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Advances In Engineering Mechanics--reflections And Outlooks: In Honor Of Theodore Y-t Wu Sep 06 2020 This volume presents more than 40 original papers on recent advances in several topics in engineering mechanics presented at The Theodore Y-T Wu Symposium on Engineering Mechanics: A celebration of Professor Wu's scientific contributions for his 80th birthday. The distinguished contributors include several members of the National Academy of Engineers and the topics cover nonlinear water waves, swimming and flying in nature, biomechanics, data analysis methodology, and propulsion hydrodynamics. The papers honor the significant accomplishments of Professor Wu in Engineering Science at Caltech, particularly in the areas of nonlinear waves, hydrodynamics, biomechanics and wave-structure interaction. They review the present state of the art of engineering mechanics, and chart the future of the field from the viewpoint of civil engineering, biomechanics, geophysics, mechanical engineering, naval architecture, ocean, and offshore engineering. The primary purpose of this book is to provide guidance and inspiration for those interested in continuing to advance engineering mechanics into the 21st century. To quote Professor Wu: "The value of a book publication lies in disseminating new knowledge attained with effort and dedication from all those who participate, and in having the useful results within ready reach of students and researchers actively working in the field."

Fractional Derivative Modeling in Mechanics and Engineering May 03 2020 This book highlights the theory of fractional calculus and its wide applications in mechanics and engineering. It describes research findings in using fractional calculus methods for modeling and numerical simulation of complex mechanical behavior. It covers the mathematical basis of fractional calculus, the relationship between fractal and fractional calculus, unconventional statistics and anomalous diffusion, typical applications of fractional calculus, and the numerical solution of the fractional differential equation. It also summarizes the latest findings, such as variable order derivative, distributed order derivative, and its applications. The book avoids lengthy mathematical demonstrations and presents the theories related to the applications in an easily readable manner. This textbook intends for students, researchers, and professionals in applied physics, engineering mechanics, and applied mathematics. It is also of high reference value for those in environmental mechanics, geotechnical mechanics, biomechanics, and rheology.

Beyond Perturbation Nov 01 2022 Solving nonlinear problems is inherently difficult, and the stronger the nonlinearity, the more intractable solutions become. Analytic approximations often break down as nonlinearity becomes strong, and even perturbation approximations are valid only for problems with weak nonlinearity. This book introduces a powerful new analytic method for nonlinear problems-homotopy analysis-that remains valid even with strong nonlinearity. In Part I, the author starts with a very simple example, then presents the basic ideas, detailed procedures, and the advantages (and limitations) of homotopy analysis. Part II illustrates the application of homotopy analysis to many interesting nonlinear problems. These range from simple bifurcations of a nonlinear boundary-value problem to the Thomas-Fermi atom model, Volterra's population model, Von Karman swirling viscous flow, and nonlinear progressive waves in deep water. Although the homotopy analysis method has been verified in a number of prestigious journals, it has yet to be fully detailed in book form. Written by a pioneer in its development, *Beyond Perturbation: Introduction to the Homotopy Analysis Method* is your first opportunity to explore the details of this valuable new approach, add it to your analytic toolbox, and perhaps make contributions to some of the questions that remain open.

Mathematical Techniques of Fractional Order Systems Jul 17 2021 *Mathematical Techniques of Fractional Order Systems* illustrates advances in linear and nonlinear fractional-order systems relating to many interdisciplinary applications, including biomedical, control, circuits, electromagnetics and

security. The book covers the mathematical background and literature survey of fractional-order calculus and generalized fractional-order circuit theorems from different perspectives in design, analysis and realizations, nonlinear fractional-order circuits and systems, the fractional-order memristive circuits and systems in design, analysis, emulators, simulation and experimental results. It is primarily meant for researchers from academia and industry, and for those working in areas such as control engineering, electrical engineering, computer science and information technology. This book is ideal for researchers working in the area of both continuous-time and discrete-time dynamics and chaotic systems. Discusses multidisciplinary applications with new fundamentals, modeling, analysis, design, realization and experimental results Includes circuits and systems based on new nonlinear elements Covers most of the linear and nonlinear fractional-order theorems that will solve many scientific issues for researchers Closes the gap between theoretical approaches and real-world applications Provides MATLAB® and Simulink code for many applications in the book

