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Homotopy Analysis Method in Nonlinear Differential Equations Beyond Perturbation Advanced Numerical and Semi-Analytical Methods for Differential Equations Beyond Perturbation Advances In The Homotopy Analysis Method Nonlinear Flow Phenomena and Homotopy Analysis The Optimal Homotopy Asymptotic Method Fluid Flow, Heat and Mass Transfer at Bodies of Different Shapes Modified Homotopy Analysis Method Modeling and Analysis of Modern Fluid Problems Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer Solving Nonlinear Boundary Value Problems Using the Homotopy Analysis Method Computational Mathematics, Nanoelectronics, and Astrophysics Modified Homotopy Analysis Method Nilpotence and Periodicity in Stable Homotopy Theory Nonlinear Multiobjective Optimization Handbook of Homotopy Theory Introduction to Perturbation Techniques Fractional Differential Equations Complex Cobordism and Stable Homotopy Groups of Spheres Simplicial Homotopy Theory Modern Classical Homotopy Theory Composition methods in homotopy groups of spheres Categorical Homotopy Theory Solving Frontier Problems of Physics: The Decomposition Method Perturbation Methods Elements of Homotopy Theory Applications of Heat, Mass and Fluid Boundary Layers Wavelet Methods for Solving Partial Differential Equations and Fractional Differential Equations General Problem of the Stability Of Motion Introduction to Homotopy Theory Modifications of Homotopy Analysis Method for Differential Equations The Application of Discrete Homotopy Analysis Method in One-dimensional Thermal Problem Oscillations In Planar Dynamic Systems Partial Differential Equations and Solitary Waves Theory Local Fractional Integral Transforms and Their Applications Perturbation Methods in Applied Mathematics A First Course in Integral Equations The Homotopy Index and Partial Differential Equations Boundary Elements XVII

Advances In The Homotopy Analysis Method Feb 28 2024 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.
Perturbation Methods May 09 2022 A textbook presenting the theory and underlying techniques of perturbation methods in a manner suitable for senior undergraduates from a broad range of disciplines.
Categorical Homotopy Theory Jul 11 2022 This book develops abstract homotopy theory from the categorical perspective with a particular focus on examples. Part I discusses two competing perspectives by which one typically first encounters homotopy (co)limits: either as derived functors definable when the appropriate diagram categories admit a compatible model structure, or through particular formulae that give the right notion in

certain examples. Emily Riehl unifies these seemingly rival perspectives and demonstrates that model structures on diagram categories are irrelevant. Homotopy (co)limits are explained to be a special case of weighted (co)limits, a foundational topic in enriched category theory. In Part II, Riehl further examines this topic, separating categorical arguments from homotopical ones. Part III treats the most ubiquitous axiomatic framework for homotopy theory - Quillen's model categories. Here, Riehl simplifies familiar model categorical lemmas and definitions by focusing on weak factorization systems. Part IV introduces quasi-categories and homotopy coherence.

Partial Differential Equations and Solitary Waves Theory Jul 31 2021 "Partial Differential Equations and Solitary Waves Theory" is a self-contained book divided into two parts: Part I is a coherent survey bringing together newly developed methods for solving PDEs. While some traditional techniques are presented, this part does not require thorough understanding of abstract theories or compact concepts. Well-selected worked examples and exercises shall guide the reader through the text. Part II provides an extensive exposition of the solitary waves theory. This part handles nonlinear evolution equations by methods such as Hirota’s bilinear method or the tanh-coth method. A self-contained treatment is presented to discuss complete integrability of a wide class of nonlinear equations. This part presents in an accessible manner a systematic presentation of solitons, multi-soliton solutions, kinks, peakons, cuspons, and compactons. While the whole book can be used as a text for advanced undergraduate and graduate students in applied mathematics, physics and engineering, Part II will be most useful for graduate students and researchers in mathematics, engineering, and other related fields. Dr. Abdul-Majid Wazwaz is a Professor of Mathematics at Saint Xavier University, Chicago, Illinois, USA.

Modified Homotopy Analysis Method Oct 26 2023 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.

Homotopy Analysis Method in Nonlinear Differential Equations Jul 03 2024 "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.

