

Solutions Perko Differential Equations And Dynamical Systems

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.

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 concepts: flow, stability, invariant manifolds, the phase plane, bifurcation, chaos, and Hamiltonian dynamics. This new edition contains several important updates and revisions throughout the book. 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.

Over the last four decades there has been extensive development in the theory of dynamical systems. This book aims at a wide audience where the first four chapters have been used for an undergraduate course in Dynamical Systems. Material from the last two chapters and from the appendices has been used quite a lot for master and PhD courses. All chapters are concluded by an exercise section. The book is also directed towards researchers, where one of the challenges is to help applied researchers acquire background for a better understanding of the data that computer simulation or experiment may provide them with the development of the theory.

This textbook presents a systematic study of the qualitative and geometric theory of nonlinear differential equations and dynamical systems. Although the main topic of the book is the local and global behavior of nonlinear systems and their bifurcations, a thorough treatment of linear systems is given at the beginning of the text. All the material necessary for a clear understanding of the qualitative behavior of dynamical systems is contained in this textbook, including an outline of the proof and examples illustrating the proof of the Hartman-Grobman theorem. In addition to minor corrections and updates throughout, this new edition includes materials on higher order Melnikov theory and the bifurcation of limit cycles for planar systems of differential equations. Blow-up for Higher-Order Parabolic, Hyperbolic, Dispersion and Schrödinger Equations shows how four types of higher-order nonlinear evolution partial differential equations (PDEs) have many commonalities through their special quasilinear degenerate representations. The authors present a unified approach to deal with these quasilinear PDEs. The book first studies the particular self-similar singularity solutions (patterns) of the equations. This approach allows four different classes of nonlinear PDEs to be treated simultaneously to establish their striking common features. The book describes many properties of the equations and examines traditional questions of existence/nonexistence, uniqueness/nonuniqueness, global asymptotics, regularizations, shock-wave theory, and various blow-up singularities. Preparing readers for more advanced mathematical PDE analysis, the book demonstrates that quasilinear degenerate higher-order PDEs, even exotic and awkward ones, are not as daunting as they first appear. It also illustrates the deep features shared by several types of nonlinear PDEs and encourages readers to develop further this unifying PDE approach from other viewpoints.

This volume provides a concise introduction to the methodology of nonstandard finite difference (NSFD) schemes construction and shows how they can be applied to the numerical integration of differential equations occurring in the natural, biomedical, and engineering sciences. These methods had their genesis in the work of Mickens in the 1990's and are now beginning to be widely studied and applied by other researchers. The importance of the book derives from its clear and direct explanation of NSFD in the introductory chapter along with a broad discussion of the future directions needed to advance the topic. Contents: Nonstandard Finite Difference Methods (R E Mickens) Application of Nonstandard Finite Difference Schemes to the Simulation Studies of Robotic Systems (R F Abo-Shanab et al.) Applications of Mickens Finite Differences to Several Related Boundary Value Problems (R Buckmire) High Accuracy Nonstandard Finite-Difference Time-Domain Algorithms for Computational Electromagnetics: Applications to Optics and Photonics (J B Cole) Nonstandard Finite Difference Schemes for Solving Nonlinear Micro Heat Transport Equations in Double-Layered Metal Thin Films Exposed to Ultrashort Pulsed Lasers (W Dai) Reliable Finite Difference Schemes with Applications in Mathematical Ecology (D T Dimitrov et al.) Applications of the Nonstandard Finite Difference Method in Non-Smooth Mechanics (Y Dumont) Finite Difference Schemes on Unbounded Domains (M Ehrhardt) Asymptotically Consistent Nonstandard Finite-Difference Methods for Solving Mathematical Models Arising in Population Biology (A B Gumel et al.) Nonstandard Finite Difference Methods and Biological Models (S R-J Jang) Robust Discretizations versus Increase of the Time Step for Chaotic Systems (C Letellier & E M A M Mendes) Contributions to the Theory of Nonstandard Finite-Difference Methods and Applications to Singular Perturbation Problems (J M-S Lubuma & K C Patidar) Frequency Accurate Finite Difference Methods (A L Perkins et al.) Nonstandard Discretization Methods on Lotka-Volterra Differential Equations (L-I W Roeger) Readership: Applied mathematicians, and researchers in numerical & computational mathematics and analysis & differential