Computational Mathematics, Nanoelectronics, and Astrophysics Aug 18 2021 This book is a collection of original papers presented at the International Conference on Computational Mathematics in Nanoelectronics and Astrophysics (CMNA 2018) held at the Indian Institute of Technology Indore, India, from 1 to 3 November 2018. It aims at presenting recent developments of computational mathematics in nanoelectronics, astrophysics and related areas of space sciences and engineering. These proceedings discuss the most advanced innovations, trends and real-world challenges encountered and their solutions with the application of computational mathematics in nanoelectronics, astrophysics and space sciences. From focusing on nano-enhanced smart technological developments to the research contributions of premier institutes in India and abroad on ISRO 's future space explorations—this book includes topics from highly interdisciplinary areas of research. The book is of interest to researchers, students and practising engineers working in diverse areas of science and engineering, ranging from applied and computational mathematics to nanoelectronics, nanofabrications and astrophysics.

Nonlinear Ordinary Differential Equations Mar 25 2022 The book discusses the solutions to nonlinear ordinary differential equations (ODEs) using analytical and numerical approximation methods. Recently, analytical approximation methods have been largely used in solving linear and nonlinear lower-order ODEs. It also discusses using these methods to solve some strong nonlinear ODEs. There are two chapters devoted to solving nonlinear ODEs using numerical methods, as in practice high-dimensional systems of nonlinear ODEs that cannot be solved by analytical approximate methods are common. Moreover, it studies analytical and numerical techniques for the treatment of parameter-dependent ODEs. The book explains various methods for solving nonlinear-oscillator and structural-system problems, including the energy balance method, harmonic balance method, amplitude frequency formulation, variational iteration method, homotopy perturbation method, iteration perturbation method, homotopy analysis method, simple and multiple shooting method, and the nonlinear stabilized march method. This book comprehensively investigates various new analytical and numerical approximation techniques that are used in solving nonlinear-oscillator and structural-system problems. Students often rely on the finite element method to such an extent that on graduation they have little or no knowledge of alternative methods of solving problems. To rectify this, the book introduces several new approximation techniques.

Modifications of Homotopy Analysis Method for Differential Equations Aug 30 2022 This book bring new solutions for various types of differential equations. Approximate analytic solution was obtained for system of differential equations specially that has chaotic behavior, delay differential equations, Schrodinger and coupled Schrodinger equation, fractional differential equations, differential algebraic equations and some other fluid mechanic models. Accurate and simple solution was presented via several modifications for homotopy analysis method.

Nonlinear Dynamical Systems in Engineering Feb 21 2022 This book presents and extend different known methods to solve different types of strong nonlinearities encountered by engineering systems. A better knowledge of the classical methods presented in the first part lead to a better choice of the so-

called “ base functions ” . These are absolutely necessary to obtain the auxiliary functions involved in the optimal approaches which are presented in the second part. Every chapter introduces a distinct approximate method applicable to nonlinear dynamical systems. Each approximate analytical approach is accompanied by representative examples related to nonlinear dynamical systems from various fields of engineering.

Poincaré's Conjecture Jun 15 2021

Computational Methods for Integral Equations Jan 23 2022

Analytical Methods in Nonlinear Oscillations Oct 20 2021 This book covers both classical and modern analytical methods in nonlinear systems. A wide range of applications from fundamental research to engineering problems are addressed. The book contains seven chapters, each with miscellaneous problems and their detailed solutions. More than 100 practice problems are illustrated, which might be useful for students and researchers in the areas of nonlinear oscillations and applied mathematics. With providing real world examples, this book shows the multidisciplinary emergence of nonlinear dynamical systems in a wide range of applications including mechanical and electrical oscillators, micro/nano resonators and sensors, and also modelling of global warming, epidemic diseases, sociology, chemical reactions, biology and ecology.

Nonlinear Flow Phenomena and Homotopy Analysis Jun 27 2022 Since most of the problems arising in science and engineering are nonlinear, they are inherently difficult to solve. Traditional analytical approximations are valid only for weakly nonlinear problems and often fail when used for problems with strong nonlinearity. “ Nonlinear Flow Phenomena and Homotopy Analysis: Fluid Flow and Heat Transfer ” presents the current theoretical developments of the analytical method of homotopy analysis. This book not only addresses the theoretical framework for the method, but also gives a number of examples of nonlinear problems that have been solved by means of the homotopy analysis method. The particular focus lies on fluid flow problems governed by nonlinear differential equations. This book is intended for researchers in applied mathematics, physics, mechanics and engineering. Both Kuppapalle Vajravelu and Robert A. Van Gorder work at the University of Central Florida, USA.

