2 D Quadratic Maps And 3 D Ode Systems A Rigorous Approach World Scientific Series On Nonlinear Science Series A World Scientific Series On Nonlinear Science Series A

This book constitutes the thoroughly refereed post-proceedings of the annual International Workshop of the Types Working Group, TYPES 2006, held in Nottingham, UK in April 2006 - co-located with the Seventh Symposium on Trends in Functional Programming, TFP 2006. The 17 revised full papers presented were carefully reviewed and selected from 29 submissions. All current issues of formal reasoning and computer programming based on type theory are addressed; in particular languages and computerised tools for reasoning, and applications in several domains such as analysis of programming languages, certified software, formalisation of mathematics and mathematics education.

Chaos is the idea that a system will produce very different long-term behaviors when the initial conditions are perturbed only slightly. Chaos is used for novel, time- or energy-critical interdisciplinary applications. Examples include high-performance circuits and devices, liquid mixing, chemical reactions, biological systems, crisis management, secure information processing, and critical decision-making in politics, economics, as well as military applications, etc. This book presents the latest investigations in the theory of chaotic systems and their dynamics. The book covers some theoretical aspects of the subject arising in the study of both discrete and continuous-time chaotic dynamical systems. This book presents the state-of-the-art of the more advanced studies of chaotic dynamical systems.

Chaotic Signals in Digital Communications combines fundamental background knowledge with state-of-the-art methods for using chaotic signals and systems in digital communications. The book builds a bridge between theoretical works and practical implementation to help researchers attain consistent performance in realistic environments. It shows the possible shortcomings of the chaos-based communication systems proposed in the literature, particularly when they are subjected to non-ideal conditions. It also presents a toolbox of techniques for researchers working to actually implement such systems. A Combination of Tutorials and In-Depth, Cutting-Edge Research Featuring contributions by active leading researchers, the book begins with an introduction to communication theory, dynamical systems, and chaotic communications suitable for those new to the field. This lays a solid foundation for the more applied chapters that follow. A Toolbox of Techniques—Including New Ways to Tackle Channel Imperfections The book covers typical chaos communication methods, namely chaotic masking, chaotic modulation, chaotic shift key, and symbolic message bearing, as well as bidirectional communication and secure communication. It also presents novel methodologies to deal with communication channel imperfections. These tackle band-limited channel chaos communication, radio channels with fading, and the resistance of a special chaotic signal to multipath propagations. In addition, the book addresses topics related to engineering applications, such as optical communications, chaotic matched filters and circuit implementations, and microwave frequency-modulated differential chaos shift keying (FM-DCSK) systems. Insights for Both Theoretical and Experimental Researchers Combining theory and practice, this book offers a unique perspective on chaotic communication in the context of non-ideal conditions. Written for theoretical and experimental researchers, it tackles the practical issues faced in implementing chaos-based signals and systems in digital communications applications.

This unique volume presents an original approach to physical acoustics with additional emphasis on the most useful surface acoustic waves on solids. The study is based on foundational work of Léon Brillouin, and application of the celebrated invariance theorem of Emmy Noether to an element of volume that is representative of the wave motion. This approach provides an easy interpretation of typical wave motions of physical acoustics in bulk, at surfaces, and across interfaces, in the form of the motion of associated quasi-particles. This type of motion, Newtonian or not, depends on the wave motion considered, and on the original modeling of the continuum that supports it. After a thoughtful review of Brillouin's fundamental ideas related to radiative stresses, wave momentum and action, and the necessary reminder on modern nonlinear continuum thermomechanics, invariance theory and techniques of asymptotics, a variety of situations and models illustrates the power and richness of the approach and its strong potential in applications. Elasticity, piezoelectricity and new models of continua with nonlinearity, viscosity and some generalized features (microstructure, weak or strong nonlocality) or unusual situations (bounding surface with energy, elastic thin film glued on a surface waveguide), are considered, exhibiting thus the versatility of the approach. This original book offers an innovative vision and treatment of the problems of wave propagation in deformable solids. It opens up new horizons in the theoretical and applied facets of physical acoustics. Contents:Pro;egomena: Wave Momentum and Radiative Stresses in 1D in the Line of BrillouinElements of Continuum ThermomechanicsPseudomomentum and Eshelby StressAction, Phonons and Wave MechanicsTransmission-Reflection ProblemsApplication to Dynamic MaterialsElastic Surface Waves in Terms of Quasi-ParticlesElectroelastic Surface Waves in Terms of Quasi-ParticlesWaves Generalized Elastic ContinuaExamples of Solitonic Systems Readership: Graduate students and researchers in applied physics and mathematics, as well as accousticians. Key Features:Originality of approach to physical acousticsInnovative vision of the problem of wave propagation in deformable solidsEnriching interaction between mathematical physics and wave theoryKeywords:Waves;Physical Acoustics;Surface Waves;Quasi-Particles;Elasticity;Invariance Theorems

