Cellular Automata Theory And Experiment Special Issues Of Physica D

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

In this ground-breaking book, John Koza shows how this remarkable paradigm works and provides substantial empirical evidence that solutions to a great variety of problems from many different fields can be found by genetically breeding populations of computer programs. Genetic programming may be more powerful than neural networks and other machine learning techniques, able to solve problems in a wider range of disciplines. In this ground-breaking book, John Koza shows how this remarkable paradigm works and provides substantial empirical evidence that solutions to a great variety of problems from many different fields can be found by genetically breeding populations of computer programs. Genetic Programming contains a great many worked examples and includes a sample computer code that will allow readers to run their own programs.In getting computers to solve problems without being explicitly programmed, Koza stresses two points: that seemingly different problems from a variety of fields can be reformulated as problems of program induction, and that the recently developed genetic programming paradigm provides a way to search the space of possible computer programs for a highly fit individual computer program to solve the problems of program induction. Good programs are found by evolving them in a computer against a fitness measure instead of by sitting down and writing them.

These days computer-generated fractal patterns are everywhere, from squiggly designs on computer art posters to illustrations in the most serious of physics journals. Interest continues to grow among scientists and, rather surprisingly, artists and designers. This book provides visual demonstrations of complicated and beautiful structures that can arise in systems, based on simple rules. It also presents papers on seemingly paradoxical combinations of randomness and structure in systems of mathematical, physical, biological, electrical, chemical, and artistic interest. Topics include: iteration, cellular automata, bifurcation maps, fractals, dynamical systems, patterns of nature created through simple rules, and aesthetic graphics drawn from the universe of mathematics and art. Chaos and Fractals is divided into six parts: Geometry and Nature; Attractors; Cellular Automata, Gaskets, and Koch Curves; Mandelbrot, Julia and Other Complex Maps; Iterated Function Systems; and Computer Art. Additionally, information on the latest practical applications of fractals and on the use of fractals in commercial products such as the antennas and reaction vessels is presented. In short, fractals are increasingly finding application in practical products where computer graphics and simulations are integral to the design process. Each of the six sections has an introduction by the editor including the latest research, references, and updates in the field. This book is enhanced with numerous color illustrations, a comprehensive index, and the many computer program examples encourage reader involvement.

This book presents a set of selected and edited papers presented at the 2nd and 3rd Design and Decision Support Conference. The purpose is to provide examples of innovative research in decision support systems in urban planning from throughout the world.

This book introduces and the new computer-based research methods for studying and modeling complex social phenomena. It is the first coherent collection that surveys the impact that computer-based methods have had on the social and behavioural sciences and illustrates the potential for future research. The methods are presented in an accessible manner and do not assume any background in computer science. The authors introduce each chapter and explain how computers can help to study social processes and each method is described in relation to a substantive issue to show how it can contribute to our understanding of complex problems. The themes covered include computer simulation, neural and social networks and the visualization of complex network data.

Cellular automata provide an interesting avenue into the study of complex systems in general, as well as having an intrinsic interest of their own. Because of their mathematical simplicity and representational robustness they have been used to model economic, political, biological, ecological, chemical, and physical systems. Almost any system which can be treated in terms of a discrete representation space in which the dynamics is based on local interaction rules can be modelled by a cellular automata. The aim of this book is to give an introduction to the analysis of cellular automata (CA) in terms of an approach in which CA rules are viewed as elements of a nonlinear operator algebra, which can be expressed in component form much as ordinary vectors are in vector algebra. Although a variety of different topics are covered, this viewpoint provides the underlying theme. The actual mathematics used is not complicated, and the material should be accessible to anyone with a junior-level university background, and a certain degree of mathematical maturity.

This book contains the courses given at the Third School on Statistical Physics and Cooperative Systems held at Santiago, Chile, from 14th to 18th December 1992. The main idea of this periodic school was to bring together scientists work with recent trends in Statistical Physics. More precisely ing on subjects related related with non linear phenomena, dynamical systems, ergodic theory, cellular au tomata, symbolic dynamics, large deviation theory and neural networks. Scientists working in these subjects come from several areas: mathematics, biology, physics, computer science, electrical engineering and artificial intelligence. Recently, a very important cross-fertilization has taken place with regard to the aforesaid scientific and technological disciplines, so as to give a new approach to the research whose common core remains in statistical physics. Each contribution is devoted to one or more of the previous subjects. In most cases

they are structured as surveys, presenting at the same time an original point of view about the topic and showing mostly new results. The expository text of Fran

