Nonlinear Dynamics And Chaos Westview

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Nonlinear Systems P. G. Drazin 1992-06-26 This book introduces the mathematical properties of nonlinear systems, mostly difference and differential equations, as an integrated theory, rather than presenting isolated fashionable topics.

Nonlinear Dynamics and Chaos STEVEN H. STROGATZ 2019-07-10

Nonlinear Dynamics and Chaos Steven H. Strogatz 2014-08-26 This textbook is aimed at newcomers to nonlinear dynamics and chaos, especially students taking a first course in the subject. The presentation stresses analytical methods, concrete examples, and geometric intuition. The theory is developed systematically, starting with first-order differential equations and their bifurcations, followed by phase plane analysis, limit cycles and their bifurcations, and culminating with the Lorenz equations, chaos, iterated maps, period doubling, renormalization, fractals, and strange attractors. A unique feature of the book is its emphasis on applications. These include mechanical vibrations, lasers, biological rhythms, superconducting circuits, insect outbreaks, chemical oscillators, genetic control systems, chaotic waterwheels, and even a technique for using chaos to send secret messages. In each case, the scientific background is explained at an elementary level and closely integrated with mathematical theory. In the twenty years since the first edition of this book appeared, the ideas and techniques of nonlinear dynamics and chaos have found application to such exciting new fields as systems biology, evolutionary game theory, and sociophysics. This second edition includes new exercises on these cutting-edge developments, on topics as varied as the curiosities of visual perception and the tumultuous love dynamics in Gone With the Wind.

Hidden Dynamics Mike R. Jeffrey 2018-12-11 The dream of mathematical modeling is of systems evolving in a continuous, deterministic, predictable way. Unfortunately continuity is lost whenever the `rules of the game' change, whether a change of behavioural regime, or a change of physical properties. From biological mitosis to seizures. From rattling machine parts to earthquakes. From individual decisions to economic crashes. Where discontinuities occur, determinacy is inevitably lost. Typically the physical laws of such change are poorly understood, and too ill-defined for standard mathematics. Discontinuities offer a way to make the bounds of scientific knowledge a part of the model, to analyse a system with detail and rigour, yet still leave room for uncertainty. This is done without recourse to stochastic modeling, instead retaining determinacy as far as possible, and focussing on the geometry of the many outcomes that become possible when it breaks down. In this book the foundations of `piecewise-smooth dynamics' theory are rejuvenated, given new life through the lens of modern nonlinear dynamics and asymptotics. Numerous examples and exercises lead the reader through from

basic to advanced analytical methods, particularly new tools for studying stability and bifurcations. The book is aimed at scientists and engineers from any background with a basic grounding in calculus and linear algebra. It seeks to provide an invaluable resource for modeling discontinuous systems, but also to empower the reader to develop their own novel models and discover as yet unknown phenomena.

Dynamical Systems for Biological Modeling Fred Brauer 2015-12-23 Dynamical Systems for Biological Modeling: An Introduction prepares both biology and mathematics students with the understanding and techniques necessary to undertake basic modeling of biological systems. It achieves this through the development and analysis of dynamical systems. The approach emphasizes qualitative ideas rather than explicit computations. Some technical details are necessary, but a qualitative approach emphasizing ideas is essential for understanding. The modeling approach helps students focus on essentials rather than extensive mathematical details, which is helpful for students whose primary interests are in sciences other than mathematics need or want. The book discusses a variety of biological modeling topics, including population biology, epidemiology, immunology, intraspecies competition, harvesting, predator-prey systems, structured populations, and more. The authors also include examples of problems with solutions and some exercises which follow the examples quite closely. In addition, problems are included which go beyond the examples, both in mathematical analysis and in the development of mathematical models for biological problems, in order to encourage deeper understanding and an eagerness to use mathematics in learning about biology.

An Introduction To Chaotic Dynamical Systems Robert Devaney 2018-03-09 The study of nonlinear dynamical systems has exploded in the past 25 years, and Robert L. Devaney has made these advanced research developments accessible to undergraduate and graduate mathematics students as well as researchers in other disciplines with the introduction of this widely praised book. In this second edition of his best-selling text, Devaney includes new material on the orbit diagram fro maps of the interval and the Mandelbrot set, as well as striking color photos illustrating both Julia and Mandelbrot sets. This book assumes no prior acquaintance with advanced mathematical topics such as measure theory, topology, and differential geometry. Assuming only a knowledge of calculus, Devaney introduces many of the basic concepts of modern dynamical systems theory and leads the reader to the point of current research in several areas.

