Nonlinear Partial Differential Equations With Applications International Series Of Numerical Mathematics

BURGESS SANTIAGO

Physical Mathematics and Nonlinear Partial Differential Equations Elsevier
What distinguishes differential geometry in the last half of the twentieth century from its earlier history is the use of nonlinear partial differential equations in the study of curved manifolds, submanifolds, mapping problems, and function theory on manifolds, among other topics. The differential equations appear as tools and as objects of study, with analytic and geometric advances fueling each other in the current explosion of progress in this area of geometry in the last twenty years. This book contains lecture notes of minicourses at the Regional Geometry Institute at Park City, Utah, in July 1992. Presented here are surveys of breaking developments in a number of areas of nonlinear partial differential equations in differential geometry. The authors of the articles are not only excellent expositors, but are also leaders in this field of research. All of the articles provide in-depth treatment of the topics and require few prerequisites and less background than current research articles.
Fourier Analysis and Nonlinear Partial Differential Equations Vieweg+Teubner Verlag
The description of many interesting phenomena in science and engineering leads to infinite-dimensional minimization or evolution problems that define nonlinear partial differential equations. While the development and analysis of numerical methods for linear partial differential equations is nearly complete, only few results are available in the case of nonlinear equations. This monograph devises numerical methods for nonlinear model problems arising in the mathematical description of phase transitions, large bending problems, image processing, and inelastic material behavior. For each of these problems the underlying mathematical model is discussed, the essential analytical properties are explained, and the proposed numerical method is rigorously analyzed. The practicality of the algorithms is illustrated by means of short

implementations.
Nonlinear Partial Differential Equations for Future Applications SIAM
This work will serve as an excellent first course in modern analysis. The main focus is on showing how self-similar solutions are useful in studying the behavior of solutions of nonlinear partial differential equations, especially those of parabolic type. This textbook will be an excellent resource for self-study or classroom use.
Applications to Biology and Engineering North Holland
Nonlinear Partial Differential Equations in Applied Science
Elsevier
This book provides a comprehensive introduction to the mathematical theory of nonlinear problems described by elliptic partial differential equations. These equations can be seen as nonlinear versions of the classical Laplace equation, and they appear as mathematical models in different branches of physics, chemistry, biology, genetics, and engineering and are also relevant in differential geometry and relativistic physics. Much of the modern theory of such equations is based on the calculus of variations and functional analysis. Concentrating on single-valued or multivalued elliptic equations with nonlinearities of various types, the aim of this volume is to obtain sharp existence or nonexistence results, as well as decay rates for general classes of solutions. Many technically relevant questions are presented and analyzed in detail. A systematic picture of the most relevant phenomena is obtained for the equations under study, including bifurcation, stability, asymptotic analysis, and optimal regularity of solutions. The method of presentation should appeal to readers with different backgrounds in functional analysis and nonlinear partial differential equations. All chapters include detailed heuristic arguments providing thorough motivation of the study developed later on in the text, in relationship with concrete processes arising in applied sciences. A systematic description of the most relevant singular phenomena described in this volume includes existence (or nonexistence) of solutions, unicity or multiplicity properties, bifurcation and asymptotic analysis, and optimal regularity. The book includes an extensive bibliography and a rich index, thus allowing for quick orientation among the vast collection of literature on the mathematical theory of nonlinear phenomena described by elliptic partial differential equations.
Nonlinear Partial Differential Equations CRC Press
This is an introduction to methods for solving nonlinear partial differential equations (NLPDEs). After the introduction of several PDEs drawn from science and engineering, the reader is introduced to techniques used to obtain exact solutions of NPDEs. The chapters include the following topics: Compatibility, Differential Substitutions, Point and Contact Transformations, First Integrals, and Functional Separability. The reader is guided through these chapters and is provided with several detailed examples. Each chapter ends with a series of exercises illustrating the material presented in each chapter. The book can be used as a textbook for a second course in PDEs (typically found in both science and engineering programs) and has been used at the University of Central Arkansas for more than ten years.
Analytical Techniques for Solving Nonlinear Partial Differential Equations Springer Science & Business Media
The third of three volumes on partial differential equations, this is devoted to nonlinear PDE. It treats a number of equations of classical continuum mechanics, including relativistic versions, as well as various equations arising in differential geometry, such as in the study of minimal surfaces, isometric imbedding, conformal deformation, harmonic maps, and prescribed Gauss curvature. In addition, some nonlinear diffusion problems are studied. It also introduces such analytical tools as the theory of L Sobolev spaces, H lder spaces, Hardy spaces, and Morrey spaces, and also a development of Calderon-Zygmund theory and paradifferential operator calculus. The book is aimed at graduate students in mathematics, and at professional mathematicians with an interest in partial differential equations, mathematical physics, differential geometry, harmonic analysis and complex analysis
Nonlinear Partial Differential Equations with Applications American Mathematical Soc.
Nonlinear Partial Differential Equations: A Symposium on Methods of Solution is a collection of papers presented at the seminar on methods of solution for nonlinear partial differential equations, held at the University of Delaware, Newark, Delaware on December 27-29, 1965. The sessions are divided into four Symposia: Analytic Methods, Approximate Methods, Numerical Methods, and Applications. Separating 19 lectures into chapters, this book starts with a presentation of the methods of similarity analysis, particularly considering the merits, advantages and disadvantages of the methods. The subsequent chapters describe the fundamental ideas behind the methods for the solution of partial differential equation derived from the theory of dynamic programming and from finite systems of ordinary differential equations. These topics are followed by reviews of the principles to the lubrication approximation and compressible boundary-layer flow computation. The discussion then shifts to several applications of nonlinear partial differential equations, including in electrical problems, two-phase flow, hydrodynamics, and heat transfer. The remaining chapters cover other solution methods for partial differential equations, such as the synergetic approach. This book will prove useful to applied mathematicians, physicists, and engineers.
Nonlinear Partial Differential Equations and Free Boundaries Longman Sc & Tech
This monograph is the first to present the theory of global attractors of Hamiltonian partial differential equations. A particular focus is placed on the results obtained in the last three decades, with chapters on the global attraction to stationary states, to solitons, and to stationary orbits. The text includes many physically relevant examples and will be of interest to graduate students and researchers in both mathematics and physics. The proofs involve novel applications of methods of harmonic analysis, including Tauberian theorems, Titchmarsh's convolution theorem, and the theory of quasimeasures. As well as the underlying theory, the authors discuss the results of numerical simulations and formulate open problems to prompt further research.
Partial Differential Equations III Elsevier
This book provides a hands-on approach to numerical continuation and bifurcation for nonlinear PDEs in 1D, 2D, and 3D. Partial differential equations (PDEs) are the main tool to describe spatially and temporally extended systems in nature. PDEs usually come with parameters, and the study of the parameter dependence of their solutions is an important task. Letting one parameter vary typically yields a branch of solutions, and at special parameter values, new branches may bifurcate. After a concise review of some analytical background and numerical methods, the author explains the free MATLAB package pde2path by using a large variety of examples with demo codes that can be easily adapted to the reader's given problem. Numerical Continuation and Bifurcation in Nonlinear PDEs will appeal to applied mathematicians and scientists