Advanced Numerical and Semi-Analytical Methods for Differential Equations Apr 25 2022 Examines numerical and semi-analytical methods for differential equations that can be used for solving practical ODEs and PDEs This student-friendly book deals with various approaches for solving differential equations numerically or semi-analytically depending on the type of equations and offers simple example problems to help readers along. Featuring both traditional and recent methods, Advanced Numerical and Semi Analytical Methods for Differential Equations begins with a review of basic numerical methods. It then looks at Laplace, Fourier, and weighted residual methods for solving differential equations. A new challenging method of Boundary Characteristics Orthogonal Polynomials (BCOPs) is introduced next. The book then discusses Finite Difference Method (FDM), Finite Element Method (FEM), Finite Volume Method (FVM), and Boundary Element Method (BEM). Following that, analytical/semi analytic methods like Akbari Ganji's Method (AGM) and Exp-function are used to solve nonlinear differential equations. Nonlinear differential equations using semi-analytical methods are also addressed, namely Adomian Decomposition Method (ADM), Homotopy Perturbation Method (HPM), Variational Iteration Method (VIM), and Homotopy Analysis Method (HAM). Other topics covered include: emerging areas of research related to the solution of differential equations based on differential quadrature and wavelet approach; combined and hybrid methods for solving differential equations; as well as an overview of fractal differential equations. Further, uncertainty in term of intervals and fuzzy numbers have also been included, along with the interval finite element method. This book: Discusses various methods for solving linear and nonlinear ODEs and PDEs Covers basic numerical techniques for solving differential equations along with various discretization methods Investigates nonlinear differential equations using semi-analytical methods Examines differential equations in an uncertain environment Includes a new scenario in which uncertainty (in term of intervals and fuzzy numbers) has been included in differential equations Contains solved example problems, as well as some unsolved problems for self-validation of the topics covered Advanced Numerical and Semi Analytical Methods for

Differential Equations is an excellent text for graduate as well as post graduate students and researchers studying various methods for solving differential equations, numerically and semi-analytically.

Advances in the Homotopy Analysis Method Dec 02 2022 Unlike other analytic techniques, the Homotopy Analysis Method (HAM) is independent of small/large physical parameters. Besides, it provides great freedom to choose equation type and solution expression of related linear high-order approximation equations. The HAM provides a simple way to guarantee the convergence of solution series. Such uniqueness differentiates the HAM from all other analytic approximation methods. In addition, the HAM can be applied to solve some challenging problems with high nonlinearity. This book, edited by the pioneer and founder of the HAM, describes the current advances of this powerful analytic approximation method for highly nonlinear problems. Coming from different countries and fields of research, the authors of each chapter are top experts in the HAM and its applications. Contents: Chance and Challenge: A Brief Review of Homotopy Analysis Method (S-J Liao) Predictor Homotopy Analysis Method (PHAM) (S Abbasbandy and E Shivanian) Spectral Homotopy Analysis Method for Nonlinear Boundary Value Problems (S Motsa and P Sibanda) Stability of Auxiliary Linear Operator and Convergence-Control Parameter (R A Van Gorder) A Convergence Condition of the Homotopy Analysis Method (M Turkyilmazoglu) Homotopy Analysis Method for Some Boundary Layer Flows of Nanofluids (T Hayat and M Mustafa) Homotopy Analysis Method for Fractional Swift–Hohenberg Equation (S Das and K Vishal) HAM-Based Package NOPH for Periodic Oscillations of Nonlinear Dynamic Systems (Y-P Liu) HAM-Based Mathematica Package BVPh 2.0 for Nonlinear Boundary Value Problems (Y-L Zhao and S-J Liao) Readership: Graduate students and researchers in applied mathematics, physics, nonlinear mechanics, engineering and finance. Keywords: Analytic Approximation Method; Nonlinear; Homotopy; Applied Mathematics Key Features: The method described in the book can overcome almost all restrictions of other analytic approximation method for nonlinear problems This book is the first in homotopy analysis method, covering the newest advances, contributed by many top experts in different fields

Advances in Mathematical Modelling, Applied Analysis and Computation Jan 29 2020 This book is a valuable source for graduate students and researchers and provides a comprehensive introduction to recent theories and applications of mathematical modeling and numerical simulation. It includes selected peer-reviewed papers presented at the 4th International Conference on Mathematical Modelling, Applied Analysis and Computation (ICMMAAC 2021), held at JECRC University, Jaipur, India, during August 57, 2021. The book is focused on mathematical modeling of various problems arising in science and engineering and new efficient numerical approaches for solving linear nonlinear problems and rigorous mathematical theories, which can be used to analyze different kinds of mathematical models. Applications of mathematical methods in physics, chemistry, biology, mechanical engineering, civil engineering, computer science, social science, and finance are presented.