Memory is a universal function of organized matter. What is the mathematics of memory? How does memory affect the space-time behaviour of spatially extended systems? Does memory increase complexity? This book provides answers to these questions. It focuses on the study of spatially extended systems, i.e., cellular automata and other related discrete complex systems. Thus, arrays of locally connected finite state machines, or cells, update their states simultaneously, in discrete time, by the same transition rule. The classical dynamics in these systems is Markovian: only the actual configuration is taken into account to generate the next one. Generalizing the conventional view on spatially extended

discrete dynamical systems evolution by allowing cells (or nodes) to be featured by some trait state computed as a function of its own previous state-values, the transition maps of the classical systems are kept unaltered, so that the effect of memory can be easily traced. The book demonstrates that discrete dynamical systems with memory are not only priceless tools for modeling natural phenomena but unique mathematical and aesthetic objects.

The two-volume set LNCS 4051 and LNCS 4052 constitutes the refereed proceedings of the 33rd International Colloquium on Automata, Languages and Programming, ICALP 2006, held in Venice, Italy, July 2006. In all, these volumes present more 100 papers and lectures. Volume II (4052) presents 2 invited papers and 2 additional conference tracks with 24 papers each, focusing on algorithms, automata, complexity and games as well as on security and cryptography foundation.

Advanced differential equations appear in several applications especially as mathematical models in economics, an advanced term may for example reflect the dependency on anticipated capital stock. This book also deals with nonoscillation properties of scalar advanced differential equations. Some new oscillation and nonoscillation criteria are given for linear delay or advanced differential equations with variable coefficients and not necessarily constant delays or advanced arguments. The present book has been written in the light of the latest syllabi of several Universities. The subject matter has been presented in such a way that it is easily accessible to students. The method of presentation is very clear and lucid which can be easily followed by the students. The contents conform to the specified syllabi and are so structured as to enable the student to move easily from the fundamental to the complex. It is our earnest hope that this book will be of great value to all our students.

Ordinary differential equations (ODEs) arise in many contexts of mathematics and science (social as well as natural). Mathematical descriptions of change use differentials and derivatives. Various differentials, derivatives, and functions become related to each other via equations, and thus a differential equation is a result that describes dynamically changing phenomena, evolution, and variation. Often, quantities are defined as the rate of change of other quantities (for example, derivatives of displacement with respect to time), or gradients of quantities, which is how they enter differential equations. Ordinary differential equations are equations to be solved in which the unknown element is a function, rather than a number, and in which the known information relates that function to its derivatives. Few such equations admit an explicit answer, but there is a wealth of qualitative information describing the solutions and their dependence on the defining equation. Systems of differential equations form the basis of mathematical models in a wide range of fields - from engineering and physical sciences to finance and biological sciences. Differential equations are relations between unknown functions and their derivatives. Computing numerical solutions to differential equations is one of the most important tasks in technical computing, and one of the strengths of MATLAB. The book explains the origins of various types of differential equations. The scope of the book is limited to linear differential equations of the first order, linear differential equation of higher order, partial differential equations and special methods of solution of differential equations of second order, keeping in view the requirement of students.