Differential Dynamical Systems James D. Meiss 2007-01-01 Differential equations are the basis for models of any physical systems that exhibit smooth change. This book combines much of the material found in a traditional course on ordinary differential equations with an introduction to the more modern theory of dynamical systems. Applications of this theory to physics, biology, chemistry, and engineering are shown through examples in such areas as population modeling, fluid dynamics, electronics, and mechanics.Differential Dynamical Systems begins with coverage of linear systems, including matrix algebra; the focus then shifts to foundational material on nonlinear differential equations, making heavy use of the contraction-mapping theorem. Subsequent chapters deal specifically with dynamical systems conceptsflow, stability, invariant manifolds, the phase plane, bifurcation, chaos, and Hamiltonian dynamics. Throughout the book, the author includes exercises to help students develop an analytical and geometrical understanding of dynamics. Many of the exercises and examples are based on applications and some involve computation; an appendix offers simple codes written in Maple, Mathematica, and MATLAB software to give students practice with computation applied to dynamical systems problems. Audience This textbook is intended for senior undergraduates and first-year graduate students in pure and applied mathematics, engineering, and the physical sciences. Readers should be comfortable with elementary differential equations and linear algebra and should have had exposure to advanced calculus. Contents List of Figures; Preface; Acknowledgments; Chapter 1:

Introduction; Chapter 2: Linear Systems; Chapter 3: Existence and Uniqueness; Chapter 4: Dynamical Systems; Chapter 5: Invariant Manifolds; Chapter 6: The Phase Plane; Chapter 7: Chaotic Dynamics; Chapter 8: Bifurcation Theory; Chapter 9: Hamiltonian Dynamics; Appendix: Mathematical Software; Bibliography; Index

An Introduction to Complex Systems Paul Fieguth 2016-11-26 This undergraduate text explores a variety of large-scale phenomena - global warming, ice ages, water, poverty - and uses these case studies as a motivation to explore nonlinear dynamics, power-law statistics, and complex systems. Although the detailed mathematical descriptions of these topics can be challenging, the consequences of a system being nonlinear, power-law, or complex are in fact quite accessible. This book blends a tutorial approach to the mathematical aspects of complex systems together with a complementary narrative on the global/ecological/societal implications of such systems. Nearly all engineering undergraduate courses focus on mathematics and systems which are small scale, linear, and Gaussian. Unfortunately there is not a single large-scale ecological or social phenomenon that is scalar, linear, and Gaussian. This book offers students insights to better understand the large-scale problems facing the world and to realize that these cannot be solved by a single, narrow academic field or perspective. Instead, the book seeks to emphasize understanding, concepts, and ideas, in a way that is mathematically rigorous, so that the concepts do not feel vague, but not so technical that the mathematics get in the way. The book is intended for undergraduate students in a technical domain such as engineering, computer science, physics, mathematics, and environmental studies.

Nonlinear Dynamical Systems with Self-Excited and Hidden Attractors Viet-Thanh Pham 2018-02-26 This book highlights the latest findings on nonlinear dynamical systems including two types of attractors: self-excited and hidden attractors. Further, it presents both theoretical and practical approaches to investigating nonlinear dynamical systems with self-excited and hidden attractors. The book includes 20 chapters contributed by respected experts, which focus on various applications such as biological systems, memristor-based systems, fractional-order systems, finance systems, business cycles, oscillators, coupled systems, hyperchaotic systems, flexible robot manipulators, electronic circuits, and control models. Special attention is given to modeling, design, circuit realization, and practical applications to address recent research problems in nonlinear dynamical systems. The book provides a valuable reference guide to nonlinear dynamical systems for engineers, researchers, and graduate students, especially those whose work involves mechanics, electrical engineering, and control systems.

