Solutions Nonlinear Equations

Exact Solutions and Invariant Subspaces of Nonlinear Partial Differential Equations in Mechanics and PhysicsProgramming for Computations - PythonIterative Methods for Linear and Nonlinear EquationsThe Optimal Homotopy Asymptotic MethodNonlinear Systems and ApplicationsIterative Solution of Nonlinear Equations in Several VariablesIntroduction to Nonlinear Differential and Integral EquationsNonlinear OpticsHandbook of Nonlinear Partial Differential EquationsProgramming for Computations - PythonPartial Differential Equations IIIInverse Problems and Nonlinear Evolution EquationsSolving Nonlinear Partial Differential Equations with Maple and MathematicaThe Nonlinear Diffusion EquationPower System OperationsNumerical Solution of Nonlinear EquationsComputational Solution of Nonlinear Systems of EquationsNonlinear Systems of Partial Differential EquationsIntermediate AlgebraNonlinear Equations: Methods, Models and ApplicationsMultipoint Methods for Solving Nonlinear EquationsCollege AlgebraGlobal Solutions of Nonlinear Schrödinger EquationsBlow-Up in Nonlinear Equations of Mathematical PhysicsModern Nonlinear EquationsProgramming for Computations - MATLAB/OctaveAdvanced Numerical Methods with Matlab 2Optimal Solution of Nonlinear EquationsIterative Methods for Solving Nonlinear Equations and SystemsA Priori Estimates for Positive Solutions of Strongly Nonlinear Equations in Two VariablesMorse Index of Solutions of Nonlinear Elliptic EquationsElementary Differential EquationsLinear and Nonlinear Integral EquationsNonlinear Differential EquationsSolving Nonlinear Equations with Newton's MethodNumerical and Analytical Solutions for Solving Nonlinear Equations in Heat TransferNumerical Solution of Systems of Nonlinear Algebraic EquationsIntroduction To Numerical Computation, An (Second Edition)Nonlinear Problems of EngineeringInternational Symposium on Nonlinear Differential Equations and Nonlinear Mechanics

Exact Solutions and Invariant Subspaces of Nonlinear Partial Differential Equations in Mechanics and Physics

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.

Programming for Computations - Python

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.

Iterative Methods for Linear and Nonlinear Equations

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.

The Optimal Homotopy Asymptotic Method

Nonlinear Systems and Applications: An International Conference contains the proceedings of an International Conference on Nonlinear Systems and Applications held at the University of Texas at Arlington, on July 19-23, 1976. The conference provided a forum for reviewing advances in nonlinear systems and their applications and tackled a wide array of topics ranging from abstract evolution equations and nonlinear semigroups to controllability and reachability. Various methods used in solving equations are also discussed, including approximation techniques for delay systems. Most of the applications are in the area of the life sciences. Comprised of 59 chapters, this book begins with a discussion on monotonically convergent upper and lower bounds for classes of conflicting populations, followed by an analysis of constrained problems. The reader is then introduced to approximation techniques for delay systems in biological models; differential inequalities for Liapunov functions; and stability or chaos in discrete epidemic models. Subsequent chapters deal with nonlinear boundary value problems for elliptic systems; bounds for solutions of reaction-diffusion equations; monotonicity and measurability; and periodic solutions of some integral equations from the theory of epidemics. This monograph will be helpful to students, practitioners, and researchers in the field of mathematics.

Nonlinear Systems and Applications

Iterative Solution of Nonlinear Equations in Several Variables

Introduction to Nonlinear Differential and Integral Equations

Nonlinear Differential Equations and Nonlinear Mechanics provides information pertinent to nonlinear differential equations, nonlinear mechanics, control theory, and other related topics. This book discusses the properties of solutions of equations in standard form in the infinite time interval. Organized into 49 chapters, this book starts with an overview of the characteristic types of differential equation systems with small parameters. This text then explains the structurally stable fields on a differentiable two manifold are the ones that exhibit the simplest features. Other chapters explore the canonic system of hyperbolic partial differential equations with fixed characteristics. This book discusses as well the monofrequent oscillations that are predominantly near one or the other of the linear modes of motion. The final chapter deals with the existence and asymptotic character of solutions of the nonlinear boundary value problem. This book is a valuable resource for pure and applied mathematicians. Aircraft engineers will also find this book useful.