During the last fifty years, Gopinath Kallianpur has made extensive and significant contributions to diverse areas of probability and statistics, including stochastic finance, Fisher consistent estimation, non-linear prediction and filtering problems, zero-one laws for Gaussian processes and reproducing kernel Hilbert space theory, and stochastic differential equations in infinite dimensions. To honor Kallianpur's pioneering work and scholarly achievements, a number of leading experts have written research articles highlighting progress and new directions of research in these and related areas. This commemorative volume, dedicated to Kallianpur on the occasion of his seventy-fifth birthday, will pay tribute to his multi-faceted achievements and to the deep insight and inspiration he has so graciously offered his students and colleagues throughout his career. Contributors to the volume: S. Aida, N. Asai, K. B. Athreya, R. N. Bhattacharya, A. Budhiraja, P. S. Chakraborty, P. Del Moral, R. Elliott, L. Gawarecki, D. Goswami, Y. Hu, J. Jacod, G. W. Johnson, L. Johnson, T. Koski, N. V. Krylov, I. Kubo, H.-H. Kuo, T. G. Kurtz, H. J. Kushner, V. Mandrekar, B. Margolius, R. Mikulevicius, I. Mitoma, H. Nagai, Y. Ogura, K. R. Parthasarathy, V. Perez-Abreu, E. Platen, B. V. Rao, B. Rozovskii, I. Shigekawa, K. B. Sinha, P. Sundar, M. Tomisaki, M. Tsuchiya, C. Tudor, W. A. Woycynski, J. Xiong.

There is no recent elementary introduction to the theory of discrete dynamical systems that stresses the topological background of the topic. This book fills this gap: it deals with this theory as 'applied general topology'. We treat all important concepts needed to understand recent literature. The book is addressed primarily to graduate students. The prerequisites for understanding this book are modest: a certain mathematical maturity and course in General Topology are sufficient.

A revision of a professional text on the phenomena of chaotic vibrations in fluids and solids. Major changes reflect the latest developments in this fast-moving topic, the introduction of problems to every chapter, additional mathematics and applications, more coverage of fractals, numerous computer and physical experiments. Contains eight pages of 4-color pictures.

This book presents the latest trends, methods and results in nonlinear dynamics with a special focus on oligopolies. It contains a number of technical appendices that summarize techniques of global dynamics not easily accessible elsewhere.

This graduate text surveys both the theoretical and experimental aspects of deterministic chaotic behaviour.

This textbook, now in its second edition, provides a broad introduction to both continuous and discrete dynamical systems, the theory of which is motivated by examples from a wide range of disciplines. It emphasizes applications and simulation utilizing MATLAB®, Simulink®, the Image Processing Toolbox® and the Symbolic Math toolbox®, including MuPAD. Features new to the second edition include · sections on series solutions of ordinary differential equations, perturbation methods, normal forms, Gröbner bases, and chaos synchronization; · chapters on image processing and binary oscillator computing; · hundreds of new illustrations, examples, and exercises with solutions; and · over eighty up-to-date MATLAB program files and Simulink model files available online. These files were voted MATLAB Central Pick of the Week in July 2013. The hands-on approach of Dynamical Systems with Applications using MATLAB, Second Edition, has minimal prerequisites, only requiring familiarity with ordinary differential equations. It will appeal to advanced undergraduate and graduate students, applied mathematicians, engineers, and researchers in a broad range of disciplines such as population dynamics, biology, chemistry, computing, economics, nonlinear optics, neural networks, and physics. Praise for the first edition Summing up, it can be said that this text allows the reader to have

an easy and quick start to the huge field of dynamical systems theory. MATLAB/SIMULINK facilitate this approach under the aspect of learning by doing. —OR News/Operations Research Spectrum The MATLAB programs are kept as simple as possible and the author's experience has shown that this method of teaching using MATLAB works well with computer laboratory classes of small sizes.... I recommend ‘Dynamical Systems with Applications using MATLAB’ as a good handbook for a diverse readership: graduates and professionals in mathematics, physics, science and engineering. —Mathematica

This book constitutes the refereed proceedings of the 9th European Conference on Genetic Programming, EuroGP 2006, held in Budapest, Hungary, in April 2006, colocated with EvoCOP 2006. The 21 revised plenary papers and 11 revised poster papers were carefully reviewed and selected from 59 submissions. The papers address fundamental and theoretical issues, along with a wide variety of papers dealing with different application areas.

"This book provides original research on the theoretical and applied aspects of artificial life, as well as addresses scientific, psychological, and social issues of synthetic life-like behavior and abilities"--Provided by publisher.