equations. Usable as a secondary text to a standard undergraduate or graduate course on numerical methods for differential equations. Keywords: Numerical Integration Methods; Finite Differences; Nonstandard Finite Difference Schemes; Differential Equations; Discrete Models; Numerical and Computational Mathematics Key Features: A collection of papers from renowned experts in their respective fields Provides the most recent work on the application of NSFD schemes and some of the mathematical analysis related to these schemes

As a limit theory of quantum mechanics, classical dynamics comprises a large variety of phenomena, from computable (integrable) to chaotic (mixing) behavior. This book presents the KAM (Kolmogorov-Arnold-Moser) theory and asymptotic completeness in classical scattering. Including a wealth of fascinating examples in physics, it offers not only an excellent selection of basic topics, but also an introduction to a number of current areas of research in the field of classical mechanics. Thanks to the didactic structure and concise appendices, the presentation is self-contained and requires only knowledge of the basic courses in mathematics. The book addresses the needs of graduate and senior undergraduate students in mathematics and physics, and of researchers interested in approaching classical mechanics from a modern point of view.

This text emphasizes rigorous mathematical techniques for the analysis of boundary value problems for ODEs arising in applications. The emphasis is on proving existence of solutions, but there is also a substantial chapter on uniqueness and multiplicity questions and several chapters which deal with the asymptotic behavior of solutions with respect to either the independent variable or some parameter. These equations may give special solutions of important PDEs, such as steady state or traveling wave solutions. Often two, or even three, approaches to the same problem are described. The advantages and disadvantages of different methods are discussed. The book gives complete classical proofs, while also emphasizing the importance of modern methods, especially when extensions to infinite dimensional settings are needed. There are some new results as well as new and improved proofs of known theorems. The final chapter presents three unsolved problems which have received much attention over the years. Both graduate students and more experienced researchers will be interested in the power of classical methods for problems which have also been studied with more abstract techniques. The presentation should be more accessible to mathematically inclined researchers from other areas of science and engineering than most graduate texts in mathematics.

This volume contains the peer-reviewed proceedings of the International Conference on Modelling and Simulation (MS-17), held in Kolkata, India, 4th-5th November 2017, organized by the Association for the Advancement of Modelling and Simulation Techniques in Enterprises (AMSE, France) in association with the Institution of Engineering Technology (IET, UK), Kolkata Network. The contributions contained here showcase some recent advances in modelling and simulation across various aspects of science and technology. This book brings together articles describing applications of modelling and simulation techniques in fields as diverse as physics, mathematics, electrical engineering, industrial electronics, control, automation, power systems, energy and robotics. It includes a special section on mechanical, fuzzy, optical and opto-electronic control of oscillations. It provides a snapshot of the state of the art in modelling and simulation methods and their applications, and will be of interest to researchers and engineering professionals from industry, academia and research organizations.

This book constitutes the refereed proceedings of the 7th International Conference on Principles and Practice of Constraint Programming, CP 2001, held in Paphos, Cyprus, in November/December 2001. The 37 revised full papers, 9 innovative applications presentations, and 14 short papers presented were carefully reviewed and selected from a total of 135 submissions. All current issues in constraint processing are addressed, ranging from theoretical and foundational issues to advanced and innovative applications in a variety of fields.

This volume provides a concise introduction to the methodology of nonstandard finite difference (NSFD) schemes construction and shows how they can be applied to the numerical integration of differential equations occurring in the natural, biomedical, and engineering sciences. These methods had their genesis in the work of Mickens in the 1990's and are now beginning to be widely studied and applied by other researchers. The importance of the book derives from its clear and direct explanation of NSFD in the introductory chapter along with a broad discussion of the future directions needed to advance the topic.

