When people should go to the book stores, search launch by shop, shelf by shelf, it is truly problematic. This is why we allow the book compilations in this website. It will totally ease you to look guide nonlinear oscillations dynamical systems and bifurcations of vector fields applied mathematical sciences as you such as.

By searching the title, publisher, or authors of guide you really want, you can discover them rapidly. In the house, workplace, or perhaps in your method can be all best area within net connections. If you objective to download and install the nonlinear oscillations dynamical systems and bifurcations of vector fields applied mathematical sciences, it is no question easy then, in the past currently we extend the associate to buy and make bargains to download and install nonlinear oscillations dynamical systems and bifurcations of vector fields applied mathematical sciences fittingly simple!
techniques of dynamical systems and bifurcation theories to the study of nonlinear oscillations. Taking their cue from Poincare, the authors stress the geometrical and topological properties of solutions of differential equations and iterated maps. Numerous exercises, some of which require nontrivial algebraic manipulations and computer work, convey the important analytical underpinnings of problems in dynamical systems and help readers develop an intuitive feel for the properties involved.

Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields - John Guckenheimer 2013-11-21

An application of the techniques of dynamical systems and bifurcation theories to the study of nonlinear oscillations. Taking their cue from Poincare, the authors stress the geometrical and topological properties of solutions of differential equations and iterated maps. Numerous exercises, some of which require nontrivial algebraic manipulations and computer work, convey the important analytical underpinnings of problems in dynamical systems and help readers develop an intuitive feel for the properties involved.

Nonlinear Oscillations and Waves in Dynamical Systems - P.S Landa 2013-06-29

A rich variety of books devoted to dynamical chaos, solitons, self-organization has appeared in recent years. These problems were all considered independently of one another. Therefore many of readers of these books do not suspect that the problems discussed are divisions of a great generalizing science - the theory of oscillations and waves. This science is not some branch of physics or mechanics, it is a science in its own right. It is in some sense a meta-science. In this respect the theory of oscillations and waves is closest to mathematics. In this book we call the reader's attention to the present-day theory of non-linear oscillations and waves. Oscillatory and wave processes in the systems of diversified physical natures, both periodic and chaotic, are considered from a unified point of view. The
relation between the theory of oscillations and waves, non-linear dynamics and synergetics is discussed. One of the purposes of this book is to convince reader of the necessity of a thorough study popular branches of the theory of oscillations and waves, and to show that such science as non-linear dynamics, synergetics, soliton theory, and so on, are, in fact, constituent parts of this theory. The primary audiences for this book are researchers having to do with oscillatory and wave processes, and both students and post-graduate students interested in a deep study of the general laws and applications of the theory of oscillations and waves.

Nelineinye Kolebaniia, Dinamicheskie Sistemy i Bifurkatsii Vektornykh Polei- John Guckenheimer 2002

Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields- John Guckenheimer 1983

Introduction to Applied Nonlinear Dynamical Systems and Chaos- Stephen Wiggins 2006-04-18 This introduction to applied nonlinear dynamics and chaos places emphasis on teaching the techniques and ideas that will enable students to take specific dynamical systems and obtain some quantitative information about their behavior. The new edition has been updated and extended throughout, and contains a detailed glossary of terms. From the reviews: "Will serve as one of the most eminent introductions to the geometric theory of dynamical systems." --Monatshefte für Mathematik

Nonlinear Oscillations, Dynamical Systems and Bifurcations of Vector Fields- J. Guckenheimer 1983
Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields - John Guckenheimer 2017

Introduction to Nonlinear Oscillations - Vladimir I. Nekorkin 2015-04-01 A systematic outline of the basic theory of oscillations, combining several tools in a single textbook. The author explains fundamental ideas and methods, while equally aiming to teach students the techniques of solving specific (practical) or more complex problems. Following an introduction to fundamental notions and concepts of modern nonlinear dynamics, the text goes on to set out the basics of stability theory, as well as bifurcation theory in one and two-dimensional cases. Foundations of asymptotic methods and the theory of relaxation oscillations are presented, with much attention paid to a method of mappings and its applications. With each chapter including exercises and solutions, this book can be used in courses on oscillation theory for physics and engineering students. It also serves as a good reference for students and scientists in computational neuroscience.