from physics, chemistry, biology, and economics interested in the numerical solution of nonlinear PDEs, particularly the parameter dependence of solutions. It can be used as a supplemental text in courses on nonlinear PDEs and modeling and bifurcation.

Weak Convergence Methods for Nonlinear Partial Differential Equations Springer
This book is devoted to the applications of probability theory to the theory of nonlinear partial differential equations. More precisely, it is shown that all positive solutions for a class of nonlinear elliptic equations in a domain are described in terms of their traces on the boundary of the domain. The main probabilistic tool is the theory of superdiffusions, which describes a random evolution of a cloud of particles. A substantial enhancement of this theory is presented that will be of interest to anyone who works on applications of probabilistic methods to mathematical analysis. The book is suitable for graduate students and research mathematicians interested in probability theory and its applications to differential equations. Also of interest by this author is ""Diffusions, Superdiffusions and Partial Differential Equations"" in the ""AMS"" series, Colloquium Publications.

Harmonic Measure Springer Science & Business Media
Separation of Variables and Exact Solutions to Nonlinear PDEs is devoted to describing and applying methods of generalized and functional separation of variables used to find exact solutions of nonlinear partial differential equations (PDEs). It also presents the direct method of symmetry reductions and its more general version. In addition, the authors describe the differential constraint method, which generalizes many other exact methods. The presentation involves numerous examples of utilizing the methods to find exact solutions to specific nonlinear equations of mathematical physics. The equations of heat and mass transfer, wave theory, hydrodynamics, nonlinear optics, combustion theory, chemical technology, biology, and other disciplines are studied. Particular attention is paid to nonlinear equations of a reasonably general form that depend on one or several arbitrary functions. Such equations are the most difficult to analyze. Their exact solutions are of significant practical interest, as they are suitable to assess the accuracy of various approximate analytical and numerical methods. The book contains new material previously unpublished in monographs. It is intended for a broad audience of scientists, engineers, instructors, and students specializing in applied and computational mathematics, theoretical physics, mechanics, control theory, chemical engineering science, and other disciplines. Individual sections of the book and examples are suitable for lecture courses on partial differential equations, equations of mathematical physics, and methods of mathematical physics, for delivering special courses and for practical training.