Nonlinear Optics

Nonlinear Problems of Engineering reviews certain nonlinear problems of engineering. This book provides a discussion of nonlinear problems that occur in four areas, namely, mathematical methods, fluid mechanics, mechanics of solids, and transport phenomena. Organized into 15 chapters, this book begins with an overview of some of the fundamental ideas of two mathematical theories, namely, invariant imbedding and dynamic programming. This text then explores nonlinear integral equations, which have long occupied a prominent place in mathematical analysis. Other chapters consider the phenomena associated with essentially divergent small-divisor series, such as may occur in the formal solution of differential equations that represent the oscillations of conservative dynamical systems. This book discusses as well the mechanics of idealized textiles consisting of inextensible filaments. The final chapter deals with the use of the Peaceman–Rachford alternating direction implicit method for solving the finite difference analogs of boundary value problems. This book is a valuable resource for engineers and mathematicians.

Handbook of Nonlinear Partial Differential Equations

Covers major types of classical equations: operator, functional, difference, integro-differential, and more. Suitable for graduate students as well as scientists, technologists, and mathematicians. "A welcome contribution." — Math Reviews. 1964 edition.

Programming for Computations - Python

Linear and Nonlinear Integral Equations: Methods and Applications is a self-contained book divided into two parts. Part I offers a comprehensive and systematic treatment of linear integral equations of the first and second kinds. The text brings together newly developed methods to reinforce and complement the existing procedures for solving linear integral equations. The Volterra integral and integro-differential equations, the Fredholm integral and integro-differential equations, the Volterra-Fredholm integral equations, singular and weakly singular integral equations, and systems of these equations, are handled in this part by using many different computational schemes. Selected worked-through examples and exercises will guide readers through the text. Part II provides an extensive exposition on the nonlinear integral equations and their varied applications, presenting in an accessible manner a systematic treatment of ill-posed Fredholm problems, bifurcation points, and singular points. Selected applications are also investigated by using the powerful Padé approximants. This book is intended for scholars and researchers in the fields of physics, applied mathematics and engineering. It can also be used as a text for advanced undergraduate and graduate students in applied mathematics, science and engineering, and related fields. Dr. Abdul-Majid Wazwaz is a Professor of Mathematics at Saint Xavier University in Chicago, Illinois, USA.

Partial Differential Equations III

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.

Inverse Problems and Nonlinear Evolution Equations

This monograph presents in a unified manner the use of the Morse index, and especially its connections to the maximum principle, in the study of nonlinear elliptic equations. The knowledge or a bound on the Morse index of a solution is a very important qualitative information which can be used in several ways for different problems, in order to derive uniqueness, existence or nonexistence, symmetry, and other properties of solutions.

Solving Nonlinear Partial Differential Equations with Maple and Mathematica

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.

The Nonlinear Diffusion Equation

This book is based on the method of operator identities and related theory of S-nodes, both developed by Lev Sakhnovich. The notion of the transfer matrix function generated by the S-node plays an essential role. The authors present fundamental solutions of various important systems of differential equations using the transfer matrix function, that is, either directly in the form of the transfer matrix function or via the representation in this form of the corresponding Darboux matrix, when Bäcklund–Darboux transformations and explicit solutions are considered. The transfer matrix function representation of the fundamental solution yields solution of an inverse problem, namely, the problem to recover system from its Weyl function. Weyl theories of selfadjoint and skew-selfadjoint Dirac systems, related canonical systems, discrete Dirac systems, system auxiliary to the N-wave equation and a system rationally depending on the spectral parameter are obtained in this way. The results on direct and inverse problems are applied in turn to the study of the initial-boundary value problems for integrable (nonlinear) wave equations via inverse spectral transformation method. Evolution of the Weyl function and solution of the initial-boundary value problem in a semi-strip are derived for many important nonlinear equations. Some uniqueness and global existence results are also proved in detail using evolution formulas. The reading of the book requires only some basic knowledge of linear algebra, calculus and operator theory from the standard university courses.