Multiple Time Scale Dynamics Christian Kuehn 2015-02-25 This book provides an introduction to dynamical systems with multiple time scales. The approach it takes is to provide an overview of key areas, particularly topics that are less available in the introductory form. The broad range of topics included makes it accessible for students and researchers new to the field to gain a quick and thorough overview. The first of its kind, this book merges a wide variety of different mathematical techniques into a more unified framework. The book is highly illustrated with many examples and exercises and an extensive bibliography. The target audience of this book are senior undergraduates, graduate students as well as researchers interested in using the multiple time scale dynamics theory in nonlinear science, either from a theoretical or a mathematical modeling perspective.

Complexity, Global Politics, and National Security David S. Alberts 2002 Contents:Acknowledgements Foreword (Lt. Ervin J. Rokke)Preface (Davis S. Alberts and Thomas Czerwinski)SETTING THE SCENEThe Simple and the Complex (Murray Gell-Mann)America in the World Today (Zbigniew Brzezinski)COMPLEXITY THEORY and NATIONAL SECURITY POLICYComplex

Systems: The Role of Interactions (Robert Jervis)Many Damn Things Simultaneously: Complexity Theory and World Affairs (James N. Rosenau)Complexity, Chaos, and National Security Policy: Metaphors or Tools? (Alvin M. Saperstein)The Reaction to Chaos (Steven R. Mann)COMPLEXITY THEORY, STRATEGY, and OPERATIONSClausewitz, Nonlinearity, and the Importance of Imagery (Alan D. Beyerchen)Complexity and Organization Management (Robert R. Maxfield)Command and (Out of) Control: The Military Implications of Complexity Theory (John F. Schmitt)Complexity Theory and Air Power (Steven M. Rinaldi)Chaos Theory and U. S. Military Strategy: A "Leapfrog" Strategy for U.S. Defense Policy (Michael J. Mazarr)Contributors EditorsBibliography

Data-Driven Science and Engineering Steven L. Brunton 2019-02-28 Data-driven discovery is revolutionizing the modeling, prediction, and control of complex systems. This textbook brings together machine learning, engineering mathematics, and mathematical physics to integrate modeling and control of dynamical systems with modern methods in data science. It highlights many of the recent advances in scientific computing that enable data-driven methods to be applied to a diverse range of complex systems, such as turbulence, the brain, climate, epidemiology, finance, robotics, and autonomy. Aimed at advanced undergraduate and beginning graduate students in the engineering and physical sciences, the text presents a range of topics and methods from introductory to state of the art.

Infinite Powers Steven Strogatz 2019 From preeminent math personality and author of The Joy of x, a brilliant and endlessly appealing explanation of calculus - how it works and why it makes our lives immeasurably better. Without calculus, we wouldn't have cell phones, TV, GPS, or ultrasound. We wouldn't have unraveled DNA or discovered Neptune or figured out how to put 5,000 songs in your pocket. Though many of us were scared away from this essential, engrossing subject in high school and college, Steven Strogatz's brilliantly creative, down-to-earth history shows that calculus is not about complexity; it's about simplicity. It harnesses an unreal number--infinity--to tackle real-world problems, breaking them down into easier ones and then reassembling the answers into solutions that feel miraculous. Infinite Powers recounts how calculus tantalized and thrilled its inventors, starting with its first glimmers in ancient Greece and bringing us right up to the discovery of gravitational waves (a phenomenon predicted by calculus). Strogatz reveals how this form of math rose to the challenges of each age: how to determine the area of a circle with only sand and a stick; how to explain why Mars goes "backwards" sometimes; how to make electricity with magnets; how to ensure your rocket doesn't miss the moon; how to turn the tide in the fight against AIDS. As Strogatz proves, calculus is truly the language of the universe. By unveiling the principles of that language, Infinite Powers makes us marvel at the world anew.

Dynamics Of Complex Systems Yaneer Bar-yam 2019-03-04 This book aims to develop models and modeling techniques that are useful when applied to all complex systems. It adopts both analytic tools and computer simulation. The book is intended for students and researchers with a variety of backgrounds.