Complex Cobordism and Stable Homotopy Groups of Spheres Nov 14 2022 Since the publication of its first edition, this book has served as one of the few available on the classical Adams spectral sequence, and is the best account on the Adams-Novikov spectral sequence. This new edition has been updated in many places, especially the final chapter, which has been completely rewritten with an eye toward future research in the field. It remains the definitive reference on the stable homotopy groups of spheres. The first three chapters introduce the homotopy groups of spheres and take the reader from the classical results in the field though the computational aspects of the classical Adams spectral sequence and its modifications, which are the main tools topologists have to investigate the homotopy groups of spheres. Nowadays, the most efficient tools are the Brown-Peterson theory, the Adams-Novikov spectral sequence, and the chromatic spectral sequence, a device for analyzing the global structure of the stable homotopy groups of spheres and relating them to the cohomology of the Morava stabilizer groups. These topics are described in detail in Chapters 4 to 6. The revamped Chapter 7 is the computational payoff of the book, yielding a lot of information about the stable homotopy group of spheres. Appendices follow, giving self-contained accounts of the theory of formal group laws and the homological algebra associated with Hopf algebras and Hopf algebroids. The book is intended for anyone wishing to study computational stable homotopy theory. It is accessible to graduate students with a knowledge of algebraic topology and recommended to anyone wishing to venture into the frontiers of the subject.
A First Course in Integral Equations Apr 27 2021 This book presents the subject of integral equations in an accessible manner for a variety of applications. Emphasis is placed on understanding the subject while avoiding the abstract and compact theorems. A distinctive feature of the book is that it introduces the recent powerful and reliable developments in this field, which are not covered in traditional texts. The newly developed decomposition method, the series solution method and the direct computation method are thoroughly implemented, which allows the topic to be far more accessible. The book also includes some of the traditional techniques for comparison.Using the newly developed methods, the author successfully handles Fredholm and Volterra integral equations, singular integral equations, integro-differential equations and nonlinear integral equations, with promising results for linear and nonlinear models. Many examples are given to introduce the material in a clear and thorough fashion. In addition, many exercises are provided to build confidence, ease and skill in using the new methods.This book may be used as a text for advanced undergraduates and graduate students in mathematics and scientific areas, and as a work of reference for research study of differential equations and numerical analysis.
The Application of Discrete Homotopy Analysis Method in One-dimensional Thermal Problem Oct 02 2021
Fluid Flow, Heat and Mass Transfer at Bodies of Different Shapes Nov 26 2023 Most of the equations governing the problems related to science and engineering are nonlinear in nature. As a result, they are inherently difficult to solve. Analytical solutions are available only for some special cases. For other cases, one has no easy means but to solve the problem must depend on numerical solutions. Fluid Flow, Heat and Mass Transfer at Bodies of Different Shapes: Numerical Solutions presents the current theoretical developments of boundary layer theory, a branch of transport phenomena. Also, the book addresses the theoretical developments in the area and presents a number of physical problems that have been solved by analytical or numerical method. It is focused particularly on fluid flow problems governed by nonlinear differential equations. The book is intended for researchers in applied mathematics, physics, mechanics and engineering. Addresses basic concepts to understand the theoretical framework for the method Provides examples of nonlinear problems that have been solved through the use of numerical method Focuses on fluid flow problems governed by nonlinear equations
Advanced Numerical and Semi-Analytical Methods for Differential Equations May 01 2024 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.

Fractional Differential Equations Dec 16 2022 This multi-volume handbook is the most up-to-date and comprehensive reference work in the field of fractional calculus and its numerous applications. This second volume collects authoritative chapters covering the mathematical theory of fractional calculus, including ordinary and partial differential equations of fractional order, inverse problems, and evolution equations.

Oscillations In Planar Dynamic Systems Aug 31 2021 This book provides a concise presentation of the major techniques for determining analytic approximations to the solutions of planar oscillatory dynamic systems. These systems model many important phenomena in the sciences and engineering. In addition to the usual perturbation procedures, the book gives the details of when and how to correctly apply the method of harmonic balance for both first-order and higher-order calculations. This procedure is rarely given or discussed fully in standard textbooks. The basic philosophy of the book stresses how to initiate and complete the calculation of approximate solutions. This is done by a clear presentation of necessary background materials and by the working out of many examples.