Power System Operations

Nonlinear optics is a rapidly developing field of modern physics. Nonlinear optical phenomena such as self-focusing, self-phase modulation, soliton formation and propagation, higher harmonic generation, different types of stimulated light scattering, and four-wave mixing have attracted interest from the fundamental point of view of the investigation of light/matter interaction, and as a basis for applications in contemporary optical communications and optical signal processing. Nonlinear Optics - Novel Results in Theory and Applications contains novel results concerning the mathematical methods of nonlinear optical phenomena analysis, soliton formation and propagation in optical fibers, and peculiarities of nonlinear optical phenomena in micro- and nanostructures. The book may be interesting for researchers and engineers interested in nonlinear optics, lasers, and optical communications.

Numerical Solution of Nonlinear Equations

Engineering applications offer benefits and opportunities across a range of different industries and fields. By developing effective methods of analysis, results and solutions are produced with higher accuracy. Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer is an innovative source of academic research on the optimized techniques for analyzing heat transfer equations and the application of these methods across various fields. Highlighting pertinent topics such as the differential transformation method, industrial applications, and the homotopy perturbation method, this book is ideally designed for engineers, researchers, graduate students, professionals, and academics interested in applying new mathematical techniques in engineering sciences.

Computational Solution of Nonlinear Systems of Equations

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 Systems of Partial Differential Equations

This book is published open access under a CC BY 4.0 license. This book presents computer programming as a key method for solving mathematical problems. This second edition of the well-received book has been extensively revised: All code is now written in Python version 3.6 (no longer version 2.7). In addition, the two first chapters of the previous edition have been extended and split up into five new chapters, thus expanding the introduction to programming from 50 to 150 pages. Throughout the book, the explanations provided are now more detailed, previous examples have been modified, and new sections, examples and exercises have been added. Also, a number of small errors have been corrected. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style employed 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 students to write simple programs for solving common mathematical problems with numerical methods in the context of engineering and science courses. The emphasis is on generic algorithms, clean program design, the use of functions, and automatic tests for verification.

Intermediate Algebra

Nonlinear Equations: Methods, Models and Applications

The purpose of this book is to introduce and study numerical methods basic and advanced ones for scientific computing. This last refers to the implementation of appropriate approaches to the treatment of a scientific problem arising from physics (meteorology, pollution, etc.) or of engineering (mechanics of structures, mechanics of fluids, treatment signal, etc.). Each chapter of this book recalls the essence of the different methods resolution and presents several applications in the field of engineering as well as programs developed under Matlab software.

Multipoint Methods for Solving Nonlinear Equations

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).

College Algebra

Optimal Solution of Nonlinear Equations is a text/monograph designed to provide an overview of optimal computational methods for the solution of nonlinear equations, fixed points of contractive and noncontractive mapping, and for the computation of the topological degree. It is of interest to any reader working in the area of Information-Based Complexity. The worst-case settings are analyzed here. Several classes of functions are studied with special emphasis on tight complexity bounds and methods which are close to or achieve these bounds. Each chapter ends with exercises, including companies and open-ended research based exercises.

Global Solutions of Nonlinear Schrödinger Equations

This text has been written in clear and accurate language that students can read and comprehend. The author has minimized the number of explicitly state theorems and definitions, in favor of dealing with concepts in a more conversational manner. This is illustrated by over 250 worked out examples. The problems are extremely high quality and are regarded as one of the text's many strengths. This book also allows the instructor to select the level of technology desired. Trench has simplified this by using the symbols C and L. C exercises call for computation and/or graphics, and L exercises are laboratory exercises that require extensive use of technology. Several sections include informal advice on the use of technology. The instructor who prefers not to emphasize technology can ignore these exercises.

Blow-Up in Nonlinear Equations of Mathematical Physics

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

Modern Nonlinear Equations

This book serves as a set of lecture notes for a senior undergraduate level course on the introduction to numerical computation, which was developed through 4 semesters of teaching the course over 10 years. The book requires minimum background knowledge from the students, including only a three-semester of calculus, and a bit on matrices.The book covers many of the introductory topics for a first course in numerical computation, which fits in the short time frame of a semester course. Topics range from polynomial approximations and interpolation, to numerical methods for ODEs and PDEs. Emphasis was made more on algorithm development, basic mathematical ideas behind the algorithms, and the implementation in Matlab.The book is supplemented by two sets of videos, available through the author's YouTube channel. Homework problem sets are provided for each chapter, and complete answer sets are available for instructors upon request.The second edition contains a set of selected advanced topics, written in a self-contained manner, suitable for self-learning or as additional material for an honored version of the course. Videos are also available for these added topics.