Nonlinear Oscillations - Ali H. Nayfeh 2008-09-26 Nonlinear Oscillations is a self-contained and thorough treatment of the vigorous research that has occurred in nonlinear mechanics since 1970. The book begins with fundamental concepts and techniques of analysis and progresses through recent developments and provides an overview that abstracts and introduces main nonlinear phenomena. It treats systems having a single degree of freedom, introducing basic concepts and analytical methods, and extends concepts and methods to systems having degrees of freedom. Most of this material cannot be found in any other text. Nonlinear Oscillations uses simple physical examples to explain nonlinear dispersive and nondispersive waves. The notation is unified and the analysis modified to conform to discussions. Solutions are worked out in detail for numerous
Nonlinear Differential Equations and Dynamical Systems-Ferdinand Verhulst
2012-12-06 Bridging the gap between elementary courses and the research literature in this field, the book covers the basic concepts necessary to study differential equations. Stability theory is developed, starting with linearisation methods going back to Lyapunov and Poincaré, before moving on to the global direct method. The Poincaré-Lindstedt method is introduced to approximate periodic solutions, while at the same time proving existence by the implicit function theorem. The final part covers relaxation oscillations, bifurcation theory, centre manifolds, chaos in mappings and differential equations, and Hamiltonian systems. The subject material is presented from both the qualitative and the quantitative point of view, with many examples to illustrate the theory, enabling the reader to begin research after studying this book.

Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields-John Guckenheimer 2014-09-01

Applied Asymptotic Methods in Nonlinear Oscillations-Yuri A. Mitropolsky 2013-03-09
Many dynamical systems are described by differential equations that can be separated into one part, containing linear terms with constant coefficients, and a second part, relatively small compared with the first, containing nonlinear terms. Such a system is said to be weakly nonlinear. The small terms rendering the system nonlinear are referred to as perturbations. A weakly nonlinear system is called quasi-linear and is governed by quasi-linear differential equations. We will be interested in systems that reduce to harmonic oscillators in the absence of perturbations. This book is devoted primarily to applied asymptotic methods in nonlinear
oscillations which are associated with the names of N. M. Krylov, N. N. Bogoliubov and Yu. A. Mitropolskii. The advantages of the present methods are their simplicity, especially for computing higher approximations, and their applicability to a large class of quasi-linear problems. In this book, we confine ourselves basically to the scheme proposed by Krylov, Bogoliubov as stated in the monographs [6, 21]. We use these methods, and also develop and improve them for solving new problems and new classes of nonlinear differential equations. Although these methods have many applications in Mechanics, Physics and Technique, we will illustrate them only with examples which clearly show their strength and which are themselves of great interest. A certain amount of more advanced material has also been included, making the book suitable for a senior elective or a beginning graduate course on nonlinear oscillations.

Dynamical Systems and Nonlinear Waves in Plasmas

Santo Banerjee 2021-09-10 Dynamical systems and Nonlinear Waves in Plasmas is written in a clear and comprehensible style to serve as a compact volume for advanced postgraduate students and researchers working in the areas of Applied Physics, Applied Mathematics, Dynamical Systems, Nonlinear waves in Plasmas or other nonlinear media. It provides an introduction to the background of dynamical systems, waves, oscillations and plasmas. Basic concepts of dynamical systems and phase plane analysis for the study of dynamical properties of nonlinear waves in plasmas are presented. Different kinds of waves in plasmas are introduced. Reductive perturbative technique and its applications to derive different kinds of nonlinear evolution equations in plasmas are discussed. Analytical wave solutions of these nonlinear evolution equations are presented using the concept of bifurcation theory of planar dynamical systems in a very simple way. Bifurcations of both small and arbitrary amplitudes of various nonlinear acoustic waves in plasmas are presented using
Phase plots and time-series plots. Super nonlinear waves and its bifurcation behaviour are discussed for various plasma systems. Multiperiodic, quasiperiodic and chaotic motions of nonlinear plasma waves are discussed in presence of external periodic force. Multistability of plasma waves is investigated. Stable oscillation of plasma waves is also presented in dissipative plasmas. The book is meant for undergraduate and postgraduate students studying plasma physics. It will also serve a reference to the researchers, scientists and faculties to pursue the dynamics of nonlinear waves and its properties in plasmas. It describes the concept of dynamical systems and is useful in understanding exciting features, such as solitary wave, periodic wave, supernonlinear wave, chaotic, quasiperiodic and coexisting structures of nonlinear waves in plasmas. The concepts and approaches, discussed in the book, will also help the students and professionals to study such features in other nonlinear media.

