Solutions Nonlinear Equations

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Nonlinear Reaction-Diffusion-Convection Equations CRC Press This book focuses on

the approximation of nonlinear equations using iterative methods. Nine contributions are presented on the construction and analysis of these methods, the coverage encompassing convergence, efficiency, robustness, dynamics, and applications. Many problems are stated in the form of nonlinear equations, using mathematical modeling. In particular, a wide range of problems in Applied Mathematics and in Engineering can be solved by finding the solutions to these equations. The book reveals the importance of studying convergence aspects in iterative methods and shows that selection of the most efficient and robust iterative method for a given problem is crucial to guaranteeing a good approximation. A number of sample criteria for selecting the optimal method are presented, including those regarding the order of convergence, the computational cost, and the stability, including the dynamics. This book will appeal to researchers whose field of interest is related to nonlinear problems and equations, and their approximation.

Finite Difference Computing with PDEs CRC Press

It is well known that symmetry-based methods are very powerful tools for investigating nonlinear partial differential equations (PDEs), notably for their

reduction to those of lower dimensionality (e.g. to ODEs) and constructing exact solutions. This book is devoted to (1) search Lie and conditional (non-classical) symmetries of nonlinear RDC equations, (2) constructing exact solutions using the symmetries obtained, and (3) their applications for solving some biologically and physically motivated problems. The book summarises the results derived by the authors during the last 10 years and those obtained by some other authors.

Computing All Real Solutions to Systems of Nonlinear Equations with Continuation American Mathematical Soc.

Nonlinear Partial Differential Equations

Solving Nonlinear Partial Differential Equations with Maple and Mathematica Oxford University Press

This book on Newton's method is a user-oriented guide to algorithms and implementation. In just over 100 pages, it shows, via algorithms in pseudocode, in MATLAB, and with several examples, how one can choose an appropriate Newton-type method for a given problem, diagnose problems, and write an efficient solver or apply one written by others. It contains trouble-shooting guides to the major algorithms, their most common failure modes, and the likely causes of failure. It also includes many worked-out examples (available on the SIAM website) in pseudocode and a collection of MATLAB codes, allowing readers to experiment with the algorithms easily and implement them in other languages.

Iterative solution of nonlinear equations in

several variables CRC Press Nonlinear equations arise in essentially every branch of modern science, engineering, and mathematics. However, in only a very few special cases is it possible to obtain useful solutions to nonlinear equations via analytical calculations. As a result, many scientists resort to computational methods. This book contains the proceedings of the Joint AMS-SIAM Summer Seminar, ``Computational Solution of Nonlinear Systems of Equations," held in July 1988 at Colorado State University. The aim of the book is to give a wide-ranging survey of essentially all of the methods which comprise currently active areas of research in the computational solution of systems of nonlinear equations. A number of ``entry-level" survey papers were solicited, and a series of test problems has been collected in an appendix. Most of the articles are accessible to students who have had a course in numerical analysis.

Optimal Solution of Nonlinear Equations Gordon & Breach Publishing Group
This book presents computer programming as a key method for solving mathematical problems. There are two versions of the book, one for MATLAB and one for Python. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style is more accessible and concise, in keeping with the needs of engineering students. The book outlines the shortest possible path from no previous

experience with programming to a set of skills that allows the students to write simple programs for solving common mathematical problems with numerical methods in engineering and science courses. The emphasis is on generic algorithms, clean design of programs, use of functions, and automatic tests for verification.