The Quantum Cellular Automaton (QCA) concept represents an attempt to break away from the traditional three-terminal device paradigm that has dominated digital computation. Since its early formulation in 1993 at Notre Dame University, the QCA idea has received significant attention and several physical implementations have been proposed. This book provides a comprehensive discussion of the simulation approaches and the experimental work that have been undertaken on the fabrication of devices capable of demonstrating the fundamentals of QCA action. Complementary views of future perspectives for QCA technology are presented, highlighting a process of realistic simulation and of targeted experiments that can be assumed as a model for the evaluation of future device proposals. Contents: The Concept of Quantum-Dot Cellular Automata (C S Lent)QCA Simulation with the Occupation-Number Hamiltonian (M Macucci & M Governale)Realistic Time-Independent Models of a QCA Cell (J Martorell et al.)Time-Independent Simulation of QCA Circuits (L Bonci et al.)Simulation of the Time-Dependent Behavior of QCA Circuits with the Occupation-Number Hamiltonian (I Yakimenko & K-F Berggren)Time-Dependent Analysis of QCA Circuits with the Monte Carlo Method (L Bonci et al.)Implementation of QCA Cells with SOI Technology (F E Prins et al.)Implementation of QCA Cells in GaAs Technology (Y Jin et al.)Non-Invasive Charge Detectors (G Iannaccone et al.)Metal Dot QCA (G L Snider et al.)Molecular QCA (C S Lent)Magnetic Quantum-Dot Cellular Automata (MQCA) (A Imre et al.) Readership: Physicists, electronic engineers and academics. Keywords:Quantum Cellular Automata;QCA;Nanoelectronics;Quantum Dots;Numerical SimulationKey Features:Covers the integration between experimental and simulation activities, which can be used as a template for the development and assessment of future nanoelectronic technologiesComprehensive description of the different theoretical techniques developed to analyze QCA circuitsAnalysis of how real-world problems in the fabrication process impact a device proposal and may be crucial in determining its feasibility

This book addresses the intellectual foundations, function, modeling approaches and complexity of cellular automata; explores cellular automata in combination with genetic algorithms, neural networks and agents; and discusses the applications of cellular automata in economics, traffic and the spread of disease. Pursuing a blended approach between knowledge and philosophy, it assigns equal value to methods and applications.

Cellular automata are a class of spatially and temporally discrete mathematical systems characterized by local interaction and synchronous dynamical evolution. Introduced by the mathematician John von Neumann in the 1950s as simple models of biological self-reproduction, they are prototypical models for complex systems and processes consisting of a large number of simple, homogeneous, locally interacting components. Cellular automata have been the focus of great attention over the years because of their ability to generate a rich spectrum of very complex patterns of behavior out of sets of relatively simple underlying rules. Moreover, they appear to capture many essential features of complex self-organizing cooperative behavior observed in real systems.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.

YinYang bipolar relativity can trace its philosophical origins to ancient Chinese YinYang cosmology, which claims that everything has two sides or two opposite, but reciprocal, poles or energies. More specifically, this discipline is intended to be a logical unification of general relativity and quantum mechanics. YinYang Bipolar Relativity: A Unifying Theory of Nature, Agents and Causality with Applications in Quantum Computing, Cognitive Informatics and Life Sciences presents real-world applications of YinYang bipolar relativity that focus on quantum computing and agent interaction. This unique work makes complex theoretical topics, such as the ubiquitous effects of quantum entanglement, logically comprehendible to a vast audience.

The term "artificial life" describes research into synthetic systems that possess some of the essential properties of life. This interdisciplinary field includes biologists, computer scientists, physicists, chemists, geneticists, and others. Artificial life may be viewed as an attempt to understand high-level behavior from low-level rules—for example, how the simple interactions between ants and their environment lead to complex trail-following behavior. An understanding of such relationships in particular systems can suggest novel solutions to complex real-world problems such as disease prevention, stock-market prediction, and data mining on the Internet. Since their inception in 1987, the Artificial Life meetings have grown from small workshops to truly international conferences, reflecting the field's increasing appeal to researchers in all areas of science.

