve, there are many reasons to be optimistic about the various theoretical and empirical contributions in better understanding leadership from a scholarly and scientific perspective. The Oxford Handbook of Leadership and Organizations brings together a collection of comprehensive, state-of-the-science reviews and perspectives on the most pressing historical and contemporary leadership issues - with a particular focus on theory and research - and looks to the future of the field. It provides a broad picture of the leadership field as well as detailed reviews and perspectives within the respective areas. Each chapter, authored by leading international authorities in the various leadership sub-disciplines, explores the history and background of leadership in organizations, examines important research issues in leadership from both quantitative and qualitative perspectives, and forges new directions in leadership research, practice, and education.

From Cells to Societies

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.

Brain Dynamics

This classic text provides an excellent introduction to a new and rapidly developing field of research. Now well established as a textbook in this rapidly developing field of research, the new edition is much enlarged and covers a host of new results.

The Oxford Handbook of Leadership and Organizations

This is a book book for researchers and practitioners interested in modeling, prediction and forecasting of natural systems based on nonlinear dynamics. It is a practical guide to data analysis and to the development of algorithms, especially for complex systems. Topics such as the characterization of nonlinear correlations in data as dynamical systems, reconstruction of dynamical models from data, nonlinear noise reduction and the limits of predicatability are discussed. The chapters are written by leading experts and consider practical problems such as signal and time series analysis, biomedical data analysis, financial analysis, stochastic modeling, human evolution, and political modeling. The book includes new methods for nonlinear filtering

of complex signals, new algorithms for signal classification, and the concept of the \"Global Brain\".

Modelling the Dynamics of Biological Systems

This book has a rather strange history. It began in spring 1989, thirteen years after our Systems Science Department at SUNY-Binghamton was established, when I was asked by a group of students in our doctoral program to have a meeting with them. The spokesman of the group, Cliff Joslyn, opened our meeting by stating its purpose. I can closely paraphrase what he said: \"We called this meeting to discuss with you, as Chairman of the Department, a fundamental problem with our systems science curriculum. In general, we consider it a good curriculum: we learn a lot of concepts, principles, and methodological tools, mathematical, computational, heu ristic, which are fundamental to understanding and dealing with systems. And, yet, we learn virtually nothing about systems science itself. What is systems science? What are its historical roots? What are its aims? Where does it stand and where is it likely to go? These are pressing questions to us. After all, aren't we supposed to carry the systems science flag after we graduate from this program? We feel that a broad introductory course to systems science is urgently needed in the curriculum. Do you agree with this assessment?\" The answer was obvious and, yet, not easy to give: \"I agree, of course, but I do not see how the situation could be alleviated in the foreseeable future.

Quantum Signatures of Chaos

It is increasingly being recognized that the experimental and theoretical study of the complex system brain requires the cooperation of many disciplines, in cluding biology, medicine, physics, chemistry, mathematics, computer science, linguistics, and others. In this way brain research has become a truly interdis ciplinary endeavor. Indeed, the most important progress is quite often made when different disciplines cooperate. Thus it becomes necessary for scientists to look across the fence surrounding their disciplines. The present book is written precisely in this spirit. It addresses graduate students, professors and scientists in a variety of fields, such as biology, medicine and physics. Be yond its mathematical representation the book gives ample space to verbal and pictorial descriptions of the main and, as I believe, fundamental new insights, so that it will be of interest to a general readership, too. I use this opportunity to thank my former students, some of whom are my present co-workers, for their cooperation over many years. Among them I wish to mention in particular M. Bestehorn, L. Borland, H. Bunz, A. Daf fertshofer, T. Ditzinger, E. Fischer, A. Fuchs, R. Haas, R. Honlinger, V. Jirsa, M. Neufeld, M. Ossig, D. Reimann, M. Schanz, G. Schoner, P. Tass, C. Uhl. My particular thanks go to R. Friedrich and A. Wunderlin for their constant help in many respects. Stimulating discussions with a number of colleagues from a variety of fields are also highly appreciated.

Predictability of Complex Dynamical Systems

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.

Facets of Systems Science

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.

Principles of Brain Functioning

This landmark volume offers a collection of conceptual papers and empirical research studies that investigate the dynamics of language learning motivation from a complex dynamic systems perspective. The contributors include some of the most well-established scholars from three continents, all addressing the question of how we can understand motivation if we perceive it as continuously changing and evolving rather than as a fixed learner trait. The data-based studies also provide useful research models and templates for graduate students and scholars in the fields of applied linguistics and SLA who are interested in engaging with the intriguing area of examining language learning in a dynamic vein.

Ambiguity in Mind and Nature

In our daily lives we conceive of our surroundings as an objectively given reality. The world is perceived through our senses, and ~hese provide us, so we believe, with a faithful image of the world. But occ~ipnally we are forced to realize that our senses deceive us, e. g. , by illusions. For a while it was believed that the sensation of color is directly r~lated to the frequency of light waves, until E. Land (the inventor of the polaroid camera) showed in detailed experiments that our perception of, say, a colored spot depends on the colors of its surrounding. On the other hand, we may experience hallucinations or dreams as real. Quite evidently, the relationship between the \"world\" and our \"brain\" is intricate. Another strange problem is the way in which we perceive time or the \"Now\". Psychophysical experiments tell us that the psychological \"Now\" is an extended period of time in the sense of physics. The situation was made still more puzzling when, in the nineteen-twenties, Heisenberg and others realized that, by observing processes in the microscopic world of electrons and other elementary particles, we strongly interfere with that world. The outcome of experiments - at least in general - can only be predicted statistically. What is the nature ofthis strange relationship between \"object\" and \"observer\"? This is another crucial problem of the inside-outside or endo-exo dichotomy.

Nonlinear Nonequilibrium Thermodynamics II

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.

Motivational Dynamics in Language Learning

Inside Versus Outside