Methods of Mathematical Modelling Apr 13 2021 This book features original research articles on the topic of mathematical modelling and fractional differential equations. The contributions, written by leading researchers in the field, consist of chapters on classical and modern dynamical systems modelled by fractional differential equations in physics, engineering, signal processing, fluid mechanics, and bioengineering, manufacturing, systems engineering, and project management. The book offers theory and practical applications for the solutions of real-life problems and will be of interest to graduate level students, educators, researchers, and scientists interested in mathematical modelling and its diverse applications. Features Presents several recent developments in the theory and applications of fractional calculus Includes chapters on different analytical and numerical methods dedicated to several mathematical equations Develops methods for the mathematical models which are governed by fractional differential equations Provides methods for models in physics, engineering, signal processing, fluid mechanics, and bioengineering Discusses real-world problems, theory, and applications

Fractional Derivatives with Mittag-Leffler Kernel Aug 06 2020 This book offers a timely overview of fractional calculus applications, with a special emphasis on fractional derivatives with Mittag-Leffler

kernel. The different contributions, written by applied mathematicians, physicists and engineers, offers a snapshot of recent research in the field, highlighting the current methodological frameworks together with applications in different fields of science and engineering, such as chemistry, mechanics, epidemiology and more. It is intended as a timely guide and source of inspiration for graduate students and researchers in the above-mentioned areas.

Modeling and Analysis of Modern Fluid Problems Oct 27 2019 Modeling and Analysis of Modern Fluids helps researchers solve physical problems observed in fluid dynamics and related fields, such as heat and mass transfer, boundary layer phenomena, and numerical heat transfer. These problems are characterized by nonlinearity and large system dimensionality, and 'exact' solutions are impossible to provide using the conventional mixture of theoretical and analytical analysis with purely numerical methods. To solve these complex problems, this work provides a toolkit of established and novel methods drawn from the literature across nonlinear approximation theory. It covers Padé approximation theory, embedded-parameters perturbation, Adomian decomposition, homotopy analysis, modified differential transformation, fractal theory, fractional calculus, fractional differential equations, as well as classical numerical techniques for solving nonlinear partial differential equations. In addition, 3D modeling and analysis are also covered in-depth. Systematically describes powerful approximation methods to solve nonlinear equations in fluid problems Includes novel developments in fractional order differential equations with fractal theory applied to fluids Features new methods, including Homotopy Approximation, embedded-parameter perturbation, and 3D models and analysis

New Developments in Science and Mathematics Jul 05 2020 All over the world there are considerable development in science and mathematics. This book presents new developments in physics, chemistry, biology, mathematics and their application areas. Each area of applications has its own peculiarities requiring specialized solutions. The International Dumlupinar Science and Mathematics Congress - IDUSMAC 2022 was held at Kütahya Dumlupinar University from 05 to 07 September, 2022 with the intention of bringing together researchers and students from these various areas. This book contains peer reviewed full papers, which are oral presented at the congress, and recent developments in science and mathematics not previously published. We would like to thank each of the authors for contributing our book and Kütahya Dumlupinar University Scientific Research Projects Coordination Unit for financial support (Project Number 2022/49).

Generalized Fractional Order Differential Equations Arising in Physical Models Sep 18 2021 This book analyzes the various semi-analytical and analytical methods for finding approximate and exact solutions of fractional order partial differential equations. It explores approximate and exact solutions obtained by various analytical methods for fractional order partial differential equations arising in physical models.

Encyclopedia of Ocean Engineering Dec 30 2019 This encyclopedia adopts a wider definition for the concept of ocean engineering. Specifically, it includes (1) offshore engineering: fixed and floating offshore oil and gas platforms; pipelines and risers; cables and moorings; buoy technology; foundation engineering; ocean mining; marine and offshore renewable energy; aquaculture engineering; and subsea engineering; (2) naval architecture: ship and special marine vehicle design; intact and damaged stability; technology for energy efficiency and green shipping; ship production technology; decommissioning and recycling; (3) polar and Arctic Engineering: ice mechanics; ice-structure interaction; polar operations; polar design; environmental protection; (4) underwater technologies: AUV/ROV design; AUV/ROV hydrodynamics; maneuvering and control; and underwater-specific communicating and sensing systems for AUV/ROVs. It summarizes the A-Z of the background and application knowledge of ocean engineering for use by ocean scientists and ocean engineers as well as nonspecialists such as engineers and scientists from all disciplines, economists, students, and politicians. Ocean engineering theories, ocean devices and equipment, ocean design and operation technologies are described by international experts, many from industry and each entry offers an introduction and references for further study, making current technology and operating practices available for future generations to learn from. The book also furthers our understanding of the current state of the art, leading to new and more efficient technologies with breakthroughs from new theory and