This book is a comprehensive collection of known results about the Lozi map, a piecewise-affine version of the Henon map. Henon map is one of the most studied examples in dynamical systems and it attracts a lot of attention from researchers, however it is difficult to analyze analytically. Simpler structure of the Lozi map makes it more suitable for such analysis. The book is not only a good introduction to the Lozi map and its generalizations, it also summarizes of important concepts in dynamical systems theory such as hyperbolicity, SRB measures, attractor types, and more.

This book is essentially devoted to complex properties (Phase plane structure and bifurcations) of two-dimensional noninvertible maps, i.e. maps having either a non-unique inverse, or no real inverse, according to the plane point. They constitute models of sets of discrete dynamical systems encountered in Engineering (Control, Signal Processing, Electronics), Physics, Economics, Life Sciences. Compared to the studies made in the one-dimensional case, the two-dimensional situation remained a long time in an underdeveloped state. It is only since these last years that the interest for this research has increased. Therefore the book purpose is to give a global presentation of a matter, available till now only in a partial form. Fundamental notions and tools (such as “critical manifolds”), as the most part of results, are accompanied by many examples and figures. Contents:Generalities on Dynamics Systems and MapsOne-Dimensional Noninvertible MapsTwo-Dimensional Noninvertible Maps. Properties of Critical CurvesAbsorbing Areas and Chaotic Areas of Two-Dimensional Noninvertible MapsBasins and Their BifurcationsOn Some Properties of Invariant Sets of Two-Dimensional Noninvertible Maps Readership: Nonlinear scientists, engineers and physicists. keywords:Noninvertible Maps;Multiple Preimages;Critical Curves;Plane Foliation;Absorbing Areas;Chaotic Areas;Invariant Sets;Disconnected Basins;Multiplyconnected Basins;Bifurcations involving Critical Sets

This volume collects contributions by leading experts in the area of commutative algebra related to the INdAM meeting “Homological and Computational Methods in Commutative Algebra” held in Cortona (Italy) from May 30 to June 3, 2016 . The conference and this volume are dedicated to Winfried Bruns on the occasion of his 70th birthday. In particular, the topics of this book strongly reflect the variety of Winfried Bruns’ research interests and his great impact on commutative algebra as well as its applications to related fields. The authors discuss recent and relevant developments in algebraic geometry, commutative algebra, computational algebra, discrete geometry and homological algebra. The book offers a unique resource, both for young and more experienced researchers seeking comprehensive overviews and extensive bibliographic references.

The field of nonlinear optics has witnessed a tremendous evolution since its beginnings in the early sixties. Its frontiers have been extended in many direc tions and its techniques have intruded upon many areas of both fundamental and practical interest. The field itself has been enriched with many new phe nomena and concepts that have further extended its scope and strengthened its connection with other areas. As a consequence, it is becoming increasingly unrealistic to expect to cover the different facets and trends of this field in the lectures or proceed ings of a summer school, however advanced these may be. However much of the current progress and interest in this field springs to a large extent from the promise and expectation that highly performing all-optical devices that exploit and operate on the principles of nonlinear optics will constitute an important branch of future technology and will provide new alternatives in information processing and transmission. The conception of new devices, in general, requires an intricate and bold combination of facts and methods from most diverse fields, in order to perform functions and operations that fit into an overall technological ensemble.

This book is based on research on the rigorous proof of chaos and bifurcations in 2-D quadratic maps, especially the invertible case such as the H•non map, and in 3-D ODE's, especially piecewise linear systems such as the Chua's circuit. In addition, the book covers some recent works in the field of general 2-D quadratic maps, especially their classification into equivalence classes, and finding regions for chaos, hyperchaos, and non-chaos in the space of bifurcation parameters. Following the main introduction to the rigorous tools used to prove chaos and bifurcations in the two representative systems, is the study of the invertible case of the 2-D quadratic map, where previous works are oriented toward H•non mapping. 2-D quadratic maps are then classified into 30 maps with well-known formulas. Two proofs on the regions for chaos, hyperchaos, and non-chaos in the space of the bifurcation parameters are presented using a technique based on the second-derivative test and bounds for Lyapunov exponents. Also included is the proof of chaos in the piecewise linear Chua's system using two methods, the first of which is based on the construction of Poincar• map, and the second is based on a computer-assisted proof. Finally, a rigorous analysis is provided on the bifurcational phenomena in the piecewise linear Chua's system using both an analytical 2-D mapping and a 1-D approximated Poincar• mapping in addition to other analytical methods.