Optimal Solution of Nonlinear Equations Birkhäuser

During the last few years, several fairly systematic nonlinear theories of generalized solutions of rather arbitrary nonlinear partial differential equations have emerged. The aim of this volume is to offer the reader a sufficiently detailed introduction to two of these recent nonlinear theories which have so far contributed most to the study of generalized solutions of nonlinear partial differential equations, bringing the reader to the level of ongoing research. The essence of the two nonlinear theories presented in this volume is the observation that much of the mathematics concerning existence, uniqueness regularity, etc., of generalized solutions for nonlinear partial differential equations can be reduced to elementary calculus in Euclidean spaces, combined with elementary algebra in quotient rings of families of smooth functions on Euclidean spaces, all of that joined by certain asymptotic interpretations. In this way, one avoids the complexities and difficulties of the customary functional analytic methods which would involve sophisticated topologies on various function spaces. The result is a rather elementary yet powerful and far-reaching method which can, among others, give generalized

solutions to linear and nonlinear partial differential equations previously unsolved or even unsolvable within distributions or hyperfunctions. Part 1 of the volume discusses the basic limitations of the linear theory of distributions when dealing with linear or nonlinear partial differential equations, particularly the impossibility and degeneracy results. Part 2 examines the way Colombeau constructs a nonlinear theory of generalized functions and then succeeds in proving quite impressive existence, uniqueness, regularity, etc., results concerning generalized solutions of large classes of linear and nonlinear partial differential equations. Finally, Part 3 is a short presentation of the nonlinear theory of Rosinger, showing its connections with Colombeau's theory, which it contains as a particular case.

Handbook of Ordinary Differential Equations SIAM

This book presents new methodsfor theconstruction of global asymptotics of solutions to nonlinear equations with small parameter. With these methodsit is possible to matchasymptotics of various properties with each other in transition regions and to get unified formulas for connectedcharacteristic parameters of approximate solutions.

Generalized Solutions of Nonlinear Partial Differential Equations Springer Science & Business Media

The Handbook of Nonlinear Partial Differential Equations is the latest in a series of acclaimed handbooks by these authors and presents exact solutions of more than 1600 nonlinear equations encountered in science and engineering--many more than any other book available. The equations include those of parabolic, hyperbolic, elliptic and other types, and the authors pay special attention to equations of general form that involve arbitrary functions. A supplement

at the end of the book discusses the classical and new methods for constructing exact solutions to nonlinear equations. To accommodate different mathematical backgrounds, the authors avoid wherever possible the use of special terminology, outline some of the methods in a schematic, simplified manner, and arrange the equations in increasing order of complexity. Highlights of the Handbook:

Iterative Methods for Linear and Nonlinear Equations

Springer

The emphasis of the book is given in how to construct different types of solutions (exact, approximate analytical, numerical, graphical) of numerous nonlinear PDEs correctly, easily, and quickly. The reader can learn a wide variety of techniques and solve numerous nonlinear PDEs included and many other differential equations, simplifying and transforming the equations and solutions, arbitrary functions and parameters, presented in the book). Numerous comparisons and relationships between various types of solutions, different methods and approaches are provided, the results obtained in Maple and Mathematica, facilitates a deeper understanding of the subject. Among a big number of CAS, we choose the two systems, Maple and Mathematica, that are used worldwide by students, research mathematicians, scientists, and engineers. As in the our previous books, we propose the idea to use in parallel both systems, Maple and Mathematica, since in many research problems frequently it is required to compare independent results obtained by using different computer algebra systems, Maple and/or Mathematica, at all stages of the solution

process. One of the main points (related to CAS) is based on the implementation of a whole solution method (e.g. starting from an analytical derivation of exact governing equations, constructing discretizations and analytical formulas of a numerical method, performing numerical procedure, obtaining various visualizations, and comparing the numerical solution obtained with other types of solutions considered in the book, e.g. with asymptotic solution).

Computational Solution of Nonlinear Systems of Equations Springer Nature

A collection of research articles originating from the Workshop on Nonlinear Analysis and Applications held in Bergamo in July 2001. Classical topics of nonlinear analysis were considered, such as calculus of variations, variational inequalities, critical point theory and their use in various aspects of the study of elliptic differential equations and systems, equations of Hamilton-Jacobi, Schrödinger and Navier-Stokes, and free boundary problems. Moreover, various models were focused upon: travelling waves in supported beams and plates, vortex condensation in electroweak theory, information theory, non-geometrical optics, and Dirac-Fock models for heavy atoms.