**Differential Equations and Dynamical Systems**-Lawrence Perko 2012-12-06
Mathematics is playing an ever more important role in the physical and biological sciences, provoking a blurring of boundaries between scientific disciplines and a resurgence of interest in the modern as well as the classical techniques of applied mathematics. This renewal of interest, both in research and teaching, has led to the establishment of the series: Texts in Applied Mathematics (TAM). The development of new courses is a natural consequence of a high level of excitement on the research frontier as newer techniques, such as numerical and symbolic computer systems, dynamical systems, and chaos, mix with and reinforce the traditional methods of applied mathematics. Thus, the purpose of this textbook series is to meet the current and future needs of these advances and encourage the teaching of new courses. TAM will publish textbooks suitable for use in advanced undergraduate and beginning graduate courses, and will complement the Applied Mathematical Sciences (AMS) series, which will focus on
advanced textbooks and research level monographs. Preface to the Second Edition This book covers those topics necessary for a clear understanding of the qualitative theory of ordinary differential equations and the concept of a dynamical system. It is written for advanced undergraduates and for beginning graduate students. It begins with a study of linear systems of ordinary differential equations, a topic already familiar to the student who has completed a first course in differential equations.

Dynamical Systems And Nonlinear Oscillations - Proceedings Of The Symposium - Ikegami G 1986-01-01

Nonlinear Differential Equations and Dynamical Systems - Ferdinand Verhulst 2012-12-06 For lecture courses that cover the classical theory of nonlinear differential equations associated with Poincare and Lyapunov and introduce the student to the ideas of bifurcation theory and chaos, this text is ideal. Its excellent pedagogical style typically consists of an insightful overview followed by theorems, illustrative examples, and exercises.

Regular and Chaotic Oscillations - Polina S. Landa 2001-04-01 This text maps out the modern theory of non-linear oscillations. The material is presented in a non-traditional manner and emphasises the new results of the theory - obtained partially by the author, who is one of the leading experts in the area. Among the topics are: synchronization and chaotization of self-oscillatory systems and the influence of weak random vibration on modification of characteristics and behaviour of the non-linear systems.

Dynamical Systems and Nonlinear Oscillations - Gikō Ikegami 1986
Nonautonomous Dynamics - David N. Cheban 2020-01-22
This book emphasizes those topological methods (of dynamical systems) and theories that are useful in the study of different classes of nonautonomous evolutionary equations. The content is developed over six chapters, providing a thorough introduction to the techniques used in the Chapters III-VI described by Chapter I-II. The author gives a systematic treatment of the basic mathematical theory and constructive methods for Nonautonomous Dynamics. They show how these diverse topics are connected to other important parts of mathematics, including Topology, Functional Analysis and Qualitative Theory of Differential/Difference Equations. Throughout the book a nice balance is maintained between rigorous mathematics and applications (ordinary differential/difference equations, functional differential equations and partial difference equations). The primary readership includes graduate and PhD students and researchers in in the field of dynamical systems and their applications (control theory, economic dynamics, mathematical theory of climate, population dynamics, oscillation theory etc).

Analytical Methods in Nonlinear Oscillations - Ebrahim Esmailzadeh 2018-06-29
This book covers both classical and modern analytical methods in nonlinear systems. A wide range of applications from fundamental research to engineering problems are addressed. The book contains seven chapters, each with miscellaneous problems and their detailed solutions. More than 100 practice problems are illustrated, which might be useful for students and researchers in the areas of nonlinear oscillations and applied mathematics. With providing real world examples, this book shows the multidisciplinary emergence of nonlinear dynamical systems in a wide range of applications including mechanical and electrical oscillators, micro/nano resonators and sensors, and also modelling of global warming, epidemic diseases, sociology, chemical reactions, biology and ecology.
Introduction to Nonlinear Oscillations
Vladimir I. Nekorkin 2016-05-02 A systematic outline of the basic theory of oscillations, combining several tools in a single textbook. The author explains fundamental ideas and methods, while equally aiming to teach students the techniques of solving specific (practical) or more complex problems. Following an introduction to fundamental notions and concepts of modern nonlinear dynamics, the text goes on to set out the basics of stability theory, as well as bifurcation theory in one and two-dimensional cases. Foundations of asymptotic methods and the theory of relaxation oscillations are presented, with much attention paid to a method of mappings and its applications. With each chapter including exercises and solutions, including computer problems, this book can be used in courses on oscillation theory for physics and engineering students. It also serves as a good reference for students and scientists in computational neuroscience.