This introductory text combines models from physics and biology with rigorous reasoning in describing the theory of ordinary differential equations along with applications and computer simulations with Maple. Offering a concise course in the theory of ordinary differential equations, it also enables the reader to enter the field of computer simulations. Thus, it is a valuable read for students in mathematics as well as in physics and engineering. It is also addressed to all those interested in mathematical modeling with ordinary differential equations and systems. Contents Part I: Theory Chapter 1 First-Order Differential Equations Chapter 2 Linear Differential Systems Chapter 3 Second-Order Differential Equations Chapter 4 Nonlinear Differential Equations Chapter 5 Stability of Solutions Chapter 6 Differential Systems with Control Parameters Part II: Exercises Seminar 1 Classes of First-Order Differential Equations Seminar 2 Mathematical Modeling with Differential Equations Seminar 3 Linear Differential Systems Seminar 4 Second-Order Differential Equations Seminar 5 Gronwall's Inequality Seminar 6 Method of Successive Approximations Seminar 7 Stability of Solutions Part III: Maple CodeLab 1 Introduction to Maple Lab 2 Differential Equations with Maple Lab 3 Linear Differential Systems Lab 4 Second-Order Differential Equations Lab 5 Nonlinear Differential Systems Lab 6 Numerical Computation of Solutions Lab 7 Writing Custom Maple Programs Lab 8 Differential Systems with Control Parameters

Differential Equations and Dynamical Systems Springer Science & Business Media

This textbook provides a comprehensive introduction to the qualitative theory of ordinary differential equations. It includes a discussion of the existence and uniqueness of solutions, phase portraits, linear equations, stability theory, hyperbolicity and equations in the plane. The emphasis is primarily on results and methods that allow one to analyze qualitative properties of the solutions without solving the equations explicitly. The text includes numerous examples that illustrate in detail the new concepts and results as well as

exercises at the end of each chapter. The book is also intended to serve as a bridge to important topics that are often left out of a course on ordinary differential equations. In particular, it provides brief introductions to bifurcation theory, center manifolds, normal forms and Hamiltonian systems.

This text is concerned with quantitative aspects of the theory of nonlinear diffusion equations, which appear as mathematical models in different branches of Physics, Chemistry, Biology and Engineering.

This book provides a self-contained introduction to ordinary differential equations and dynamical systems suitable for beginning graduate students. The first part begins with some simple examples of explicitly solvable equations and a first glance at qualitative methods. Then the fundamental results concerning the initial value problem are proved: existence, uniqueness, extensibility, dependence on initial conditions. Furthermore, linear equations are considered, including the Floquet theorem, and some perturbation results. As somewhat independent topics, the Frobenius method for linear equations in the complex domain is established and Sturm-Liouville boundary value problems, including oscillation theory, are investigated. The second part introduces the concept of a dynamical system. The Poincaré-Bendixson theorem is proved, and several examples of planar systems from classical mechanics, ecology, and electrical engineering are investigated. Moreover, attractors, Hamiltonian systems, the KAM theorem, and periodic solutions are discussed. Finally, stability is studied, including the stable manifold and the Hartman-Grobman theorem for both continuous and discrete systems. The third part introduces chaos, beginning with the basics for iterated interval maps and ending with the Smale-Birkhoff theorem and the Melnikov method for homoclinic orbits. The text contains almost three hundred exercises. Additionally, the use of mathematical software systems is incorporated throughout, showing how they can help in the study of differential equations.

An easy to understand guide covering key principles of ordinary differential equations and their applications.