This book provides a self-contained exposition of the theory of plane Cremona maps, reviewing the classical theory. The book updates, correctly proves and generalises a number of classical results by allowing any configuration of singularities

for the base points of the plane Cremona maps. It also presents some material which has only appeared in research papers and includes new, previously unpublished results. This book will be useful as a reference text for any researcher who is interested in the topic of plane birational maps.

A Physarum machine is a programmable amorphous biological computer experimentally implemented in the vegetative state of true slime mould Physarum polycephalum. It comprises an amorphous yellowish mass with networks of protoplasmic veins, programmed by spatial configurations of attracting and repelling gradients. This book demonstrates how to create experimental Physarum machines for computational geometry and optimization, distributed manipulation and transportation, and general-purpose computation. Being very cheap to make and easy to maintain, the machine also functions on a wide range of substrates and in a broad scope of environmental conditions. As such a Physarum machine is a 'green' and environmentally friendly unconventional computer. The book is readily accessible to a nonprofessional reader, and is a priceless source of experimental tips and inventive theoretical ideas for anyone who is inspired by novel and emerging non-silicon computers and robots. An account on Physarum Machines can be viewed at http: //www.youtube.com/user/PhysarumMachines.

This collection of review articles is devoted to new developments in the study of chaotic dynamical systems with some open problems and challenges. The papers, written by many of the leading experts in the field, cover both the experimental and theoretical aspects of the subject. This edited volume presents a variety of fascinating topics of current interest and problems arising in the study of both discrete and continuous time chaotic dynamical systems. Exciting new techniques stemming from the area of nonlinear dynamical systems theory are currently being developed to meet these challenges. Presenting the state-of-the-art of the more advanced studies of chaotic dynamical systems, Frontiers in the Study of Chaotic Dynamical Systems with Open Problems is devoted to setting an agenda for future research in this exciting and challenging field. Contents:Problems with Lorenz's Modeling and the Algorithm of Chaos Doctrine (S OuYang & Y Lin)Nonexistence of Chaotic Solutions of Nonlinear Differential Equations (L S Yao)Some Open Problems in the Dynamics of Quadratic and Higher Degree Polynomial ODE Systems (F Zhang & J Heidel)On Chaotic and Hyperchaotic Complex Nonlinear Dynamical Systems (G M Mahmoud)On the Study of Chaotic Systems with Non-Horseshoe Template (A Ray et al.)Instability of Solutions of Fourth and Fifth Order Delay Differential Equations (C Tunç)Some Conjectures About the Synchronizability and the Topology of Networks (A Caneco et al.)Wavelet Study of Dynamical Systems Using Partial Differential Equations (E B Postnikov)Combining the Dynamics of Discrete Dynamical Systems (J S Cánovas)Code Structure for Pairs of Linear Maps with Some Open Problems (P Troshin)Recent Advances in Open Billiards with Some Open Problems (C P Dettmann)Open Problems in the Dynamics of the Expression of Gene Interaction Networks (L S Liebovitch & V Naudot)How to Transform a Type of Chaos in Dynamical Systems? (E Zeraoulia & J C Sprott) Readership: Graduate students and researchers interested in chaotic dynamical systems. Keywords:Nonlinear Differential Equations;Lorenz Modeling;ODE;Discrete Dynamical Systems;Chaotic Systems

Recognising that the economy is a complex system with boundedly rational interacting agents, the book presents a theory of behavioral rationality and heterogeneous expectations in complex economic systems and confronts the nonlinear dynamic models with empirical stylized facts and laboratory experiments. The complexity modeling paradigm has been strongly advocated since the late 1980s by some economists and by multidisciplinary scientists from various fields, such as physics, computer science and biology. More recently the complexity view has also drawn the attention of policy makers, who are faced with complex phenomena, irregular fluctuations and sudden, unpredictable market transitions. The complexity tools - bifurcations, chaos, multiple equilibria - discussed in this book will help students, researchers and policy makers to build more realistic behavioral models with heterogeneous expectations to describe financial market movements and macro-economic fluctuations, in order to better manage crises in a complex global economy.