Nonlinear Oscillations in Mechanical Engineering
Alexander Fidlin 2005-12-27 "Nonlinear Oscillations in Mechanical Engineering" explores the effects of nonlinearities encountered in applications in that field. Since the nonlinearities are caused, first of all, by contacts between different mechanical parts, the main part of this book is devoted to oscillations in mechanical systems with discontinuities caused by dry friction and collisions. Another important source of nonlinearity which is covered is that caused by rotating unbalanced parts common in various machines as well as variable inertias occurring in all kinds of crank mechanisms. This book is written for advanced undergraduate and postgraduate students, but it may be also helpful and interesting for both theoreticians and practitioners working in the area of mechanical engineering at universities, in research labs or institutes and especially in the R and D departments within industrial firms.
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.

Applied Nonlinear Dynamics - Ali H. Nayfeh
2008-11-20 A unified and coherent treatment of analytical, computational and experimental techniques of nonlinear dynamics with numerous illustrative applications. Features a discourse on geometric concepts such as Poincaré maps. Discusses chaos, stability and bifurcation analysis for systems of differential and algebraic equations. Includes scores of examples to facilitate understanding.

Non-Linear Differential Equations and Dynamical Systems - Luis Manuel Braga da Costa Campos
2019-11-05 Non-Linear Differential Equations and Dynamical Systems is the second book within Ordinary Differential Equations with Applications to Trajectories and Vibrations, Six-volume Set. As a set, they are the fourth book in the series Mathematics and Physics Applied to Science and Technology. This second book consists of two chapters (chapters 3 and 4 of the set). The first chapter considers nonlinear differential equations of first order, including variable coefficients. A first-order differential equation is equivalent to a first-order differential in two variables. The differentials of order higher than the first and with more than two variables are also considered. The applications include the representation of vector fields by potentials. The second chapter in the book starts with linear oscillators with...
coefficients varying with time, including parametric resonance. It proceeds to non-linear oscillators including non-linear resonance, amplitude jumps, and hysteresis. The non-linear restoring and friction forces also apply to electromechanical dynamos. These are examples of dynamical systems with bifurcations that may lead to chaotic motions. Presents general first-order differential equations including non-linear like the Ricatti equation Discusses differentials of the first or higher order in two or more variables Includes discretization of differential equations as finite difference equations Describes parametric resonance of linear time dependent oscillators specified by the Mathieu functions and other methods Examines non-linear oscillations and damping of dynamical systems including bifurcations and chaotic motions

Nonlinear Oscillations and Waves in Dynamical Systems - Polina S. Landa 2012-12-22
A rich variety of books devoted to dynamical chaos, solitons, self-organization has appeared in recent years. These problems were all considered independently of one another. Therefore many of readers of these books do not suspect that the problems discussed are divisions of a great generalizing science - the theory of oscillations and waves. This science is not some branch of physics or mechanics, it is a science in its own right. It is in some sense a meta-science. In this respect the theory of oscillations and waves is closest to mathematics. In this book we call the reader's attention to the present-day theory of non-linear oscillations and waves. Oscillatory and wave processes in the systems of diversified physical natures, both periodic and chaotic, are considered from a unified point of view. The relation between the theory of oscillations and waves, non-linear dynamics and synergetics is discussed. One of the purposes of this book is to convince reader of the necessity of a thorough study popular branches of of the theory of oscillations and waves, and to show that such science as non-linear dynamics, synergetics, soliton theory, and so on, are, in fact, constituent parts of this theory. The primary audiences for
this book are researchers having to do with oscillatory and wave processes, and both students and post-graduate students interested in a deep study of the general laws and applications of the theory of oscillations and waves.