Backstepping Control of Nonlinear Dynamical Systems Sundarapandian Vaidyanathan 2020-08-15 Backstepping Control of Nonlinear Dynamical Systems addresses both the fundamentals of backstepping control and advances in the field. The latest techniques explored include 'active backstepping control', 'adaptive backstepping control', 'fuzzy backstepping control' and 'adaptive fuzzy backstepping control'. The reference book provides numerous simulations using MATLAB and circuit design. These illustrate the main results of theory and applications of backstepping control of nonlinear control systems. Backstepping control encompasses varied aspects of mechanical engineering and has many different applications within the field. For example, the book covers aspects related to robot

manipulators, aircraft flight control systems, power systems, mechanical systems, biological systems and chaotic systems. This multifaceted view of subject areas means that this useful reference resource will be ideal for a large cross section of the mechanical engineering community. Details the real-world applications of backstepping control Gives an up-to-date insight into the theory, uses and application of backstepping control Bridges the gaps for different fields of engineering, including mechanical engineering, aeronautical engineering, electrical engineering, communications engineering, robotics and biomedical instrumentation

Nonlinear Optics Alan Newell 2018-05-04 This book is about Nonlinear Optics, the study of how high-intensity light propagates through and interacts with matter. It takes the reader from the starting point of Maxwell's equations to some of the frontiers of modern research in the subject.

The Joy of X Steven Henry Strogatz 2012 A comprehensive tour of leading mathematical ideas by an award-winning professor and columnist for the New York Times Opinionator series demonstrates how math intersects with philosophy, science and other aspects of everyday life. By the author of The Calculus of Friendship. 50,000 first printing.

El Niño Southern Oscillation in a Changing Climate Michael J. McPhaden 2020-11-24 Comprehensive and up-to-date information on Earth's most dominant year-to-year climate variation The El Niño Southern Oscillation (ENSO) in the Pacific Ocean has major worldwide social and economic consequences through its global scale effects on atmospheric and oceanic circulation, marine and terrestrial ecosystems, and other natural systems. Ongoing climate change is projected to significantly alter ENSO's dynamics and impacts. El Niño Southern Oscillation in a Changing Climate presents the latest theories, models, and observations, and explores the challenges of forecasting ENSO as the climate continues to change. Volume highlights include: Historical background on ENSO and its societal consequences Review of key El Niño (ENSO warm phase) and La Niña (ENSO cold phase) characteristics Mathematical description of the underlying physical processes that generate ENSO variations Conceptual framework for understanding ENSO changes on decadal and longer time scales, including the response to greenhouse gas forcing ENSO impacts on extreme ocean, weather, and climate events, including tropical cyclones, and how ENSO affects fisheries and the global carbon cycle Advances in modeling, paleo-reconstructions, and operational climate forecasting Future projections of ENSO and its impacts Factors influencing ENSO events, such as inter-basin climate interactions and volcanic eruptions The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity. Its publications disseminate scientific knowledge and provide resources for researchers, students, and professionals. Find out more about this book from this Q&A with the editors.

Student Solutions Manual for Nonlinear Dynamics and Chaos, 2nd edition Mitchal Dichter 2018-05-15 This official Student Solutions Manual includes solutions to the odd-numbered exercises featured in the second edition of Steven Strogatz's classic text Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering. The textbook and accompanying Student Solutions Manual are aimed at newcomers to nonlinear dynamics and chaos, especially students taking a first course in the subject. Complete with graphs and worked-out solutions, this manual demonstrates techniques for students to analyze differential equations, bifurcations, chaos, fractals, and other subjects Strogatz explores in his popular book.

MEMS Linear and Nonlinear Statics and Dynamics Mohammad I. Younis 2011-06-27 MEMS Linear and Nonlinear Statics and Dynamics presents the necessary analytical and computational tools for MEMS designers to model and simulate most known MEMS devices, structures, and phenomena. This

book also provides an in-depth analysis and treatment of the most common static and dynamic phenomena in MEMS that are encountered by engineers. Coverage also includes nonlinear modeling approaches to modeling various MEMS phenomena of a nonlinear nature, such as those due to electrostatic forces, squeeze-film damping, and large deflection of structures. The book also: Includes examples of numerous MEMS devices and structures that require static or dynamic modeling Provides code for programs in Matlab, Mathematica, and ANSYS for simulating the behavior of MEMS structures Provides real world problems related to the dynamics of MEMS such as dynamics of electrostatically actuated devices, stiction and adhesion of microbeams due to electrostatic and capillary forces MEMS Linear and Nonlinear Statics and Dynamics is an ideal volume for researchers and engineers working in MEMS design and fabrication.