Cellular AutomataTheory and ExperimentMIT Press

This book constitutes the refereed proceedings of the 6th International Conference on Cellular Automata for Research and Industry, ACRI 2004, held in Amsterdam, The Netherlands in October 2004. The 60 revised full papers and 30 poster papers presented were carefully reviewed and selected from 150 submissions. The papers are devoted to methods and theory; evolved cellular automata; traffic, networks, and communication; applications in science and engineering; biomedical applications, natural phenomena and ecology; and social and economical applications.

This book constitutes the proceedings of the 10th International Conference on Parallel Computing Technologies, PaCT 2009, held in Novosibirsk, Russia on August 31-September 4, 2009. The 34 full papers presented together with 2 invited papers and 7 poster papers were carefully reviewed and selected from 72 submissions. The papers are organized in

topical sections on models of parallel computing, methods and algorithms, fine-grained parallelism, parallel programming tools and support, and applications.

Upon publication, the first edition of the CRC Concise Encyclopedia of Mathematics received overwhelming accolades for its unparalleled scope, readability, and utility. It soon took its place among the top selling books in the history of Chapman & Hall/CRC, and its popularity continues unabated. Yet also unabated has been the d

The thirty four contributions in this book cover many aspects of contemporary studies on cellular automata and include reviews, research reports, and guides to recent literature and available software. Cellular automata, dynamic systems in which space and time are discrete, are yielding interesting applications in both the physical and natural sciences. The thirty four contributions in this book cover many aspects of contemporary studies on cellular automata and include reviews, research reports, and guides to recent literature and available software. Chapters cover mathematical analysis, the structure of the space of cellular automata, learning rules with specified properties: cellular automata in biology, physics, chemistry, and computation theory; and generalizations of cellular automata in neural nets, Boolean nets, and coupled map lattices.Current work on cellular automata may be viewed as revolving around two central and closely related problems: the forward problem and the inverse problem. The forward problem concerns the description of properties of given cellular automata. Properties considered include reversibility, invariants, criticality, fractal dimension, and computational power. The role of cellular automata in computation theory is seen as a particularly exciting venue for exploring parallel computers as theoretical and practical tools in mathematical physics. The inverse problem, an area of study gaining prominence particularly in the natural sciences, involves designing rules that possess specified properties or perform specified task. A long-term goal is to develop a set of techniques that can find a rule or set of rules that can reproduce quantitative observations of a physical system. Studies of the inverse problem take up the organization and structure of the set of automata, in particular the parameterization of the space of cellular automata. Optimization and learning techniques, like the genetic algorithm and adaptive stochastic cellular automata are applied to find cellular automaton rules that model such physical phenomena as crystal growth or perform such adaptive-learning tasks as balancing an inverted pole.Howard Gutowitz is Collaborateur in the Service de Physique du Solide et Résonance Magnetique, Commissariat a I'Energie Atomique, Saclay, France.

Intelligent systems, or artificial intelligence technologies, are playing an increasing role in areas ranging from medicine to the major manufacturing industries to financial markets. The consequences of flawed artificial intelligence systems are equally wide ranging and can be seen, for example, in the programmed trading-driven stock market crash of October 19, 1987. Intelligent Systems: Technology and Applications, Six Volume Set connects theory with proven practical applications to provide broad, multidisciplinary coverage in a single resource. In these volumes, international experts present case-study examples of successful practical techniques and solutions for diverse applications ranging from robotic systems to speech and signal processing, database management, and manufacturing.

This self-contained monograph is an integrated study of generic systems defined by iterated relations using the two paradigms of abstraction and composition. This accommodates the complexity of some state-transition systems and improves understanding of complex or chaotic phenomena emerging in some dynamical systems. The main insights and results of this work concern a structural form of complexity obtained by composition of simple interacting systems representing opposed attracting behaviors. This complexity is expressed in the evolution of composed systems (their dynamics) and in the relations between their initial and final states (the computation they realize). The theoretical results are validated by analyzing dynamical and computational properties of low-dimensional prototypes of chaotic systems, high-dimensional spatiotemporally complex systems, and formal systems.

Intelligence for Human Behavior Analysis," organized by Luca Iocchi, Andrea Prati and Roberto Vezzani.