Applications of Heat, Mass and Fluid Boundary Layers Mar 07 2022 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

Modern Classical Homotopy Theory Sep 12 2022 The core of classical homotopy theory is a body of ideas and theorems that emerged in the 1950s and was later largely codified in the notion of a model category. This core includes the notions of fibration and cofibration; CW complexes; long fiber and cofiber sequences; loop spaces and suspensions; and so on. Brown's representability theorems show that homology and cohomology are also contained in classical homotopy theory. This text develops classical homotopy theory from a modern point of view, meaning that the exposition is informed by the theory of model categories and that homotopy limits and colimits play central roles. The exposition is guided by the principle that it is generally preferable to prove topological results using topology (rather than algebra). The language and basic theory of homotopy limits and colimits make it possible to penetrate deep into the subject with just the rudiments of algebra. The text does reach advanced territory, including the Steenrod algebra, Bott periodicity, localization, the Exponent Theorem of Cohen, Moore, and Neisendorfer, and Miller's Theorem on the Sullivan Conjecture. Thus the reader is given the tools needed to understand and participate in research at (part of) the current frontier of homotopy theory. Proofs are not provided outright. Rather, they are presented in the form of directed problem sets. To the expert, these read as terse proofs; to novices they are challenges that draw them in and help them to thoroughly understand the arguments.

Composition methods in homotopy groups of spheres Aug 12 2022 Hiroshi Toda's classic treatment of composition methods in homotopy groups of spheres from the acclaimed Annals of Mathematics Studies series Princeton University Press is proud to have published the Annals of Mathematics Studies since 1940. One of the oldest and most respected series in science publishing, it has included many of the most important and influential mathematical works of the twentieth century. The series continues this tradition as Princeton University Press publishes the major works of the twenty-first century. To mark the continued success of the series, all books are available in paperback and as ebooks.

Simplicial Homotopy Theory Oct 14 2022 Since the beginning of the modern era of algebraic topology, simplicial methods have been used systematically and effectively for both computation and basic theory. With the development of Quillen's concept of a closed model category and, in particular, a simplicial model category, this collection of methods has become the primary way to describe non-abelian homological algebra and to address homotopy-theoretical issues in a variety of fields, including algebraic K-theory. This book supplies a modern exposition of these ideas, emphasizing model category theoretical techniques. Discussed here are the homotopy theory of simplicial sets, and other basic topics such as simplicial groups, Postnikov towers, and bisimplicial sets. The more advanced material includes homotopy limits and colimits, localization with respect to a map and with respect to a homology theory, cosimplicial spaces, and homotopy coherence. Interspersed throughout are many results and ideas well-known to experts, but uncollected in the literature. Intended for second-year graduate students and beyond, this book introduces many of the basic tools of modern homotopy theory. An extensive background in topology is not assumed.

Wavelet Methods for Solving Partial Differential Equations and Fractional Differential Equations Feb 03 2022 The main focus of the book is to implement wavelet based transform methods for solving problems of fractional order partial differential equations arising in modelling real physical phenomena. It explores analytical and numerical approximate solution obtained by wavelet methods for both classical and fractional order partial differential equations.

Boundary Elements XVII Feb 23 2021

Nonlinear Flow Phenomena and Homotopy Analysis Jan 29 2024 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 Kuppalapalle Vajravelu and Robert A. Van Gorder work at the University of Central Florida, USA.

Introduction to Perturbation Techniques Jan 17 2023 Similarities, differences, advantages and limitations of perturbation techniques are pointed out concisely. The techniques are described by means of examples that consist mainly of algebraic and ordinary differential equations. Each chapter contains a number of exercises.

Solving Nonlinear Boundary Value Problems Using the Homotopy Analysis Method Jul 23 2023 Analytical solutions of differential equations are very important for all researchers from different discipline. Obtaining such solutions is difficult in most cases, especially if the differential equation is nonlinear. One of the mostly used methods are the series methods, where the solution is represented as an infinite series. Different methods are available to evaluate the terms of this series. These methods include the well-known Taylor series method, the Adomian decomposition method, the Homotopy iteration method, and the Homotopy analysis method. In this thesis we give a survey of the different series methods available to solve initial and boundary value problems. The methods to be presented are the Taylor series method, the Adomina decomposition method, and the Homotopy analysis method. The main features of each method will be presented and the error analysis will be discussed as well. For the Homotopy analysis method, the error is controlled by introducing the parameter known as ħ, then the error is controlled by monitoring the value of the solution at a specific point for different values of ħ. This produces what is known as the ħ curve. The mathematical foundation of this method is not very well established, and the method will not work at all times. The error for the Taylor series and the Adomian decomposition method is controlled by adding more terms to the series solution which might be costly and difficult to calculate especially if the differential equation is nonlinear. In this study we will show that the error can be controlled by other means. A modified Taylor series method has been developed and will be discussed. The method is based on controlling the error through different choices of the point of expansion. The mathematical foundation of the method and application of the method to differential equations with singularities and eigenvalue problems will be presented.