Computable analysis is the modern theory of computability and complexity in analysis that arose out of Turing's seminal work in the 1930s. This was motivated by questions such as: which real numbers and real number functions are computable, and which mathematical tasks in analysis can be solved by algorithmic means? Nowadays this theory has many different facets that embrace topics from computability theory, algorithmic randomness, computational complexity, dynamical systems, fractals, and analog computers, up to logic, descriptive set theory, constructivism, and reverse mathematics. In recent decades computable analysis has invaded many branches of analysis, and researchers have studied computability and complexity questions arising from real and complex analysis, functional analysis, and the theory of differential equations, up to (geometric) measure theory and topology. This handbook represents the first coherent cross-section through most active research topics on the more theoretical side of the field. It contains 11 chapters grouped into parts on computability in analysis; complexity, dynamics, and randomness; and constructivity, logic, and descriptive complexity. All chapters are written by leading experts working at the cutting edge of the respective topic. Researchers and graduate students in the areas of theoretical computer science and mathematical logic will find systematic introductions into many branches of computable analysis, and a wealth of information and references that will help them to navigate the modern research literature in this field.

This volume presents a broad discussion of computational methods and theories on various classical and modern research problems from pure and applied mathematics. Readers conducting research in mathematics, engineering, physics, and economics will benefit from the diversity of topics covered. Contributions from an international community treat the following subjects: calculus of variations, optimization theory, operations research, game theory, differential equations, functional analysis, operator theory, approximation theory, numerical analysis, asymptotic analysis, and engineering. Specific topics include algorithms for difference of monotone operators, variational inequalities in semi-inner product spaces, function variation principles and normed minimizers, equilibria of parametrized N-player nonlinear games, multi-symplectic numerical schemes for differential equations, time-delay multi-agent systems, computational methods in non-linear design of experiments, unsupervised stochastic learning, asymptotic statistical results, global-local transformation, scattering relations of elastic waves, generalized Ostrowski and trapezoid type rules, numerical approximation, Szász Durrmeyer operators and approximation, integral inequalities, behaviour of the solutions of functional equations, functional inequalities in complex Banach spaces, functional contractions in metric spaces.

This book introduces the mathematical properties of nonlinear systems, mostly difference and differential equations, as an integrated theory, rather than presenting isolated fashionable topics. This book provides a comprehensive introduction to the theory of ordinary differential equations with a focus on mechanics and dynamical systems as important applications of the theory. The text is written to be used in the traditional way or in a more applied way. The accompanying CD contains Maple worksheets for the exercises, and special Maple code for performing various tasks. In addition to its use in a traditional one or two semester graduate course in mathematics, the book is organized to be used for interdisciplinary courses in applied mathematics, physics, and engineering.

This book presents current advances in the theory of dynamic games and their applications in several disciplines. The selected contributions cover a variety of topics ranging from purely theoretical developments in game theory, to numerical analysis of various dynamic games, and then progressing to applications of dynamic games in economics, finance, and energy supply. A unified collection of state-of-the-art advances in theoretical and numerical analysis of dynamic games and their applications, the work is suitable for researchers, practitioners, and graduate students in applied mathematics, engineering, economics, as well as environmental and management sciences.

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Thoroughly updated and expanded 4th edition of the classic text, including numerous worked examples, diagrams and exercises. An ideal resource for students and lecturers in engineering, mathematics and the sciences it is published alongside a separate Problems and Solutions Sourcebook containing over 500 problems and fully-worked solutions.

This book presents a variety of techniques for solving ordinary differential equations analytically and features a wealth of examples. Focusing on the modeling of real-world phenomena, it begins with a basic introduction to differential equations, followed by linear and nonlinear first order equations and a detailed treatment of the second order linear equations. After presenting solution methods for the Laplace transform and power series, it lastly presents systems of equations and offers an introduction to the stability theory. To help readers practice the theory covered, two types of exercises are provided: those that illustrate the general theory, and others designed to expand on the text material. Detailed solutions to all the exercises are included. The book is excellently suited for use as a textbook for an undergraduate class (of all disciplines) in ordinary differential equations.

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.