This book constitutes the thoroughly refereed post-conference proceedings of the 4th International Conference on Mobile, Secure, and Programmable Networking, held in Paris, France, in June 2018. The 27 papers presented in this volume were carefully reviewed and selected from 52 submissions. They discuss new trends in networking infrastructures, security, services and applications while focusing on virtualization and cloud computing for networks, network programming, software defined networks (SDN) and their security.

This book constitutes the thoroughly refereed post-workshop proceedings of the 5th International Workshop on Modelling and Simulation for Autonomous Systems, MESAS 2018, held in Prague, Czech Republic, in October 2018. The 46 revised full papers included in the volume were carefully reviewed and selected from 66 submissions. They are organized in the following topical sections: Future Challenges of Advanced M&S Technology; Swarming - R&D and Application; M&S of Intelligent Systems - AI, R&D and Application; AxS in Context of Future Warfare and Security Environment (Concepts, Applications, Training, Interoperability, etc.).

Contents: Dynamical Systems and Recurrences. GeneralitiesSome Properties of One-Dimensional Recurrences (Maps)Myrberg's Results on the One-Dimensional Quadratic Recurrences. Their ConsequencesThe Box-Within-a-Box Bifurcations Structure and Its ConsequencesSome Properties of Two-Dimensional Recurrences (Maps)Two-Dimensional Diffeomorphisms and the Foliated Box-Within-a-Box Bifurcations Structureand other papers Readership: Applied mathematicians, engineers and other physicists. Keywords:Endomorphism;Diffeomorphism;Recurrences;Bifurcations Structure

This unprecedented book offers all the details of the mathematical mechanics underlying state-of-the-art modeling of skeletal muscle contraction. The aim is to provide an integrated vision of mathematics, physics, chemistry and biology for this one understanding. The method is to take advantage of modern mathematical technology — Eilenberg-Mac Lane category theory, Robinson infinitesimal calculus and Kolmogorov probability theory — to examine a succession of distinguishable universes of particles, and continuous, thermodynamic, chemical, and molecular bodies, all with a focus on proofs by algebraic calculation without set theory. Also provided are metaphors and analogies, and careful distinction between representational pictures, mental model drawings, and mathematical diagrams.High school mathematics teachers, undergraduate and graduate college students, and researchers in mathematics, physics, chemistry, and biology may use this integrated publication to broaden their perspective

on science, and to experience the precision that mathematical mechanics brings to understanding the muscular mechanism of nearly all animal behavior.

About one and a half decades ago, Feigenbaum observed that bifurcations, from simple dynamics to complicated ones, in a family of folding mappings like quadratic polynomials follow a universal rule (Coullet and Tresser did some similar observation independently). This observation opened a new way to understanding transition from nonchaotic systems to chaotic or turbulent system in fluid dynamics and many other areas. The renormalization was used to explain this observed universality. This research monograph is intended to bring the reader to the frontier of this active research area which is concerned with renormalization and rigidity in real and complex one-dimensional dynamics. The research work of the author in the past several years will be included in this book. Most recent results and techniques developed by Sullivan and others for an understanding of this universality as well as the most basic and important techniques in the study of real and complex one-dimensional dynamics will also be included here.

Annotation This text introduces cellular automata from a rigorous nonlinear dynamics perspective. It supplies the missing link between nonlinear differential and difference equations to discrete symbolic analysis. It provides an analysis, and classification of the empirical results presented in Wolfram's 'New Kind of Science'.

This volume constitutes the thoroughly refereed post-workshop proceedings of the 6th International Workshop on Fuzzy Logic and Applications held in September 2005. The 50 revised full papers and 32 short papers presented together with three invited papers were carefully reviewed and selected from 86 submissions. The papers are organized in topical sections on neuro-fuzzy systems, fuzzy logic and possibility theory, pattern recognition, evolutionary algorithms, control, bioinformatics, image processing, knowledge management, and miscellaneous applications.