Methods for Solving Systems of Nonlinear Equations Springer

Nonlinear equations arise in essentially every branch of modern science, engineering, and mathematics. However, in only a very few special cases is it possible to obtain useful solutions to nonlinear equations via analytical calculations. As a result, many scientists resort to computational methods. This book contains the proceedings of the Joint AMS-SIAM Summer Seminar, ``Computational Solution of Nonlinear Systems of Equations," held in July 1988 at

Colorado State University. The aim of the book is to give a wide-ranging survey of essentially all of the methods which comprise currently active areas of research in the computational solution of systems of nonlinear equations. A number of ``entry-level'' survey papers were solicited, and a series of test problems has been collected in an appendix. Most of the articles are accessible to students who have had a course in numerical analysis.

Numerical Solution of Systems of Nonlinear Algebraic Equations

American Mathematical Soc.

This monograph looks at several trends in the investigation of singular solutions of nonlinear elliptic and parabolic equations. It discusses results on the existence and properties of weak and entropy solutions for elliptic second-order equations and some classes of fourth-order equations with L1-data and questions on the removability of singularities of solutions to elliptic and parabolic second-order equations in divergence form. It looks at localized and nonlocalized singularly peaking boundary regimes for different classes of quasilinear parabolic second- and high-order equations in divergence form. The book will be useful for researchers and post-graduate students that specialize in the field of the theory of partial differential equations and nonlinear analysis. Contents: Foreword Part I: Nonlinear elliptic equations with L^1-data Nonlinear elliptic equations of the second order with L^1-data Nonlinear equations of the fourth order with strengthened coercivity and L^1-data Part II: Removability of singularities of the solutions of quasilinear elliptic and parabolic equations of the second order Removability of singularities of the solutions of quasilinear elliptic equations Removability of singularities of the solutions of quasilinear parabolic equations Quasilinear elliptic equations with coefficients from the Kato class Part III: Boundary regimes with peaking for quasilinear parabolic equations Energy methods for the

investigation of localized regimes with peaking for parabolic second-order equations Method of functional inequalities in peaking regimes for parabolic equations of higher orders Nonlocalized regimes with singular peaking Appendix: Formulations and proofs of the auxiliary results Bibliography

Programming for Computations - MATLAB/Octave Oxford University Press, USA

The theories of bifurcation, chaos and fractals as well as equilibrium, stability and nonlinear oscillations, are part of the theory of the evolution of solutions of nonlinear equations. A wide range of mathematical tools and ideas are drawn together in the study of these solutions, and the results applied to diverse and countless problems in the natural and social sciences, even philosophy. The text evolves from courses given by the author in the UK and the United States. It introduces the mathematical properties of nonlinear systems, mostly difference and differential equations, as an integrated theory, rather than presenting isolated fashionable topics. Topics are discussed in as concrete a way as possible and worked examples and problems are used to explain, motivate and illustrate the general principles. The essence of these principles, rather than proof or rigour, is emphasized. More advanced parts of the text are denoted by asterisks, and the mathematical prerequisites are limited to knowledge of linear algebra and advanced calculus, thus making it ideally suited to both senior undergraduates and postgraduates from physics, engineering, chemistry, meteorology etc. as well as mathematics.

Iterative Methods for Solving Nonlinear Equations

and Systems Walter de Gruyter

The goal of the book is to extend classical regularity theorems for solutions of linear elliptic partial differential equations to the context of fully nonlinear elliptic equations. This class of equations often arises in control theory, optimization, and other applications. The authors give a detailed presentation of all the necessary techniques. Instead of treating these techniques in their greatest generality, they outline the key ideas and prove the results needed for developing the subsequent theory. Topics discussed in the book include the theory of viscosity solutions for nonlinear equations, the Alexandroff estimate and Krylov-Safonov Harnack-type inequality for viscosity solutions, uniqueness theory for viscosity solutions, Evans and Krylov regularity theory for convex fully nonlinear equations, and regularity theory for fully nonlinear equations with variable coefficients.