materials. As the land resources approach the exploitation limit, ocean resources are becoming the next choice for the sustainable development. As such, ocean engineering is vital in the 21st century.

Introduction to Homotopy Theory Nov 08 2020 Homotopy theory, which is the main part of algebraic topology, studies topological objects up to homotopy equivalence. Homotopy equivalence is weaker relations than topological equivalence, i.e., homotopy classes of spaces are larger than homeomorphism classes. Even though the ultimate goal of topology is to classify various classes of topological spaces up to a homeomorphism, in algebraic topology, homotopy equivalence plays a more important role than homeomorphism, essentially because the basic tools of algebraic topology (homology and homotopy groups) are invariant with respect to homotopy equivalence, and do not distinguish topologically nonequivalent, but homotopic objects. The idea of homotopy can be turned into a formal category of category theory. The homotopy category is the category whose objects are topological spaces, and whose morphisms are homotopy equivalence classes of continuous maps. Two topological spaces X and Y are isomorphic in this category if and only if they are homotopy-equivalent. Then a functor on the category of topological spaces is homotopy invariant if it can be expressed as a functor on the homotopy category. Based on the concept of the homotopy, computation methods for algebraic and differential equations have been developed. The methods for algebraic equations include the homotopy continuation method and the continuation method. The methods for differential equations include the homotopy analysis method. In practice, there are technical difficulties in using homotopies with certain spaces. Algebraic topologists work with compactly generated spaces, CW complexes, or spectra. This book deals with homotopy theory, one of the main branches of algebraic topology.

Computational Fractional Dynamical Systems Mar 13 2021 A rigorous presentation of different expansion and semi-analytical methods for fractional differential equations Fractional differential equations, differential and integral operators with non-integral powers, are used in various science and engineering applications. Over the past several decades, the popularity of the fractional derivative has increased significantly in diverse areas such as electromagnetics, financial mathematics, image processing, and materials science. Obtaining analytical and numerical solutions of nonlinear partial differential equations of fractional order can be challenging and involve the development and use of different methods of solution. Computational Fractional Dynamical Systems: Fractional Differential Equations and Applications presents a variety of computationally efficient semi-analytical and expansion methods to solve different types of fractional models. Rather than focusing on a single computational method, this comprehensive volume brings together more than 25 methods for solving an array of fractional-order models. The authors employ a rigorous and systematic approach for addressing various physical problems in science and engineering. Covers various aspects of efficient methods regarding fractional-order systems Presents different numerical methods with detailed steps to handle basic and advanced equations in science and engineering Provides a systematic approach for handling fractional-order models arising in science and engineering Incorporates a wide range of methods with corresponding results and validation Computational Fractional Dynamical Systems: Fractional Differential Equations and Applications is an invaluable resource for advanced undergraduate students, graduate students, postdoctoral researchers, university faculty, and other researchers and practitioners working with fractional and integer order differential equations.

Advanced Computing in Industrial Mathematics Nov 28 2019 This book gathers the peer-reviewed proceedings of the 13th Annual Meeting of the Bulgarian Section of the Society for Industrial and Applied Mathematics, BGSIAM'18, held in Sofia, Bulgaria. The general theme of BGSIAM'18 was industrial and applied mathematics with particular focus on: mathematical physics, numerical analysis, high performance computing, optimization and control, mathematical biology, stochastic modeling, machine learning, digitization and imaging, advanced computing in environmental, biomedical and engineering applications.

Advances in Communication and Computational Technology Aug 25 2019 This book presents high-quality peer-reviewed papers from the International Conference on Advanced Communication and Computational Technology (ICACCT) 2019 held at the National Institute of Technology, Kurukshetra,

India. The contents are broadly divided into four parts: (i) Advanced Computing, (ii) Communication and Networking, (iii) VLSI and Embedded Systems, and (iv) Optimization Techniques. The major focus is on emerging computing technologies and their applications in the domain of communication and networking. The book will prove useful for engineers and researchers working on physical, data link and transport layers of communication protocols. Also, this will be useful for industry professionals interested in manufacturing of communication devices, modems, routers etc. with enhanced computational and data handling capacities.