Programming for Computations - MATLAB/Octave

Nonlinear Differential Equations: Invariance, Stability, and Bifurcation presents the developments in the qualitative theory of nonlinear differential equations. This book discusses the exchange of mathematical ideas in stability and bifurcation theory. Organized into 26 chapters, this book begins with an overview of the initial value problem for a nonlinear wave equation. This text then focuses on the interplay between stability exchange for a stationary solution and the appearance of bifurcating periodic orbits. Other chapters consider the development of methods for ascertaining stability and boundedness and explore the development of bifurcation and stability analysis in nonlinear models of applied sciences. This book discusses as well nonlinear hyperbolic equations in further contributions, featuring stability properties of periodic and almost periodic solutions. The reader is also introduced to the stability problem of the equilibrium of a chemical network. The final chapter deals with suitable spaces for studying functional equations. This book is a valuable resource for mathematicians.

Advanced Numerical Methods with Matlab 2

Optimal Solution of Nonlinear Equations

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.

Iterative Methods for Solving Nonlinear Equations and Systems

"The text is suitable for a typical introductory algebra course, and was developed to be used flexibly. While the breadth of topics may go beyond what an instructor would cover, the modular approach and the richness of content ensures that the book meets the needs of a variety of programs."--Page 1.

A Priori Estimates for Positive Solutions of Strongly Nonlinear Equations in Two Variables

Morse Index of Solutions of Nonlinear Elliptic Equations

Since the 'Introduction' to the main text gives an account of the way in which the problems treated in the following pages originated, this 'Preface' may be limited to an acknowledgement of the support the work has received. It started during the pe riod when I was professor of aero- and hydrodynamics at the Technical University in Delft, Netherlands, and many discussions with colleagues ha ve in:fluenced its devel opment. Oftheir names I mention here only that ofH. A. Kramers. Papers No. 1-13 ofthe list given at the end ofthe text were written during that period. Severa! ofthese were attempts to explore ideas which later had to be abandoned, but gradually a line of thought emerged which promised more definite results. This line began to come to the foreground in pa per No. 3 (1939}, while a preliminary formulation ofthe results was given in paper No. 12 (1954}. At that time, however, there still was missing a practica! method for manipulating a certain distribution function of central interest. A six months stay at the Hydrodynamics Laboratories ofthe California Institute of Technology, Pasadena, California (1950-1951}, was supported by a Contract with the Department of the Air F orce, N o. AF 33(038}-17207. A course of lectures was given during this period, which were published in typescript under the title 'On Turbulent Fluid Motion', as Report No. E-34. 1, July 1951, of the Hydrodynamics Laboratory.

Elementary Differential Equations

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.

Linear and Nonlinear Integral Equations

Topics covered include differential equations of the 1st order, the Riccati equation and existence theorems, 2nd order equations, elliptic integrals and functions, nonlinear mechanics, nonlinear integral equations, more. Includes 137 problems.

Nonlinear Differential Equations

The present book carefully studies the blow-up phenomenon of solutions to partial differential equations, including many equations of mathematical physics. The included material is based on lectures read by the authors at the Lomonosov Moscow State University, and the book is addressed to a wide range of researchers and graduate students working in nonlinear partial differential equations, nonlinear functional analysis, and mathematical physics. Contents Nonlinear capacity method of S. I. Pokhozhaev Method of self-similar solutions of V. A. Galaktionov Method of test functions in combination with method of nonlinear capacity Energy method of H. A. Levine Energy method of G. Todorova Energy method of S. I. Pokhozhaev Energy method of V. K. Kalantarov and O. A. Ladyzhenskaya Energy method of M. O. Korpusov and A. G. Sveshnikov Nonlinear Schrödinger equation Variational method of L. E. Payne and D. H. Sattinger Breaking of solutions of wave equations Auxiliary and additional results