Systems of Nonlinear Partial Differential Equations CRC Press
This volume features selected, original, and peer-reviewed papers on topics from a series of workshops on Nonlinear Partial Differential Equations for Future Applications that were held in 2017 at Tohoku University in Japan. The contributions address an abstract maximal regularity with applications to parabolic equations, stability, and bifurcation for viscous compressible Navier–Stokes equations, new estimates for a compressible Gross–Pitaevskii–Navier–Stokes system, singular limits for the Keller–Segel system in critical spaces, the dynamic programming principle for stochastic optimal control, two kinds of regularity machineries for elliptic obstacle problems, and new insight on topology of nodal sets of high-energy eigenfunctions of the Laplacian. This book aims to exhibit various theories and methods that appear in the study of nonlinear partial differential equations.

Handbook of Nonlinear Partial Differential Equations Hindawi Publishing Corporation
Nonlinear Partial Differential Equations in Engineering

Elliptic Equations CRC Press
This expanded and revised second edition is a comprehensive and systematic treatment of linear and nonlinear partial differential equations and their varied applications. Building upon the successful material of the first book, this edition contains updated modern examples and applications from diverse fields. Methods and properties of solutions, along with their physical significance, help make the book more useful for a diverse readership. The book is an exceptionally complete text/reference for graduates, researchers, and professionals in mathematics, physics, and engineering.

Attractors of Hamiltonian Nonlinear Partial Differential Equations CRC Press
A massive transition of interest from solving linear partial differential equations to solving nonlinear ones has taken place during the last two or three decades. The availability of better computers has often made numerical experimentations progress faster than the theoretical understanding of nonlinear partial differential equations. The three most important nonlinear phenomena observed so far both experimentally and numerically, and studied theoretically in connection with such equations have been the solitons, shock waves and turbulence or chaotical processes. In many ways, these phenomena have presented increasing difficulties in the mentioned order. In particular, the latter two phenomena necessarily lead to nonclassical or generalized solutions for nonlinear partial differential equations.

A Symposium on Methods of Solution Springer Science & Business Media
In this volume are twenty-eight papers from the Conference on Nonlinear Partial Differential Equationsin Engineering and Applied Science, sponsored by the Office of Naval Research and held at the Universityof Rhode Island in June, 1979. Included are contributions from an international group of distinguishedmathematicians, scientists, and engineers coming from a wide variety of disciplines and having a commoninterest in the application of mathematics, particularly nonlinear partial differential equations, to realworld problems.The subject matter ranges from almost purely mathematical topics in numerical analysis and bifurcationtheory to a host of practical applications that involve nonlinear partial differential equations, suchas fluid dynamics, nonlinear waves, elasticity, viscoelasticity, hyperelasticity, solitons, metallurgy, shocklessairfoil design, quantum fields, and Darcy's law on flows in porous media.Non/inear Partial Differential Equations in Engineering and Applied Science focuses on a variety oftopics of specialized, contemporary concern to mathematicians, physical and biological scientists, andengineers who work with phenomena that can be described by nonlinear partial differential equations.

Nonlinear Partial Differential Equations in Engineering by W F Ames Elsevier
This volume consists of the proceedings of the conference on Physical Mathematics and Nonlinear Partial Differential Equations held at West Virginia University in Morgantown. It describes some work dealing with weak limits of solutions to nonlinear systems of partial differential equations.

College de France Seminar Springer Science & Business Media
This work will serve as an excellent first course in modern analysis. The main focus is on showing how self-similar solutions

are useful in studying the behavior of solutions of nonlinear partial differential equations, especially those of parabolic type. This textbook will be an excellent resource for self-study or classroom use.

Nonlinear Partial Differential Equations in Applied Science Springer Science & Business Media

In recent years, the Fourier analysis methods have expereinced a growing interest in the study of partial differential equations. In particular, those techniques based on the Littlewood-Paley decomposition have proved to be very efficient for the study of evolution equations. The present book aims at presenting self-contained, state- of- the-art models of those techniques with applications to different classes of partial differential equations: transport, heat, wave and Schrödinger equations. It also offers more sophisticated models originating from fluid mechanics (in particular the incompressible and compressible Navier-Stokes equations) or general relativity. It is either directed to anyone with a good undergraduate level of knowledge in analysis or useful for experts who are eager to know the benefit that one might gain from Fourier analysis when dealing with nonlinear partial differential equations.

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