Optimal Homotopy Asymptotic Method May 27 2022 The objective of this work is to use Optimal Homotopy Asymptotic Method (OHAM), a new semi-analytic approximating technique, for solving linear and nonlinear initial and boundary value problems. The semi analytic solutions of nonlinear fourth order, eighth order, special fourth order and special sixth order boundary-value problems are computed using OHAM. Successful application of OHAM for squeezing flow is a major task in this study. This work also investigates the effectiveness of OHAM formulation for Partial Differential Equations (Wave Equation and Korteweg de Vries). OHAM is independent of the free parameter and there is no need of the initial guess as there is in Homotopy Perturbation Method (HPM), Variational Iteration Method (VIM) and Homotopy Analysis Method (HAM). OHAM works very well with large domains and provides better accuracy at lower-order of approximations. Moreover, the convergence domain can be easily adjusted. The results are compared with other methods like HPM, VIM and HAM, which reveal that OHAM is effective, simpler, easier and explicit.

Diversity of Ecosystems Sep 26 2019 The ecosystems present a great diversity worldwide and use various functionalities according to ecologic regions. In this new context of variability and climatic changes, these ecosystems undergo notable modifications amplified by domestic uses of which it was subjected to. Indeed the ecosystems render diverse services to humanity from their composition and structure but the tolerable levels are unknown. The preservation of these ecosystemic services needs a clear understanding of their complexity. The role of research is not only to characterise the ecosystems but also to clearly define the tolerable usage levels. Their characterisation proves to be important not only for the local populations that use it but also for the conservation of biodiversity. Hence, the measurement, management and protection of ecosystems need innovative and diverse methods. For all these reasons, the aim of this book is to bring out a general view on the function of ecosystems, modelling, sampling strategies, invading species, the response of organisms to modifications, the carbon dynamics, the mathematical models and theories that can be applied in diverse conditions.

Applications of Heat, Mass and Fluid Boundary Layers Mar 01 2020 Applications of Heat, Mass and Fluid Boundary Layers brings together the latest research on boundary layers where there has been remarkable advancements in recent years. This book highlights relevant concepts and solutions to energy issues and environmental sustainability by combining fundamental theory on boundary layers with real-world industrial applications from, among others, the thermal, nuclear and chemical industries. The book's editors and their team of expert contributors discuss many core themes, including advanced heat transfer fluids and boundary layer analysis, physics of fluid motion and viscous flow, thermodynamics and transport phenomena, alongside key methods of analysis such as the Merk-Chao-Fagbenle method. This book's multidisciplinary coverage will give engineers, scientists, researchers and graduate students in the areas of heat, mass, fluid flow and transfer a thorough understanding of the technicalities, methods and applications of boundary layers, with a unified approach to energy, climate change and a sustainable future. Presents up-to-date research on boundary layers with very practical applications across a diverse mix of industries Includes mathematical analysis to provide detailed explanation and clarity Provides solutions to global energy issues and environmental sustainability

Fractional Calculus: New Applications in Understanding Nonlinear Phenomena May 15 2021 In the last two decades, many new fractional operators have appeared, often defined using integrals with special functions in the kernel as well as their extended or multivariable forms. Modern operators in fractional calculus have different properties which are comparable to those of classical operators. These have

been intensively studied for modelling and analysing real-world phenomena. There is now a growing body of research on new methods to understand natural occurrences and tackle different problems. This book presents ten reviews of recent fractional operators split over three sections: 1. Chaotic Systems and Control (covers the Caputo fractional derivative, and a chaotic fractional-order financial system) 2. Heat Conduction (covers the Duhamel theorem for time-dependent source terms, and the Cattaneo–Hristov model for oscillatory heat transfer) 3. Computational Methods and Their Illustrative Applications (covers mathematical analysis for understanding 5 real-world phenomena: HTLV-1 infection of CD4+ T-cells, traveling waves, rumor-spreading, biochemical reactions, and the computational fluid dynamics of a non-powered floating object navigating in an approach channel) This volume is a resource for researchers in physics, biology, behavioral sciences, and mathematics who are interested in new applications of fractional calculus in the study of nonlinear phenomena.