**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.

**Dynamical Systems and Nonlinear Oscillations**- 1986

**Contributions to the Theory of Nonlinear Oscillations (AM-29), Volume II**- Solomon Lefschetz 2016-03-02 These two new collections, numbers 28 and 29 respectively in the Annals of Mathematics Studies, continue the high standard set by the earlier Annals Studies 20 and 24 by bringing together important contributions to the theories of games and of nonlinear differential equations.

**Geometric Theory of Dynamical Systems**- J. Jr. Palis 2012-12-06 ... cette etude qualitative (des equations differentielles) aura par elle-m me un inter t du premier ordre ... HENRI POINCARE, 1881. We present in this book a view of the Geometric Theory of Dynamical Systems, which is introductory and yet gives the reader an understanding of some of the basic ideas involved in two important topics: structural stability and genericity. This theory has been considered by many mathematicians starting with Poincare, Liapunov and Birkhoff. In recent years some of its general aims were established and it experienced considerable development. More than two decades passed between two important events: the work of Andronov and Pontryagin (1937) introducing the basic concept.
of structural stability and the articles of Peixoto (1958-1962) proving the density of stable vector fields on surfaces. It was then that Smale enriched the theory substantially by defining as a main objective the search for generic and stable properties and by obtaining results and proposing problems of great relevance in this context. In this same period Hartman and Grobman showed that local stability is a generic property. Soon after this Kupka and Smale successfully attacked the problem for periodic orbits. We intend to give the reader the flavour of this theory by means of many examples and by the systematic proof of the Hartman-Grobman and the Stable Manifold Theorems (Chapter 2), the Kupka-Smale Theorem (Chapter 3) and Peixoto's Theorem (Chapter 4). Several of the proofs we give vii Introduction VIII are simpler than the original ones and are open to important generalizations.

**Applied Non-Linear Dynamical Systems**

Jan Awrejcewicz 2014-10-21

The book is a collection of contributions devoted to analytical, numerical and experimental techniques of dynamical systems, presented at the International Conference on Dynamical Systems: Theory and Applications, held in Łódź, Poland on December 2-5, 2013. The studies give deep insight into both the theory and applications of non-linear dynamical systems, emphasizing directions for future research. Topics covered include: constrained motion of mechanical systems and tracking control; diversities in the inverse dynamics; singularly perturbed ODEs with periodic coefficients; asymptotic solutions to the problem of vortex structure around a cylinder; investigation of the regular and chaotic dynamics; rare phenomena and chaos in power converters; non-holonomic constraints in wheeled robots; exotic bifurcations in non-smooth systems; micro-chaos; energy exchange of coupled oscillators; HIV dynamics; homogenous transformations with applications to off-shore slender structures; novel approaches to a qualitative study of a dissipative system; chaos of postural sway in humans; oscillators with
fractional derivatives; controlling chaos via bifurcation diagrams; theories relating to optical choppers with rotating wheels; dynamics in expert systems; shooting methods for non-standard boundary value problems; automatic sleep scoring governed by delay differential equations; isochronous oscillations; the aerodynamics pendulum and its limit cycles; constrained N-body problems; nano-fractal oscillators and dynamically-coupled dry friction.

**Methods of Qualitative Theory in Nonlinear Dynamics**-Leonid P Shilnikov 1998-12-08

Bifurcation and Chaos has dominated research in nonlinear dynamics for over two decades and numerous introductory and advanced books have been published on this subject. There remains, however, a dire need for a textbook which provides a pedagogically appealing yet rigorous mathematical bridge between these two disparate levels of exposition. This book is written to serve the above unfulfilled need. Following the footsteps of Poincaré, and the renowned Andronov school of nonlinear oscillations, this book focuses on the qualitative study of high-dimensional nonlinear dynamical systems. Many of the qualitative methods and tools presented in this book were developed only recently and have not yet appeared in a textbook form. In keeping with the self-contained nature of this book, all topics are developed with an introductory background and complete mathematical rigor. Generously illustrated and written with a high level of exposition, this book will appeal to both beginners and advanced students of nonlinear dynamics interested in learning a rigorous mathematical foundation of this fascinating subject. Contents:Basic ConceptsStructurally Stable Equilibrium States of Dynamical SystemsStructurally Stable Periodic Trajectories of Dynamical SystemsInvariant ToriCenter Manifold. Local CaseCenter Manifold. Non-Local Case Readership: Engineers, students, mathematicians and researchers in nonlinear dynamics and dynamical systems. Keywords:Bifurcations;Dynamical Systems;Qualitative Theory;Chaos;Strange
Attractors;Nonlinear Dynamics