Galileo Unbound David D. Nolte 2018-07-12 Galileo Unbound traces the journey that brought us from Galileo's law of free fall to today's geneticists measuring evolutionary drift, entangled quantum particles moving among many worlds, and our lives as trajectories traversing a health space with thousands of dimensions. Remarkably, common themes persist that predict the evolution of species as readily as the orbits of planets or the collapse of stars into black holes. This book tells the history of spaces of expanding dimension and increasing abstraction and how they continue today to give new insight into the physics of complex systems. Galileo published the first modern law of motion, the Law of Fall, that was ideal and simple, laying the foundation upon which Newton built the first theory of dynamics. Early in the twentieth century, geometry became the cause of motion rather than the result when Einstein envisioned the fabric of space-time warped by mass and energy, forcing light rays to bend past the Sun. Possibly more radical was Feynman's dilemma of quantum particles taking all paths at once — setting the stage for the modern fields of quantum field theory and quantum computing. Yet as concepts of motion have evolved, one thing has remained constant, the need to track ever more complex changes and to capture their essence, to find patterns in the chaos as we try to predict and control our world.

A First Course in Graph Theory Gary Chartrand 2013-05-20 Written by two prominent figures in the field, this comprehensive text provides a remarkably student-friendly approach. Its sound yet accessible treatment emphasizes the history of graph theory and offers unique examples and lucid proofs. 2004 edition.

Nonlinear Dynamical Systems and Chaos H.W. Broer 2013-11-11 Symmetries in dynamical systems, "KAM theory and other perturbation theories", "Infinite dimensional systems", "Time series analysis" and "Numerical continuation and bifurcation analysis" were the main topics of the December 1995 Dynamical Systems Conference held in Groningen in honour of Johann Bernoulli. They now form the core of this work which seeks to present the state of the art in various branches of the theory of dynamical systems. A number of articles have a survey character whereas others deal with recent results in current research. It contains interesting material for all members of the dynamical systems community, ranging from geometric and analytic aspects from a mathematical point of view to applications in various sciences.

Nonlinear Electrodynamics in Biological Systems W. Adey 2012-12-06 The past half century has seen an extraordinary growth in the fields of cellular and molecular biology. From simple morphologi cal concepts of cells as the essential units of living matter there has been an ever-sharper focus on functional organization of living systems, with emphasis on molecular dynamics. Thus, life forms have come to be defined increasingly in terms of metabolism, growth, reproduction and responses to environmental perturbations. Since these properties occur in varying degrees in systems below the level of cellular organization, there has been a blurring of older models that restricted the concepts of

life to cellular systems. At the same time, a search has begun for elemental as pects of molecular and atomic behavior that might better define properties common to all life forms. This search has led to an examination of nonlinear behavior in biological macromolecules, whether in response to electrical or chemical stimulation, for example, or as a means of signaling along a molecular chain, or as a means of energy transfer. Experimental knowledge in this area has grown rapidly in the past decade, and in some respects has outstripped theoretical models adequate to ex plain these new observations. Nevertheless, it can be claimed that there is now an impressive body of experiments implicating non linear, nonequilibrium processes as fundamental steps in sequential operations of biological systems.

Hyperbolic Chaos Sergey P. Kuznetsov 2012-03-20 "Hyperbolic Chaos: A Physicist's View" presents recent progress on uniformly hyperbolic attractors in dynamical systems from a physical rather than mathematical perspective (e.g. the Plykin attractor, the Smale – Williams solenoid). The structurally stable attractors manifest strong stochastic properties, but are insensitive to variation of functions and parameters in the dynamical systems. Based on these characteristics of hyperbolic chaos, this monograph shows how to find hyperbolic chaotic attractors in physical systems and how to design a physical systems that possess hyperbolic chaos. This book is designed as a reference work for university professors and researchers in the fields of physics, mechanics, and engineering. Dr. Sergey P. Kuznetsov is a professor at the Department of Nonlinear Processes, Saratov State University, Russia.

Differential Equations, Dynamical Systems, and Linear Algebra Morris W. Hirsch 1974-06-28 This book is about dynamical aspects of ordinary differential equations and the relations between dynamical systems and certain fields outside pure mathematics. A prominent role is played by the structure theory of linear operators on finite-dimensional vector spaces; the authors have included a self-contained treatment of that subject.