Model building in the social sciences can increasingly rely on well elaborated formal theories. At the same time inexpensive large computational capacities are now available. Both make computer-based model building and simulation possible in social science, whose central aim is in particular an understanding of social dynamics. Such social dynamics refer to public opinion formation, partner choice, strategy decisions in social dilemma situations and much more. In the context of such modelling approaches, novel problems in philosophy of science arise which must be analysed - the main aim of this book. Interest in social simulation has recently been growing rapidly world- wide, mainly as a result of the increasing availability of powerful personal computers. The field has also been greatly influenced by developments in cellular automata theory (from mathematics) and in distributed artificial intelligence which provided tools readily applicable to social simulation. This book presents a number of modelling and simulation approaches and their relations to problems in philosophy of science. It addresses sociologists and other social scientists interested in formal modelling, mathematical sociology, and computer simulation as well as computer scientists interested in social science applications, and philosophers of social science.

This book contains all full papers presented at ACRI 2000, the Fourth International Conference on Cellular Automata for Research and Industry, held at the University of Karlsruhe (Germany), 4 - 6 October, 2000. The continuation of and growing interest in research on Cellular Automata models for real world phenomena indicates the feasibility of this approach. A quick glance at the table contents of this book shows that results came from such different areas as biology, economics, physics, traffic flow and urban development. This work is complemented by contributions on the implementation and evaluation of software for Cellular Automata simulation, which is a necessary (but of course in no way sufficient) ingredient for the successful application of Cellular Automata. Applying Cellular Automata without trying to understand their behavior, in depth would be an unfortunate development. But as properties and power in earlier years it was again one of the strong points of ACRI to bring together researchers not only from different application areas but also from theory. Of course, this is reflected by the list of accepted contributions which also comprise theoretical papers and even papers which certainly belong to the intersection of several fields. Examples are the generation and recognition of geometrical patters and the influence of possible failures on the power of CA which obviously are of relevance also to applications.

Cellular Automata (CA), about to enter their fifties, are coming of age, seen by the breadth and quality of CA-related research carried out worldwide, as well as by the appearance of interesting applications to real world problems. The papers collected in this book, presented at ACRI 98 (Third Conference on Cellular Automata for Research and Industry -7-9 October 1998), further demonstrate the vitality of this line ofresearch. Until some years ago, a researcher interested in dynamical modelling of spatially of

the partial extended systems had only one language at his disposal, namely that differential equations (PDE). These are wonderful tools to use when an analytical solution can be found or a perturbative approach can provide a good approximation of the observed phenomena. The use of digital computers has enormously expanded the explanatory and predictive power of partial differential equations by allowing one to treat cases which had been outside the scope of a "pen and pencil" approach. However, it has also opened up a way to new formalisms which are able to describe interesting phenomena and are, at the same time, well-suited for digital simulation.

Like any goal-oriented procedure, experiment is subject to many kinds of failures. These failures have a variety of features, depending on the particulars of their sources. For the experimenter these pitfalls should be avoided and their effects minimized. For the historian-philosopher of science and the science educator, on the other hand, they are instructive starting points for reflecting on science in general and scientific method and practice in particular. Often more is learned from failure than from confirmation and successful application. The identification of error, its source, its context, and its treatment shed light on both practices and epistemic claims. This book shows that it is fruitful to bring to light forgotten and lost failures, subject them to analysis and learn from their moral. The study of failures, errors, pitfalls and mistakes helps us understand the way knowledge is pursued and indeed generated. The book presents both historical accounts and philosophical analyses of failures in experimental practice. It covers topics such as "error as an object of study", "learning from error", "concepts and dead ends", "instrumental artifacts", and "surprise and puzzlement". This book will be of interest to historians, philosophers, and sociologists of science as well as to practicing scientists and science educators.

Lattice-gas cellular automata (LGCA) and lattice Boltzmann models (LBM) are relatively new and promising methods for the numerical solution of nonlinear partial differential equations. The book provides an introduction for graduate students and researchers. Working knowledge of calculus is required and experience in PDEs and fluid dynamics is recommended. Some peculiarities of cellular automata are outlined in Chapter 2. The properties of various LGCA and special coding techniques are discussed in Chapter 3. Concepts from statistical mechanics (Chapter 4) provide the necessary theoretical background for LGCA and LBM. The properties of lattice Boltzmann models and a method for their construction are presented in Chapter 5.