Reviews: “It is well-written and clearly organized with excellent figures ... This rigorous book, with its emphasis on mathematical technique, would form an excellent basis for an engineering course if supplemented with applications.” Applied Mechanics Reviews “Short remarks concerning various, not only mathematical, aspects of the theory add an extra flavour to the text. I recommend the book for all persons interested in the qualitative theory of differential equations.” Mathematical Reviews

Approaches to the Qualitative Theory of Ordinary Differential Equations-Tong-Ren Ding 2007 This book is an ideal text for advanced undergraduate students and graduate students with an interest in the qualitative theory of ordinary differential equations and dynamical systems. Elementary knowledge is emphasized by the detailed discussions on the fundamental theorems of the Cauchy problem, fixed-point theorems (especially the twist theorems), the principal idea of dynamical systems, the nonlinear oscillation of Duffing's equation, and some special analyses of particular differential equations. It also contains the latest research by the author as an integral part of the book.

Nonlinear Dynamical Systems Analysis for the Behavioral Sciences Using Real Data-Stephen J. Guastello 2016-04-19 Although its roots can be traced to the 19th century, progress in the study of nonlinear dynamical systems has taken off in the last 30 years. While pertinent source material exists, it is strewn about the literature in mathematics, physics, biology, economics, and psychology at varying levels of accessibility. A compendium research methods reflect

Nonlinear Dynamics-Muthusamy Lakshmanan 2012-12-06 This self-contained treatment covers all aspects of nonlinear dynamics, from fundamentals to recent developments, in a
unified and comprehensive way. Numerous examples and exercises will help the student to assimilate and apply the techniques presented.

Studies in Nonlinear Aeroelasticity-Earl H. Dowell 2012-12-06 The great bulk of the literature on aeroelasticity is devoted to linear models. Theoretical work relies heavily on linear mathematical concepts, and experimental results are commonly interpreted by assuming that the physical model behaves in a linear manner. Nevertheless, significant work has been done in nonlinear aeroelasticity, and one may expect this trend to accelerate for several reasons: our ability to compute has increased at an astonishing rate; as linear concepts have been assimilated widely, there is a natural increase in interest in the foundations of nonlinear modeling; and, finally, some phenomena long recognized to be of interest, but beyond the effective range of linear models, are now known to be essentially nonlinear in nature. In this volume, an exhaustive review of the literature is not attempted. Rather the emphasis is on fundamental ideas and a representative selection of problems. Despite obvious successes in research on problems of aeroelasticity and the existence of a broad literature, including a number of excellent monographs, up to now little attention has been devoted to a general nonlinear theory of interaction. For the most part nonlinearity has been considered either solely in the description of the behavior of a shell or in the description of the motion of a gas.

An Introduction to Nonlinear Chemical Dynamics-Irving R. Epstein 1998-10-22 Just a few decades ago, chemical oscillations were thought to be exotic reactions of only theoretical interest. Now known to govern an array of physical and biological processes, including the regulation of the heart, these oscillations are being studied by a diverse group across the sciences. This book is the first introduction to nonlinear chemical dynamics written specifically for chemists. It covers oscillating reactions,
chaos, and chemical pattern formation, and includes numerous practical suggestions on reactor design, data analysis, and computer simulations. Assuming only an undergraduate knowledge of chemistry, the book is an ideal starting point for research in the field. The book begins with a brief history of nonlinear chemical dynamics and a review of the basic mathematics and chemistry. The authors then provide an extensive overview of nonlinear dynamics, starting with the flow reactor and moving on to a detailed discussion of chemical oscillators. Throughout the authors emphasize the chemical mechanistic basis for self-organization. The overview is followed by a series of chapters on more advanced topics, including complex oscillations, biological systems, polymers, interactions between fields and waves, and Turing patterns. Underscoring the hands-on nature of the material, the book concludes with a series of classroom-tested demonstrations and experiments appropriate for an undergraduate laboratory.