Solving Nonlinear Equations with Newton's Method

This textbook provides a detailed description of operation problems in power systems, including power system modeling, power system steady-state operations, power system state estimation, and electricity markets. The book provides an appropriate blend of theoretical background and practical applications, which are developed as working algorithms, coded in Octave (or Matlab) and GAMS environments. This feature strengthens the usefulness of the book for both students and practitioners. Students will gain an insightful understanding of current power system operation problems in engineering, including: (i) the formulation of decision-making models, (ii) the familiarization with efficient solution algorithms for such models, and (iii) insights into these problems through the detailed analysis of numerous illustrative examples. The authors use a modern, “building-block” approach to solving complex problems, making the topic accessible to students with limited background in power systems. Solved examples are used to introduce new concepts and each chapter ends with a set of exercises.

Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer

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.

Numerical Solution of Systems of Nonlinear Algebraic Equations

Solving nonlinear equations in Banach spaces (real or complex nonlinear equations, nonlinear systems, and nonlinear matrix equations, among others), is a non-trivial task that involves many areas of science and technology. Usually the solution is not directly affordable and require an approach using iterative algorithms. This Special Issue focuses mainly on the design, analysis of convergence, and stability of new schemes for solving nonlinear problems and their application to practical problems. Included papers study the following topics: Methods for finding simple or multiple roots either with or without derivatives, iterative methods for approximating different generalized inverses, real or complex dynamics associated to the rational functions resulting from the application of an iterative method on a polynomial. Additionally, the analysis of the convergence has been carried out by means of different sufficient conditions assuring the local, semilocal, or global convergence. This Special issue has allowed us to present the latest research results in the area of iterative processes for solving nonlinear equations as well as systems and matrix equations. In addition to the theoretical papers, several manuscripts on signal processing, nonlinear integral equations, or partial differential equations, reveal the connection between iterative methods and other branches of science and engineering.

Introduction To Numerical Computation, An (Second Edition)

This book emphasizes in detail the applicability of the Optimal Homotopy Asymptotic Method to various engineering problems. It is a continuation of the book “Nonlinear Dynamical Systems in Engineering: Some Approximate Approaches”, published at Springer in 2011 and it contains a great amount of practical models from various fields of engineering such as classical and fluid mechanics, thermodynamics, nonlinear oscillations, electrical machines and so on. The main structure of the book consists of 5 chapters. The first chapter is introductory while the second chapter is devoted to a short history of the development of homotopy methods, including the basic ideas of the Optimal Homotopy Asymptotic Method. The last three chapters, from Chapter 3 to Chapter 5, are introducing three distinct alternatives of the Optimal Homotopy Asymptotic Method with illustrative applications to nonlinear dynamical systems. The third chapter deals with the first alternative of our approach with two iterations. Five applications are presented from fluid mechanics and nonlinear oscillations. The Chapter 4 presents the Optimal Homotopy Asymptotic Method with a single iteration and solving the linear equation on the first approximation. Here are treated 32 models from different fields of engineering such as fluid mechanics, thermodynamics, nonlinear damped and undamped oscillations, electrical machines and even from physics and biology. The last chapter is devoted to the Optimal Homotopy Asymptotic Method with a single iteration but without solving the equation in the first approximation.

Nonlinear Problems of Engineering

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:

International Symposium on Nonlinear Differential Equations and Nonlinear Mechanics

Linear and nonlinear systems of equations are the basis for many, if not most, of the models of phenomena in science and engineering, and their efficient numerical solution is critical to progress in these areas. This is the first book to be published on nonlinear equations since the mid-1980s. Although it stresses recent developments in this area, such as Newton-Krylov methods, considerable material on linear equations has been incorporated. This book focuses on a small number of methods and treats them in depth. The author provides a complete analysis of the conjugate gradient and generalized minimum residual iterations as well as recent advances including Newton-Krylov methods, incorporation of inexactness and noise into the analysis, new proofs and implementations of Broyden's method, and globalization of inexact Newton methods. Examples, methods, and algorithmic choices are based on applications to infinite dimensional problems such as partial differential equations and integral equations. The analysis and proof techniques are constructed with the infinite dimensional setting in mind and the computational examples and exercises are based on the MATLAB environment.