Delay Controlled Partial Synchronization in Complex Networks Jakub Sawicki 2019-11-30 The focus of this thesis are synchronization phenomena in networks and their intrinsic control through time delay, which is ubiquitous in real-world systems ranging from physics and acoustics to neuroscience and engineering. We encounter synchronization everywhere and it can be either a helpful or a detrimental mechanism. In the first part, after a survey of complex nonlinear systems and networks, we show that a seemingly simple system of two organ pipes gives birth to complex bifurcation and synchronization scenarios. Going from a 2-oscillator system to a ring of oscillators, we encounter the intriguing phenomenon of chimera states which are partial synchrony patterns with coexisting domains of synchronized and desynchronized dynamics. For more than a decade scientist have tried to solve the puzzle of this spontaneous symmetry-breaking emerging in networks of identical elements. We provide an analysis of initial conditions and extend our model by the addition of time delay and fractal connectivities. In the second part, we investigate partial synchronization patterns in a neuronal network and explain dynamical asymmetry arising from the hemispheric structure of the human brain. A particular focus is on the novel scenario of partial relay synchronization in multiplex networks. Such networks allow for synchronization of the coherent domains of chimera states via a remote layer, whereas the incoherent domains remain desynchronized. The theoretical framework is demonstrated with different generic models.

Ordinary Differential Equations Morris Tenenbaum 1985-10-01 Skillfully organized introductory text examines origin of differential equations, then defines basic terms and outlines the general solution of a differential equation. Subsequent sections deal with integrating factors; dilution and accretion problems; linearization of first order systems; Laplace Transforms; Newton's Interpolation Formulas, more.

Complexity Melanie Mitchell 2009-04-01 What enables individually simple insects like ants to act with such precision and purpose as a group? How do trillions of neurons produce something as extraordinarily complex as consciousness? In this remarkably clear and companionable book, leading complex systems scientist Melanie Mitchell provides an intimate tour of the sciences of complexity, a broad set of efforts that seek to explain how large-scale complex, organized, and adaptive behavior can emerge from simple interactions among myriad individuals. Based on her work at the Santa Fe Institute and drawing on its interdisciplinary strategies, Mitchell brings clarity to the workings of complexity across a broad range of biological, technological, and social phenomena, seeking out the general principles or laws that apply to all of them. Richly illustrated, Complexity: A Guided Tour--winner of the 2010 Phi Beta Kappa Book Award in Science--offers a wide-ranging overview of the ideas underlying complex systems science, the current research at the forefront of this field, and the prospects for its contribution to solving some of the most important scientific questions of our time.

Sync Steven H. Strogatz 2012-02-14 At the heart of the universe is a steady, insistent beat, the sound of cycles in sync. Along the tidal rivers of Malaysia, thousands of fireflies congregate and flash in unison; the moon spins in perfect resonance with its orbit around the earth; our hearts depend on the synchronous firing of ten thousand pacemaker cells. While the forces that synchronize the flashing of fireflies may seem to have nothing to do with our heart cells, there is in fact a deep connection. Synchrony is a science in its infancy, and Strogatz is a pioneer in this new frontier in which mathematicians and physicists attempt to pinpoint just how spontaneous order emerges from chaos. From underground caves in Texas where a French scientist spent six months alone tracking his sleep-wake cycle, to the home of a Dutch physicist who in 1665 discovered two of his pendulum clocks swinging in perfect time, this fascinating book spans disciplines, continents, and centuries. Engagingly written for readers of books such as Chaos and The Elegant Universe, Sync is a tour-de-force of nonfiction writing.

An Introduction to Dynamical Systems and Chaos G.C. Layek 2015-12-01 The book discusses continuous and discrete systems in systematic and sequential approaches for all aspects of nonlinear dynamics. The unique feature of the book is its mathematical theories on flow bifurcations, oscillatory solutions, symmetry analysis of nonlinear systems and chaos theory. The logically structured content and sequential orientation provide readers with a global overview of the topic. A systematic mathematical approach has been adopted, and a number of examples worked out in detail and exercises have been included. Chapters 1–8 are devoted to continuous systems, beginning with one-dimensional flows. Symmetry is an inherent character of nonlinear systems, and the Lie invariance principle and its algorithm for finding symmetries of a system are discussed in Chap. 8. Chapters 9–13 focus on discrete systems, chaos and fractals. Conjugacy relationship among maps and its properties are described with proofs. Chaos theory and its connection with fractals, Hamiltonian flows and symmetries of nonlinear systems are among the main focuses of this book. Over the past few decades, there has been an unprecedented interest and advances in nonlinear systems, chaos theory and fractals, which is reflected in undergraduate and postgraduate curricula around the world. The book is useful for courses in dynamical systems and chaos, nonlinear dynamics, etc., for advanced undergraduate and postgraduate students in mathematics, physics and engineering.