Approximate Analytical Methods for Solving Ordinary Differential Equations Feb 09 2021 Approximate Analytical Methods for Solving Ordinary Differential Equations (ODEs) is the first book to present all of the available approximate methods for solving ODEs, eliminating the need to wade through multiple books and articles. It covers both well-established techniques and recently developed procedures, including the classical series solution

Nonlinear Flow Phenomena and Homotopy Analysis Jul 29 2022 Since most of the problems arising in science and engineering are nonlinear, they are inherently difficult to solve. Traditional analytical approximations are valid only for weakly nonlinear problems and often fail when used for problems with strong nonlinearity. “Nonlinear Flow Phenomena and Homotopy Analysis: Fluid Flow and Heat Transfer” presents the current theoretical developments of the analytical method of homotopy analysis. This book not only addresses the theoretical framework for the method, but also gives a number of examples of nonlinear problems that have been solved by means of the homotopy analysis method. The particular focus lies on fluid flow problems governed by nonlinear differential equations. This book is intended for researchers in applied mathematics, physics, mechanics and engineering. Both Kuppapalle Vajravelu and Robert A. Van Gorder work at the University of Central Florida, USA.

Mathematical Modelling, Applied Analysis and Computation Dec 22 2021 This book contains original research papers presented at the International Conference on Mathematical Modelling, Applied Analysis and Computation, held at JECRC University, Jaipur, India, on 6-8 July, 2018. Organized into 20 chapters, the book focuses on theoretical and applied aspects of various types of mathematical modelling such as equations of various types, fuzzy mathematical models, automata, Petri nets and bond graphs for systems of dynamic nature and the usage of numerical techniques in handling modern problems of science, engineering and finance. It covers the applications of mathematical modelling in physics, chemistry, biology, mechanical engineering, civil engineering, computer science, social science and finance. A wide variety of dynamical systems like deterministic, stochastic, continuous, discrete or hybrid, with respect to time, are discussed in the book. It provides the mathematical modelling of various problems arising in science and engineering, and also new efficient numerical approaches for solving linear and nonlinear problems and rigorous mathematical theories, which can be used to analyze a different kind of mathematical models. The conference was aimed at fostering cooperation among students and researchers in areas of applied analysis, engineering and computation with the deliberations to inculcate new research ideas in their relevant fields. This volume will provide a comprehensive introduction to recent theories and applications of mathematical modelling and numerical simulation, which will be a valuable resource for graduate students and researchers of mathematical modelling and industrial mathematics.

Homotopy Analysis Method in Nonlinear Differential Equations Jan 03 2023 "Homotopy Analysis Method in Nonlinear Differential Equations" presents the latest developments and applications of the analytic approximation method for highly nonlinear problems, namely the homotopy analysis method (HAM). Unlike perturbation methods, the HAM has nothing to do with small/large physical parameters. In addition, it provides great freedom to choose the equation-type of linear sub-problems and the base functions of a solution. Above all, it provides a convenient way to guarantee the convergence of a

solution. This book consists of three parts. Part I provides its basic ideas and theoretical development. Part II presents the HAM-based Mathematica package BVPh 1.0 for nonlinear boundary-value problems and its applications. Part III shows the validity of the HAM for nonlinear PDEs, such as the American put option and resonance criterion of nonlinear travelling waves. New solutions to a number of nonlinear problems are presented, illustrating the originality of the HAM. Mathematica codes are freely available online to make it easy for readers to understand and use the HAM. This book is suitable for researchers and postgraduates in applied mathematics, physics, nonlinear mechanics, finance and engineering. Dr. Shijun Liao, a distinguished professor of Shanghai Jiao Tong University, is a pioneer of the HAM.

Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer Nov 20 2021 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.

Nonlinear Dynamics and Applications Oct 08 2020 This book covers recent trends and applications of nonlinear dynamics in various branches of society, science, and engineering. The selected peer-reviewed contributions were presented at the International Conference on Nonlinear Dynamics and Applications (ICNDA 2022) at Sikkim Manipal Institute of Technology (SMIT) and cover a broad swath of topics ranging from chaos theory and fractals to quantum systems and the dynamics of the COVID-19 pandemic. Organized by the SMIT Department of Mathematics, this international conference offers an interdisciplinary stage for scientists, researchers, and inventors to present and discuss the latest innovations and trends in all possible areas of nonlinear dynamics.