This book develops the theory of ordinary differential equations (ODEs), starting from an introductory level (with no prior experience in ODEs assumed) through to a graduate-level treatment of the qualitative theory, including bifurcation theory (but not chaos). While proofs are rigorous, the exposition is reader-friendly, aiming for the informality of face-to-face interactions. A unique feature of this book is the integration of rigorous theory with numerous applications of scientific interest. Besides providing motivation, this synthesis clarifies the theory and enhances scientific literacy. Other features include: (i) a wealth of exercises at various levels, along with commentary that explains why they matter; (ii) figures with consistent color conventions to identify nullclines, periodic orbits, stable and unstable manifolds; and (iii) a dedicated website with software templates, problem solutions, and other resources supporting the text (www.math.duke.edu/ode-book). Given its many applications, the book may be used comfortably in science and engineering courses as well as in mathematics courses. Its level is accessible to upper-level undergraduates but still appropriate for graduate students. The thoughtful presentation, which anticipates many confusions of beginning students, makes the book suitable for a teaching environment that emphasizes self-directed, active learning (including the so-called inverted classroom).

Differential Equations: Techniques, Theory, and Applications is designed for a modern first course in differential equations either one or two semesters in length. The organization of the book interweaves the three components in the subtitle, with each building on and supporting the others. Techniques include not just computational methods for producing solutions to differential equations, but also qualitative methods for extracting conceptual information about differential equations and the systems modeled by them. Theory is developed as a means of organizing, understanding, and codifying general principles. Applications show the usefulness of the subject as a whole and heighten interest in both solution techniques and theory. Formal proofs are included in cases where they enhance core understanding; otherwise, they are replaced by informal justifications containing key ideas of a proof in a more conversational format. Applications are drawn from a wide variety of fields: those in physical science and engineering are prominent, of course, but models from biology, medicine, ecology, economics, and sports are also featured. The 1,400+ exercises are especially compelling. They range from routine calculations to large-scale projects. The more difficult problems, both theoretical and applied, are typically presented in manageable steps. The hundreds of meticulously detailed modeling problems were deliberately designed along pedagogical principles found especially effective in the MAA study Characteristics of Successful Calculus Programs, namely, that asking students to work problems that require them to grapple with concepts (or even proofs) and do modeling activities is key to successful student experiences and retention in STEM programs. The exposition itself is exceptionally readable, rigorous yet conversational. Students will find it inviting and approachable. The text supports many different styles of pedagogy from traditional lecture to a flipped classroom model. The availability of a computer algebra system is not assumed, but there are many opportunities to incorporate the use of one.

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.

This volume constitutes the refereed proceedings of the 36th International Symposium on Mathematical Foundations of Computer Science, MFCS 2011, held in Warsaw, Poland, in August 2011. The 48 revised full papers presented together with 6 invited talks were carefully reviewed and selected from 129 submissions. Topics covered include algorithmic game theory, algorithmic learning theory, algorithms and data structures, automata, grammars and formal languages, bioinformatics, complexity, computational geometry, computer-assisted reasoning, concurrency theory, cryptography and security, databases and knowledge-based systems, formal specifications and program development, foundations of computing, logic in computer science, mobile computing, models of computation, networks, parallel and distributed computing, quantum computing, semantics and verification of programs, and theoretical issues in artificial intelligence.

Hybrid systems are models for complex physical systems and have become a widely used concept for understanding their behavior. Many applications are safety-critical, including car, railway, and air traffic control, robotics, physical-chemical process control, and biomedical devices. Hybrid systems analysis studies how we can build computerized controllers for physical systems

which are guaranteed to meet their design goals. The author gives a unique, logic-based perspective on hybrid systems analysis. It is the first book that leverages the power of logic for hybrid systems. The author develops a coherent logical approach for systematic hybrid systems analysis, covering its theory, practice, and applications. It is further shown how the developed verification techniques can be used to study air traffic and railway control systems. This book is intended for researchers, postgraduates, and professionals who are interested in hybrid systems analysis, cyberphysical or embedded systems design, logic and theorem proving, or transportation and automation.

This book gathers the peer-reviewed proceedings of the 12th Annual Meeting of the Bulgarian Section of the Society for Industrial and Applied Mathematics, BGSIAM'17, held in Sofia, Bulgaria, in December 2017. The general theme of BGSIAM'17 was industrial and applied mathematics, with a particular focus on: high-performance computing, numerical methods and algorithms, analysis of partial differential equations and their applications, mathematical biology, control and uncertain systems, stochastic models, molecular dynamics, neural networks, genetic algorithms, metaheuristics for optimization problems, generalized nets, and Big Data.