Visual Differential Geometry and Forms Tristan Needham 2021-07-13 An inviting, intuitive, and visual exploration of differential geometry and forms Visual Differential Geometry and Forms fulfills two principal goals. In the first four acts, Tristan Needham puts the geometry back into differential geometry. Using 235 hand-drawn diagrams, Needham deploys Newton's geometrical methods to provide geometrical explanations of the classical results. In the fifth act, he offers the first

undergraduate introduction to differential forms that treats advanced topics in an intuitive and geometrical manner. Unique features of the first four acts include: four distinct geometrical proofs of the fundamentally important Global Gauss-Bonnet theorem, providing a stunning link between local geometry and global topology; a simple, geometrical proof of Gauss's famous Theorema Egregium; a complete geometrical treatment of the Riemann curvature tensor of an n-manifold; and a detailed geometrical treatment of Einstein's field equation, describing gravity as curved spacetime (General Relativity), together with its implications for gravitational waves, black holes, and cosmology. The final act elucidates such topics as the unification of all the integral theorems of vector calculus; the elegant reformulation of Maxwell's equations of electromagnetism in terms of 2-forms; de Rham cohomology; differential geometry via Cartan's method of moving frames; and the calculation of the Riemann tensor using curvature 2-forms. Six of the seven chapters of Act V can be read completely independently from the rest of the book. Requiring only basic calculus and geometry, Visual Differential Geometry and Forms provocatively rethinks the way this important area of mathematics should be considered and taught.

Managing Emergent Phenomena Stephen J. Guastello 2001-12-01 Chaos, catastrophe, self-organization, and complexity theories (nonlinear dynamics) now have practical and measurable roles in the functioning of work organizations. Managing Emergent Phenomena begins by describing how the concept of an organization has changed from a bureaucracy, to a humanistic and organic system, to a complex adaptive system. The dynamics concepts are then explained along with the most recent research methods for analyzing real data. Applications include: work motivation, personnel selection and turnover, creative thinking by individuals and groups, the development of social networks, coordination in work groups, the emergence of leaders, work performance in organizational hierarchies, economic problems that are relevant to organizations, techniques for predicting the future, and emergency management. Each application begins with a tight summary of standard thinking on a subject, followed by the new insights that are afforded by nonlinear dynamics and the empirical data supporting those ideas. Unusual concepts are also encountered, such as the organizational unconscious, collective intelligence, and the revolt of the slaved variables. The net results are a new perspective on what is really important in organizational life, original insights on familiar experiences, and some clear signposts for the next generation of nonlinear social scientists.

Hamiltonian Dynamical Systems R.S MacKay 2020-08-17 Classical mechanics is a subject that is teeming with life. However, most of the interesting results are scattered around in the specialist literature, which means that potential readers may be somewhat discouraged by the effort required to obtain them. Addressing this situation, Hamiltonian Dynamical Systems includes some of the most significant papers in Hamiltonian dynamics published during the last 60 years. The book covers bifurcation of periodic orbits, the break-up of invariant tori, chaotic behavior in hyperbolic systems, and the intricacies of real systems that contain coexisting order and chaos. It begins with an introductory survey of the subjects to help readers appreciate the underlying themes that unite an apparently diverse collection of articles. The book concludes with a selection of papers on applications, including in celestial mechanics, plasma physics, chemistry, accelerator physics, fluid mechanics, and solid state mechanics, and contains an extensive bibliography. The book provides a worthy introduction to the subject for anyone with an undergraduate background in physics or mathematics, and an indispensable reference work for researchers and graduate students interested in any aspect of classical mechanics.