Nonlinear Equations with Small Parameter Engineering Science Reference

This book is open access under a CC BY 4.0 license. This easy-to-read book introduces the basics of solving partial differential equations by means of finite difference methods. Unlike many of the traditional academic works on the topic, this book was written for practitioners. Accordingly, it especially addresses: the construction of finite difference schemes, formulation and implementation of algorithms, verification of implementations, analyses of physical behavior as implied by the numerical solutions, and how to apply the methods and

software to solve problems in the fields of physics and biology.

Nonlinear Equations: Methods, Models and Applications Longman Publishing Group

This second edition provides much-needed updates to the original volume. Like the first edition, it emphasizes the ideas behind the algorithms as well as their theoretical foundations and properties, rather than focusing strictly on computational details; at the same time, this new version is now largely self-contained and includes essential proofs. Additions have been made to almost every chapter, including an introduction to the theory of inexact Newton methods, a basic theory of continuation methods in the setting of differentiable manifolds, and an expanded discussion of minimization methods. New information on parametrized equations and continuation incorporates research since the first edition.

Fully Nonlinear Elliptic Equations Elsevier

Numerical Solution of Systems of Nonlinear Algebraic Equations contains invited lectures of the NSF-CBMS Regional Conference on the Numerical Solution of Nonlinear Algebraic Systems with Applications to Problems in Physics, Engineering and Economics, held on July 10-14, 1972. This book is composed of 10 chapters and begins with the concepts of nonlinear algebraic equations in continuum mechanics. The succeeding chapters deal with the numerical solution of quasilinear elliptic equations, the nonlinear systems in semi-infinite programming, and the solution of large systems of linear algebraic equations. These topics are followed by a survey of some computational techniques for the nonlinear least squares problem. The remaining chapters explore the problem of nonlinear functional minimization, the modification methods, and the computer-

oriented algorithms for solving system. These chapters also examine the principles of contractor theory of solving equations. This book will prove useful to undergraduate and graduate students.

Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer Cambridge University Press

Computer Science and Applied Mathematics: Iterative Solution of Nonlinear Equations in Several Variables presents a survey of the basic theoretical results about nonlinear equations in n dimensions and analysis of the major iterative methods for their numerical solution. This book discusses the gradient mappings and minimization, contractions and the continuation property, and degree of a mapping. The general iterative and minimization methods, rates of convergence, and one-step stationary and multistep methods are also elaborated. This text likewise covers the contractions and nonlinear majorants, convergence under partial ordering, and convergence of minimization methods. This publication is a good reference for specialists and readers with an extensive functional analysis background.

The Nonlinear Limit-Point/Limit-Circle Problem Walter de Gruyter GmbH & Co KG

This book is the first on the topic and explains the most cutting-edge methods needed for precise calculations and explores the development of powerful algorithms to solve

research problems. Multipoint methods have an extensive range of practical applications significant in research areas such as signal processing, analysis of convergence rate, fluid mechanics, solid state physics, and many others. The book takes an introductory approach in making qualitative comparisons of different multipoint methods from various viewpoints to help the reader understand applications of more complex methods. Evaluations are made to determine and predict efficiency and accuracy of presented models useful to wide a range of research areas along with many numerical examples for a deep understanding of the usefulness of each method. This book will make it possible for the researchers to tackle difficult problems and deepen their understanding of problem solving using numerical methods. Multipoint methods are of great practical importance, as they determine sequences of successive approximations for evaluative purposes. This is especially helpful in achieving the highest computational efficiency. The rapid development of digital computers and advanced computer arithmetic have provided a need for new methods useful to solving practical problems in a multitude of disciplines such as applied mathematics, computer science, engineering, physics, financial mathematics, and biology. Provides a succinct way of implementing a wide range of useful and important

numerical algorithms for solving research problems Illustrates how numerical methods can be used to study problems which have applications in engineering and sciences, including signal processing, and control theory, and financial computation Facilitates a deeper insight into the development of methods, numerical analysis of convergence rate, and very detailed analysis of computational efficiency Provides a powerful means of learning by systematic experimentation with some of the many fascinating problems in science Includes highly efficient algorithms convenient for the implementation into the most common computer algebra systems such as Mathematica, MatLab, and Maple