This reader-friendly textbook presents a comprehensive review of the essentials of image data mining, and the latest cutting-edge techniques used in the field. The coverage spans all aspects of image analysis and understanding, offering deep insights into areas of feature extraction, machine learning, and image retrieval. The theoretical coverage is supported by practical mathematical models and algorithms, utilizing data from real-world examples and experiments. Topics and features: describes the essential tools for image mining, covering Fourier transforms, Gabor filters, and contemporary wavelet transforms; reviews a varied range of state-of-the-art models, algorithms, and procedures for image mining; emphasizes how to deal with real image data for practical image mining; highlights how such features as color, texture, and shape can be mined or extracted from images for image representation; presents four powerful approaches for classifying image data, namely, Bayesian classification, Support Vector Machines, Neural Networks, and Decision Trees; discusses techniques for indexing, image ranking, and image presentation, along with image database visualization methods; provides self-test exercises with instructions or Matlab code, as well as review summaries at the end of each chapter. This easy-to-follow work illuminates how concepts from fundamental and advanced mathematics can be applied to solve a broad range of image data mining problems encountered by students and researchers of computer science. Students of mathematics and other scientific disciplines will also benefit from the applications and solutions described in the text, together with the hands-on exercises that enable the reader to gain first-hand experience of computing.

Robust chaos is defined by the absence of periodic windows and coexisting attractors in some neighborhoods in the parameter space of a dynamical system. This unique book explores the definition, sources, and roles of robust chaos. The book is written in a reasonably self-contained manner and aims to provide students and researchers with the necessary understanding of the subject. Most of the known results, experiments, and conjectures about chaos in general and about robust chaos in particular are collected here in a pedagogical form. Many examples of dynamical systems, ranging from purely mathematical to natural and social processes displaying robust chaos, are discussed in detail. At the end of each chapter is a set of exercises and open problems (more than 260 in the whole book) intended to reinforce the ideas and provide additional experiences for both readers and researchers in nonlinear science in general, and chaos theory in particular.

This important collection presents recent advances in nonlinear dynamics including analytical solutions, chaos in Hamiltonian systems, time-delay, uncertainty, and bio-network dynamics. Nonlinear Dynamics and Complexity equips readers to appreciate this increasingly main-stream approach to understanding complex phenomena in nonlinear systems as they are examined in a broad array of disciplines. The book facilitates a better understanding of the mechanisms and phenomena in nonlinear dynamics and develops the corresponding mathematical theory to apply nonlinear design to practical engineering.

A highly valued resource for those who wish to move from the introductory and preliminary understandings and the measurement of chaotic behavior to a more sophisticated and precise understanding of chaotic systems. The authors provide a deep understanding of the structure of strange attractors, how they are classified, and how the information required to identify and classify a strange attractor can be extracted from experimental data. In its first edition, the Topology of Chaos has been a valuable resource for physicist and mathematicians interested in the topological analysis of dynamical systems. Since its publication in 2002, important theoretical and experimental advances have put the topological analysis program on a firmer basis. This second edition includes relevant results and connects the material to other recent developments. Following significant improvements will be included: * A gentler introduction to the topological analysis of chaotic systems for the non expert which introduces the problems and questions that one commonly encounters when observing a chaotic dynamics and which are well addressed by a topological approach: existence of unstable periodic orbits, bifurcation sequences, multistability etc. * A new chapter is devoted to bounding tori which are essential for achieving generality as well as for understanding the influence of boundary conditions. * The new edition also reflects the progress which had been made towards extending topological analysis to higher-dimensional systems by proposing a new formalism where evolving triangulations replace braids. * There has also been much progress in the understanding of what is a good representation of a chaotic system, and therefore a new chapter is devoted to embeddings. * The chapter on topological analysis program will be expanded to cover traditional measures of chaos. This will help to connect those readers who are familiar with those measures and tests to the more sophisticated methodologies discussed in detail in this book. * The addition of the Appendix with both frequently asked and open questions with answers gathers the most essential points readers should keep in mind and guides to corresponding sections in the book. This will be of great help to those who want to selectively dive into the book and its treatments rather than reading it cover to cover. What makes this book special is its attempt to classify real physical systems (e.g. lasers) using topological techniques applied to real date (e.g. time series). Hence it has become the experimenter?s guidebook to reliable and sophisticated studies of experimental data for comparison with candidate relevant theoretical models, inevitable to physicists, mathematicians, and engineers studying low-dimensional chaotic systems.

Complex Dynamics

This volume provides a broad introduction to nonlinear integral dynamical models and new classes of evolutionary integral equations. It may be used as an advanced textbook by postgraduate students to study integral dynamical models and their applications in machine learning, electrical and electronic engineering, operations research and image analysis.