Nonlinear Multiobjective Optimization Mar 19 2023 Arguably, many industrial optimization problems are of the multiobjective type. The present work, after providing a survey of the state of the art in multiobjective optimization, gives new insight into this important mathematical field by consequently taking up the viewpoint of differential geometry. This approach, unprecedented in the literature, very naturally results in a generalized homotopy method for multiobjective optimization which is theoretically well-founded and numerically efficient. The power of the new method is demonstrated by solving two real-life problems of industrial optimization. The book presents recent results obtained by the author and is aimed at mathematicians, scientists, students and practitioners interested in optimization and numerical homotopy methods.

Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer Aug 24 2023 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.

The Optimal Homotopy Asymptotic Method Dec 28 2023 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.

Beyond Perturbation Mar 31 2024 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

Local Fractional Integral Transforms and Their Applications Jun 29 2021 Local Fractional Integral Transforms and Their Applications provides information on how local fractional calculus has been successfully applied to describe the numerous widespread real-world phenomena in the fields of physical sciences and engineering sciences that involve non-differentiable behaviors. The methods of integral transforms via local fractional calculus have been used to solve various local fractional ordinary and local fractional partial differential equations and also to figure out the presence of the fractal phenomenon. The book presents the basics of the local fractional derivative operators and investigates some new results in the area of local integral transforms. Provides applications of local fractional Fourier Series Discusses definitions for local fractional Laplace transforms Explains local fractional Laplace transforms coupled with analytical methods

Modifications of Homotopy Analysis Method for Differential Equations Nov 02 2021 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.

Elements of Homotopy Theory Apr 07 2022 As the title suggests, this book is concerned with the elementary portion of the subject of homotopy theory. It is assumed that the reader is familiar with the fundamental group and with singular homology theory, including the Universal Coefficient and Kiinneth Theorems. Some acquaintance with manifolds and Poincare duality is desirable, but not essential. Anyone who has taught a course in algebraic topology is familiar with the fact that a formidable amount of technical machinery must be introduced and mastered before the simplest applications can be made. This phenomenon is also observable in the more advanced parts of the subject. I have attempted to short-circuit it by making maximal use of elementary methods. This approach entails a leisurely exposition in which brevity and perhaps elegance are sacrificed in favor of concreteness and ease of application. It is my hope that this approach will make homotopy theory accessible to workers in a wide range of other subjects-subjects in which its impact is beginning to be felt. It is a consequence of this approach that the order of development is to a certain

extent historical. Indeed, if the order in which the results presented here does not strictly correspond to that in which they were discovered, it nevertheless does correspond to an order in which they might have been discovered had those of us who were working in the area been a little more perspicacious.

Beyond Perturbation Jun 02 2024 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 Pertubation: 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.

Perturbation Methods in Applied Mathematics May 28 2021 This book is a revised and updated version, including a substantial portion of new material, of J. D. Cole's text Perturbation Methods in Applied Mathe matics, Ginn-Blaisdell, 1968. We present the material at a level which assumes some familiarity with the basics of ordinary and partial differential equations. Some of the more advanced ideas are reviewed as needed; therefore this book can serve as a text in either an advanced undergraduate course or a graduate level course on the subject. The applied mathematician, attempting to understand or solve a physical problem, very often uses a perturbation procedure. In doing this, he usually draws on a backlog of experience gained from the solution of similar examples rather than on some general theory of perturbations. The aim of this book is to survey these perturbation methods, especially in connection with differ ential equations, in order to illustrate certain general features common to many examples. The basic ideas, however, are also applicable to integral equations, integrodifferential equations, and even to_difference equations. In essence, a perturbation procedure consists of constructing the solution for a problem involving a small parameter B, either in the differential equation or the boundary conditions or both, when the solution for the limiting case B = 0 is known. The main mathematical tool used is asymptotic expansion with respect to a suitable asymptotic sequence of functions of B.