This book discusses a variety of topics related to industrial and applied mathematics, focusing on wavelet theory, sampling theorems, inverse problems and their applications, partial differential equations as a model of real-world problems, computational linguistics, mathematical models and methods for meteorology, earth systems, environmental and medical science, and the oil industry. It features papers presented at the International Conference in Conjunction with 14th Biennial Conference of ISIAM, held at Guru Nanak Dev University, Amritsar, India, on 2–4 February 2018. The conference has emerged as an influential forum, bringing together prominent academic scientists, experts from industry, and researchers. The topics discussed include Schrodinger operators, quantum kinetic equations and their application, extensions of fractional integral transforms, electrical impedance tomography, diffuse optical tomography, Galerkin method by using wavelets, a Cauchy problem associated with Korteweg–de Vries equation, and entropy solution for scalar conservation laws. This book motivates and inspires young researchers in the fields of industrial and applied mathematics.

Many textbooks on differential equations are written to be interesting to the teacher rather than the student. Introduction to Differential Equations with Dynamical Systems is directed toward students. This concise and up-to-date textbook addresses the challenges that undergraduate mathematics, engineering, and science students experience during a first course on differential equations. And, while covering all the standard parts of the subject, the book emphasizes linear constant coefficient equations and applications, including the topics essential to engineering students. Stephen Campbell and Richard Haberman--using carefully worded derivations, elementary explanations, and examples, exercises, and figures rather than theorems and proofs--have written a book that makes learning and teaching differential equations easier and more relevant. The book also presents elementary dynamical systems in a unique and flexible way that is suitable for all courses, regardless of length.

Superb, self-contained graduate-level text covers standard theorems concerning linear systems, existence and uniqueness of solutions, and dependence on parameters.

Focuses on stability theory and its applications to oscillation phenomena, self-excited oscillations, more. Includes exercises.

Exact Solutions and Invariant Subspaces of Nonlinear Partial Differential Equations in Mechanics and Physics is the first book to provide a systematic construction of exact solutions via linear invariant subspaces for nonlinear differential operators. Acting as a guide to nonlinear evolution equations and models from physics and mechanics, the book focuses on the existence of new exact solutions on linear invariant subspaces for nonlinear operators and their crucial new properties. This practical reference deals with various partial differential equations (PDEs) and models that exhibit some common nonlinear invariant features. It begins with classical as well as more recent examples of solutions on invariant subspaces. In the remainder of the book, the authors develop several techniques for constructing exact solutions of various nonlinear PDEs, including reaction-diffusion and gas dynamics models, thin-film and Kuramoto-Sivashinsky equations, nonlinear dispersion (compacton) equations, KdV-type and Harry Dym models, quasilinear magma equations, and Green-Naghdi equations. Using exact solutions, they describe the evolution properties of blow-up or extinction phenomena, finite interface propagation, and the oscillatory, changing sign behavior of weak solutions near interfaces for nonlinear PDEs of various types and orders. The techniques surveyed in Exact Solutions and Invariant Subspaces of Nonlinear Partial Differential Equations in Mechanics and Physics serve as a preliminary introduction to the general theory of nonlinear evolution PDEs of different orders and types.

Introduction to Dynamical Systems and Geometric Mechanics provides a comprehensive tour of two fields that are intimately entwined: dynamical systems is the study of the behavior of physical systems that may be described by a set of nonlinear first-order ordinary differential equations in Euclidean space, whereas geometric mechanics explore similar systems that instead evolve on differentiable manifolds. The first part discusses the linearization and stability of trajectories and fixed points, invariant manifold theory, periodic orbits, Poincaré maps, Floquet theory, the Poincaré-Bendixson theorem, bifurcations, and chaos. The second part of the book begins with a self-contained chapter on differential geometry that introduces notions of manifolds, mappings, vector fields, the Jacobi-Lie bracket, and differential forms.

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

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