Chaos, Complexity and Leadership 2018 Şefika Şule ERÇETİN 2020-01-16 This book constitutes the proceedings of the 6th International Symposium on Chaos, Complexity and Leadership (ICCLS). Written by interdisciplinary researchers and students from the fields of mathematics, physics, education,

economics, political science, statistics, the management sciences and social sciences, the peer-reviewed contributions explore chaotic and complex systems, as well as chaos and complexity theory in the context of their applicability to management and leadership. The book discusses current topics, such as complexity leadership in the healthcare fields and tourism industry, conflict management and organization intelligence, and presents practical applications of theoretical concepts, making it a valuable resource for managers and leaders.

Nonlinear Dynamics and Chaos Steven H. Strogatz 2018-05-04 This textbook is aimed at newcomers to nonlinear dynamics and chaos, especially students taking a first course in the subject. The presentation stresses analytical methods, concrete examples, and geometric intuition. The theory is developed systematically, starting with first-order differential equations and their bifurcations, followed by phase plane analysis, limit cycles and their bifurcations, and culminating with the Lorenz equations, chaos, iterated maps, period doubling, renormalization, fractals, and strange attractors.

A First Course In Chaotic Dynamical Systems Robert L. Devaney 2018-05-04 A First Course in Chaotic Dynamical Systems: Theory and Experiment is the first book to introduce modern topics in dynamical systems at the undergraduate level. Accessible to readers with only a background in calculus, the book integrates both theory and computer experiments into its coverage of contemporary ideas in dynamics. It is designed as a gradual introduction to the basic mathematical ideas behind such topics as chaos, fractals, Newton's method, symbolic dynamics, the Julia set, and the Mandelbrot set, and includes biographies of some of the leading researchers in the field of dynamical systems. Mathematical and computer experiments are integrated throughout the text to help illustrate the meaning of the theorems presented. Chaotic Dynamical Systems Software, Labs 1-6 is a supplementary labouratory software package, available separately, that allows a more intuitive understanding of the mathematics behind dynamical systems theory. Combined with A First Course in Chaotic Dynamical Systems , it leads to a rich understanding of this emerging field.

Sync Steven Strogatz 2004-04-29 'SYNC' IS A STORY OF A DAZZLING KIND OF ORDER IN THE UNIVERSE, THE HARMONY THAT COMES FROM CYCLES IN SYNC. THE TENDENCY TO SYCHRONIZE IS ONE OF THE MOST FAR- REACHING DRIVES IN ALL OF NATURE. IT EXTENDS FROM PEOPLE TO PLANETS, FROM ANIMALS TO ATOMS. IN 'SYNC' PROFESSOR STEVEN STROGATZ CONSIDERS A RANGE OF APPLICATIONS - HUMAN SLEEP AND CIRCADIAN RHYTHMS, MENSTRUAL SYNCHRONY, INSECT OUTBREAKS, SUPERCONDUCTORS, LASERS, SECRET CODES, HEART ARRHYTHMIAS AND FADS - CONNECTING ALL TRHOUGH AN EXPLORATION OF THE SAME MATHEMATICAL THEME: SELF- ORGANISATION, OR THE SPONTANEOUS EMERGENCE OF ORDER OUT OF CHAOS. FOCUSED ENOUGH TO PRESENT A COHERENT WORLD UNTO THEMSELVES, STROGATZ'S CHOSEN TOPICS TOUCH ON SEVERAL OF THE HOTTEST DIRECTIONS IN CONTEMPORARY SCIENCE.

The Nonlinear World Yoshitsugu Oono 2012-10-30 The most important characteristic of the "world filled with nonlinearity" is the existence of scale interference: disparate space–time scales interfere with each other. Thus, the effects of unknowable scales invade the world that we can observe directly. This leads to various peculiar phenomena such as chaos, critical phenomena, and complex biological phenomena, among others. Conceptual analysis and phenomenology are the keys to describe and understand phenomena that are subject to scale interference, because precise description of unfamiliar phenomena requires precise concepts and their phenomenological description. The book starts with an illustration of conceptual analysis in terms of chaos and randomness, and goes on to explain renormalization group philosophy as an approach to phenomenology. Then, abduction is outlined as a way to express what we

have understood about the world. The book concludes with discussions on how we can approach genuinely complex phenomena, including biological phenomena. The main target of this volume is young people who have just started to appreciate the world seriously. The author also wishes the book to be helpful to those who have been observing the world, but who wish to appreciate it afresh from a different angle.

Chaos and Nonlinear Dynamics Robert C. Hilborn 1994 Mathematics of Computing -- Miscellaneous.