Methods of Qualitative Theory in Nonlinear Dynamics-Leonid P Shilnikov 2001-09-27
Bifurcation and chaos has dominated research in nonlinear dynamics for over two decades, and numerous introductory and advanced books have been published on this subject. There remains, however, a dire need for a textbook which provides a pedagogically appealing yet rigorous mathematical bridge between these two disparate levels of exposition. This book has been written to serve that unfulfilled need. Following the footsteps of Poincaré, and the renowned Andronov school of nonlinear oscillations, this book focuses on the qualitative study of high-dimensional nonlinear dynamical systems. Many of the qualitative methods and tools presented in the book have been developed only recently and have not yet appeared in textbook form. In keeping with the self-contained nature of the book, all the topics are developed with introductory background and complete mathematical rigor. Generously illustrated and written at a high level of exposition, this
invaluable book will appeal to both the beginner and the advanced student of nonlinear dynamics interested in learning a rigorous mathematical foundation of this fascinating subject.

Contents:
- Structurally Stable Systems
- Bifurcations of Dynamical Systems
- The Behavior of Dynamical Systems on Stability Boundaries of Equilibrium States
- The Behavior of Dynamical Systems on Stability Boundaries of Periodic Trajectories
- Local Bifurcations on the Route Over Stability Boundaries
- Global Bifurcations at the Disappearance of a Saddle-Node Equilibrium States and Periodic Orbits
- Bifurcations of Homoclinic Loops of Saddle Equilibrium States
- Safe and Dangerous Boundaries

Readership: Engineers, students, mathematicians and researchers in nonlinear dynamics and dynamical systems.

Keywords: Bifurcations; Dynamical Systems; Qualitative Theory; Chaos; Strange Attractors; Nonlinear Dynamics

Reviews:
- “The book is a welcome addition to the literature on bifurcation theory. In particular, Chapters 12 and 13 contain a wealth of material on global bifurcations (particularly on those of codimension two) that has not been published in a textbook before. The book is well-written and nicely illustrated, while being mathematically rigorous (in places quite technical). It will be of interest to anyone, including dedicated non-specialist readers, from about graduate level onwards, who want to learn about the mathematical theory of (global) bifurcations.” Mathematical Reviews
- “The book is a welcome addition to the classical list of books on bifurcation theory. It is an advanced book, attempting to be more general in the abstract theory of this theory. It is very well written and contains a large number of explanatory footnotes and pictures. As such, it is very instructive even for researchers well initiated in the subject. It is also suitable as a textbook, albeit at an advanced level. Thus, it is a ‘must’ for everyone seriously interested in bifurcation theory.” Zentralblatt MATH

Self-Oscillations in Dynamic Systems - Luis T.
Aguilar 2015-10-01 This monograph presents a simple and efficient two-relay control algorithm for generation of self-excited oscillations of a desired amplitude and frequency in dynamic systems. Developed by the authors, the two-relay controller consists of two relays switched by the feedback received from a linear or nonlinear system, and represents a new approach to the self-generation of periodic motions in underactuated mechanical systems. The first part of the book explains the design procedures for two-relay control using three different methodologies – the describing-function method, Poincaré maps, and the locus-of-a perturbed-relay-system method – and concludes with stability analysis of designed periodic oscillations. Two methods to ensure the robustness of two-relay control algorithms are explored in the second part, one based on the combination of the high-order sliding mode controller and backstepping, and the other on higher-order sliding-modes-based reconstruction of uncertainties and their compensation where Lyapunov-based stability analysis of tracking error is used. Finally, the third part illustrates applications of self-oscillation generation by a two-relay control with a Furuta pendulum, wheel pendulum, 3-DOF underactuated robot, 3-DOF laboratory helicopter, and fixed-phase electronic circuits. Self-Oscillations in Dynamic Systems will appeal to engineers, researchers, and graduate students working on the tracking and self-generation of periodic motion of electromechanical systems, including non-minimum-phase systems. It will also be of interest to mathematicians working on analysis of periodic solutions.