The Classical Stefan Problem Jun 03 2020 *The Classical Stefan Problem: Basic Concepts, Modelling and Analysis with Quasi-Analytical Solutions and Methods, New Edition*, provides the fundamental theory, concepts, modeling, and analysis of the physical, mathematical, thermodynamical, and metallurgical properties of classical Stefan and Stefan-like problems as applied to heat transfer problems with phase-changes, such as from liquid to solid. This self-contained work reports and derives the results from tensor analysis, differential geometry, non-equilibrium thermodynamics, physics, and functional analysis, and is thoroughly enriched with many appropriate references for in-depth background reading on theorems. Each chapter in this fully revised and updated edition begins with basic concepts and objectives, also including direction on how the subject matter was developed. It contains more than 400 pages of new material on quasi-analytical solutions and methods of classical Stefan and Stefan-like problems. The book aims to bridge the gap between the theoretical and solution aspects of the afore-mentioned problems. Provides both the phenomenology and mathematics of Stefan problems Bridges physics and mathematics in a concrete and readable manner Presents well-organized chapters that start with proper definitions followed by explanations and references for further reading Includes both numerical and quasi-analytical solutions and methods of classical Stefan and Stefan-like problems

Modified Homotopy Analysis Method Sep 30 2022 We present a modification of an analytic technique, namely the homotopy analysis method (HAM) to obtain symbolic approximate solutions for linear and nonlinear differential equations of fractional order. This method was applied to three examples: a fractional oscillation equation, a fractional Riccati equation and a fractional Lane-Emden equation which were presented as fractional initial value problems (FIVPs). We extend this modification to provide approximate solutions of linear and nonlinear fractional boundary value problems (FBVPs). Four examples are tested using the extended approach. Also, four physical problems are solved using the modification of the HAM. The HAM is a strong and easy-to-use analytic tool for nonlinear problems and

does not need small / large parameters in the equations. Comparison of the results with those of Adomian decomposition method (ADM), variational iteration method (VIM), and homotopy perturbation method (HPM), has led us to significant consequences. The obtained results show that the present method is very effective and convenient in solving nonlinear cases and the ADM, VIM and HPM are special cases of the HAM.

Fractional Dynamics and Control Apr 01 2020 Fractional Dynamics and Control provides a comprehensive overview of recent advances in the areas of nonlinear dynamics, vibration and control with analytical, numerical, and experimental results. This book provides an overview of recent discoveries in fractional control, delves into fractional variational principles and differential equations, and applies advanced techniques in fractional calculus to solving complicated mathematical and physical problems. Finally, this book also discusses the role that fractional order modeling can play in complex systems for engineering and science.

Homotopy Methods and Global Convergence Dec 10 2020 This Proceedings presents refereed versions of most of the papers presented at the NATO Advanced Research Institute on Homotopy Methods and Global Convergence held in Porto Cervo, Sardinia, June 3-6, 1981. This represents the fourth recent occurrence of an international conference addressing the common theme of fixed point computation. The first such conference, titled "Computing Fixed Points with Applications," was held in the Department of Mathematical Sciences at Clemson University, Clemson, South Carolina, June 26-28, 1974 and was sponsored by the Office of Naval Research and the Office of the Army Research Center. The second conference, "Symposium on Analysis and Computation of Fixed Points," was held at the University of Wisconsin, Madison, May 7-8, 1979, under the sponsorship of the National Science Foundation, the U. S. Army, and the Mathematics Research Center of the University of Wisconsin, Madison. The third conference, titled "Symposium on Fixed Point Algorithms and Complementarity," was held at the University of Southampton, Southampton, UK, July 3-5, 1979 and was sponsored by U. N. E. S. C. O. , European Research Office (London), Department of Mathematics (University of Southampton), I. B. M. U. K. , Ltd. , Lloyds Bank, Ltd. , and the Office of Naval Research (London). The Advanced Research Institute held in Sardinia was devoted to the theory and application of modern homotopy methods. The following topics were stressed: Path-Following Techniques; Bottom-Line Applications; Global vs. Classical Methods; and Sta- v vi PREFACE of-the-Art, Perspectives and Potential.

Advances in Fuzzy Integral and Differential Equations Jan 11 2021 As the title of the book suggests, the topics of this book are organized into two parts. The first part points out the fuzzy differential equations and the second one is related to the fuzzy integral equations. The book contains nine chapters that six chapters are about fuzzy differential equations and three of them are about fuzzy integral equations. In each part, the chapters' authors are going to discuss the topics theoretically and numerically. All researchers and students in the field of mathematical, computer, and also engineering sciences can benefit from the subjects of the book.