The 21st century has seen the beginnings of a great restoration effort towards the world’s forests, accompanied by the emergence of an increasing literature on reforestation, regeneration and regrowth of forest cover. Yet to date, there is no volume which synthesises current knowledge on the extent, trends, patterns and drivers of reforestation. This edited volume draws together research from leading researchers to explore reforestation and forest regrowth across the world, from multiple dimensions – including ecosystem services, protected areas, social institutions, economic transitions, remediation of environmental problems, conservation and land abandonment – and at different scales. Detailing the methods and analyses used from across a wide range of disciplines, and incorporating research from North, South and Central America, Africa, Asia and Europe, this groundbreaking book provides a global overview of current trends, explores their underlying causes and proposes future forest trajectories. The first of its kind, the book will provide an invaluable reference for researchers and students involved in interdisciplinary research and working on issues relevant to the biophysical, geographic, socioeconomic and institutional processes associated with reforestation.

This book constitutes the refereed proceedings of the 7th International Conference on Cellular Automata for Research and Industry, ACRI 2006. The book presents 53 revised full papers and 19 revised poster papers together with 6 invited lectures. Topical sections include CA theory and implementation, computational theory, population dynamics, physical modeling, urban, environmental and social modeling, traffic and boolean networks, multi-agents and robotics, as well as crowds and cellular automata, and more.

This book constitutes the refereed proceedings of the 9th International Conference on Cellular Automata for Research and Industry, ACRI 2010, held in Ascoli Piceno, Italy, in September 2010. The first part of the volume contains 39 revised papers that were carefully reviewed and selected from the main conference; they are organized according to six main topics: theoretical results on cellular automata, modeling and simulation with cellular automata, CA dynamics, control and synchronization, codes and cryptography with cellular automata, cellular automata and networks, as well as CA-based hardware. The second part of the volume comprises 35 revised papers dedicated to contributions presented during ACRI 2010 workshops on theoretical advances, specifically asynchronous cellular automata, and challenging application contexts for cellular automata: crowds and CA, traffic and CA, and the international workshop of natural computing.

Book on cellular automata (CA) considers such questions as nonconstructible configurations, extremal possibilities of CA, complexity of finite configurations and global transition functions, modeling in CA, decomposition of global transition functions, appendices of CA, etc.

In the late 1960s British mathematician John Conway invented a virtual mathematical machine that operates on a two-dimensional array of square cell. Each cell takes two states, live and dead. The cells’ states are updated simultaneously and in discrete time. A dead cell comes to life if it has exactly three live neighbours. A live cell remains alive if two or three of its neighbours are alive, otherwise the cell dies. Conway’s Game of Life became the most programmed solitary game and the most known cellular automaton. The book brings together results of forty years of study into computational, mathematical, physical and engineering aspects of The Game of Life cellular automata. Selected topics include phenomenology and statistical behaviour; space-time dynamics on Penrose tilling and hyperbolic spaces; generation of music; algebraic properties; modelling of financial markets; semi-quantum extensions; predicting emergence; dual-graph based analysis; fuzzy, limit behaviour and threshold scaling; evolving cell-state transition rules; localization dynamics in quasi-chemical analogues of GoL; self-organisation towards criticality; asynochrous implementations. The volume is unique because it gives a comprehensive presentation of the theoretical and experimental foundations, cutting-edge computation techniques and mathematical analysis of the fabulously complex, self-organized and emergent phenomena defined by incredibly simple rules.

Many of the best researchers and writers in discrete mathematics come together in a volume inspired by Ron Graham.

This volume contains selected papers presented at the Second Asia-Paci c C- ference on Simulated Evolution and Learning (SEAL’98), from 24 to 27 Nov- ber 1998, in Canberra, Australia. SEAL’98 received a total of 92 submissions (67 papers for the regular sessions and 25 for the applications sessions). All papers were reviewed by three independent reviewers. After review, 62 papers were - cepted for oral presentation and 13 for poster presentation. Some of the accepted papers were selected for inclusion in this volume. SEAL’98 also featured a fully refereed special session on Evolutionary Computation in Power Engineering - ganised by Professor Kit Po Wong and Dr Loi Lei Lai. Two of the ve accepted papers are included in this volume. The papers included in these proceedings cover a wide range of topics in simulated evolution and learning, from self-adaptation to dynamic modelling, from reinforcement learning to agent systems, from evolutionary games to e- lutionary economics, and from novel theoretical results to successful applications, among others. SEAL’98 attracted 94 participants from 14 di erent countries, namely A- tralia, Belgium, Brazil, Germany, Iceland, India, Japan, South Korea, New Z- land, Portugal, Sweden, Taiwan, UK and the USA. It had three distinguished international scientists as keynote speakers, giving talks on natural computation (Hans-Paul Schwefel), reinforcement learning (Richard Sutton), and novel m- els in evolutionary design (John Gero). More information about SEAL’98 is still available at http://www.cs.adfa.edu.au/conference/seal98/.

"The theme of this book is the use of Cellular Automatas (CAs) to model biological systems, describing 2-D CAs to create

populations of "life-like agents" with their own genomes"--Provided by publisher.

Complex Systems Science in Biomedicine Thomas S. Deisboeck and J. Yasha Kresh Complex Systems Science in Biomedicine covers the emerging field of systems science involving the application of physics, mathematics, engineering and computational methods and techniques to the study of biomedicine including nonlinear dynamics at the molecular, cellular, multi-cellular tissue, and organismic level. With all chapters helmed by leading scientists in the field, Complex Systems Science in Biomedicine's goal is to offer its audience a timely compendium of the ongoing research directed to the understanding of biological processes as whole systems instead of as isolated component parts. In Parts I & II, Complex Systems Science in Biomedicine provides a general systems thinking perspective and presents some of the fundamental theoretical underpinnings of this rapidly emerging field. Part III then follows with a multi-scaled approach, spanning from the molecular to macroscopic level, exemplified by studying such diverse areas as molecular networks and developmental processes, the immune and nervous systems, the heart, cancer and multi-organ failure. The volume concludes with Part IV that addresses methods and techniques driven in design and development by this new understanding of biomedical science. Key Topics Include: • Historic Perspectives of General Systems Thinking • Fundamental Methods and Techniques for Studying Complex Dynamical Systems • Applications from Molecular Networks to Disease Processes • Enabling Technologies for Exploration of Systems in the Life Sciences Complex Systems Science in Biomedicine is essential reading for experimental, theoretical, and interdisciplinary scientists working in the biomedical research field interested in a comprehensive overview of this rapidly emerging field. About the Editors: Thomas S. Deisboeck is currently Assistant Professor of Radiology at Massachusetts General Hospital and Harvard Medical School in Boston. An expert in interdisciplinary cancer modeling, Dr. Deisboeck is Director of the Complex Biosystems Modeling Laboratory which is part of the Harvard-MIT Martinos Center for Biomedical Imaging. J. Yasha Kresh is currently Professor of Cardiothoracic Surgery and Research Director, Professor of Medicine and Director of Cardiovascular Biophysics at the Drexel University College of Medicine. An expert in dynamical systems, he holds appointments in the School of Biomedical Engineering and Health Systems, Dept. of Mechanical Engineering and Molecular Pathobiology Program. Prof. Kresh is Fellow of the American College of Cardiology, American Heart Association, Biomedical Engineering Society, American Institute for Medical and Biological Engineering.

This volume contains the courses given at the Sixth Summer School on Complex Systems held at Facultad de Ciencias Fisicas y Maternaticas, Universidad de Chile at Santiago, Chile, from 14th to 18th December 1998. This school was addressed to graduate students and researchers working on areas related with recent trends in Complex Systems, including dynamical systems, cellular automata, complexity and cutoff in Markov chains. Each contribution is devoted to one of these subjects. In some cases they are structured as surveys, presenting at the same time an original point of view and showing mostly new results. The paper of Pierre Arnoux investigates the relation between low complex systems and chaotic systems, showing that they can be put into relation by some re normalization operations. The case of quasi-crystals is fully studied, in particular the Sturmian quasi-crystals. The paper of Franco Bagnoli and Raul Rechtman establishes relations be tween Lyapunov exponents and synchronization processes in cellular automata. The principal goal is to associate tools, usually used in physical problems, to an important problem in cellularautomata and computer science, the synchronization problem. The paper of Jacques Demongeot and colleagues gives a presentation of at tractors of dynamical systems appearing in biological situations. For instance, the relation between positive or negative loops and regulation systems.

This book constitutes the proceedings of the 11th International Conference on Cellular Automata for Research and Industry, ACRI 2014, held in Krakow, Poland, in September 2014. The 67 full papers and 7 short papers presented in this volume were carefully reviewed and selected from 125 submissions. They are organized in topical sections named: theoretical results on cellular automata; cellular automata dynamics and synchronization; modeling and simulation with cellular automata; cellular automata-based hardware and computing; cryptography, networks and pattern recognition with cellular automata. The volume also contains contributions from ACRI 2014 workshops on crowds and cellular automata; asynchronous cellular automata; traffic and cellular automata; and agent-based simulation and cellular automata.