Modified Homotopy Analysis Method May 21 2023

Modeling and Analysis of Modern Fluid Problems Sep 24 2023 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

Homotypy Approximation, embedded-parameter perturbation, and 3D models and analysis

Solving Frontier Problems of Physics: The Decomposition Method Jun 09 2022 The Adomian decomposition method enables the accurate and efficient analytic solution of nonlinear ordinary or partial differential equations without the need to resort to linearization or perturbation approaches. It unifies the treatment of linear and nonlinear, ordinary or partial differential equations, or systems of such equations, into a single basic method, which is applicable to both initial and boundary-value problems. This volume deals with the application of this method to many problems of physics, including some frontier problems which have previously required much more computationally-intensive approaches. The opening chapters deal with various fundamental aspects of the decomposition method. Subsequent chapters deal with the application of the method to nonlinear oscillatory systems in physics, the Duffing equation, boundary-value problems with closed irregular contours or surfaces, and other frontier areas. The potential application of this method to a wide range of problems in diverse disciplines such as biology, hydrology, semiconductor physics, wave propagation, etc., is highlighted. For researchers and graduate students of physics, applied mathematics and engineering, whose work involves mathematical modelling and the quantitative solution of systems of equations.

Introduction to Homotopy Theory Dec 04 2021 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.

The Homotopy Index and Partial Differential Equations Mar 26 2021 The homotopy index theory was developed by Charles Conley for two sided flows on compact spaces. The homotopy or Conley index, which provides an algebraic-topologi cal measure of an isolated invariant set, is defined to be the ho motopy type of the quotient space N /N , where is a certain 1 2 1 2 compact pair, called an index pair. Roughly speaking, N1 isolates the invariant set and N2 is the "exit ramp" of N . 1 It is shown that the index is independent of the choice of the in dex pair and is invariant under homotopic perturbations of the flow. Moreover, the homotopy index generalizes the Morse index of a nQnde generate critical point p with respect to a gradient flow on a com pact manifold. In fact if the Morse index of p is k, then the homo topy index of the invariant set {p} is Ik - the homotopy type of the pointed k-dimensional unit sphere.

Nilpotence and Periodicity in Stable Homotopy Theory Apr 19 2023 Nilpotence and Periodicity in Stable Homotopy Theory describes some major advances made in algebraic topology in recent years, centering on the nilpotence and periodicity theorems, which were conjectured by the author in 1977 and proved by Devinatz, Hopkins, and Smith in 1985. During the last ten years a number of significant advances have been made in homotopy

theory, and this book fills a real need for an up-to-date text on that topic. Ravenel's first few chapters are written with a general mathematical audience in mind. They survey both the ideas that lead up to the theorems and their applications to homotopy theory. The book begins with some elementary concepts of homotopy theory that are needed to state the problem. This includes such notions as homotopy, homotopy equivalence, CW-complex, and suspension. Next the machinery of complex cobordism, Morava K-theory, and formal group laws in characteristic p are introduced. The latter portion of the book provides specialists with a coherent and rigorous account of the proofs. It includes hitherto unpublished material on the smash product and chromatic convergence theorems and on modular representations of the symmetric group.

General Problem of the Stability Of Motion Jan 05 2022 This book makes more widely accessible the text of Lyapunov's major memoir of the general problem of the stability of motion. Translated by A. T. Fuller (University of Cambridge), the work is now available for the first time in the English language, and marked the centenary of the Russian publication in the late 1800s. Including a biography of Lyapunov and a comprehensive bibliography of his work, this excellent volume will prove to be of fundamental interest to all those concerned with the concept of the stability of motion, boundaries of stability, and with nonlinear dynamics.

Handbook of Homotopy Theory Feb 15 2023 The Handbook of Homotopy Theory provides a panoramic view of an active area in mathematics that is currently seeing dramatic solutions to long-standing open problems, and is proving itself of increasing importance across many other mathematical disciplines. The origins of the subject date back to work of Henri Poincaré and Heinz Hopf in the early 20th century, but it has seen enormous progress in the 21st century. A highlight of this volume is an introduction to and diverse applications of the newly established foundational theory of ¥ -categories. The coverage is vast, ranging from axiomatic to applied, from foundational to computational, and includes surveys of applications both geometric and algebraic. The contributors are among the most active and creative researchers in the field. The 22 chapters by 31 contributors are designed to address novices, as well as established mathematicians, interested in learning the state of the art in this field, whose methods are of increasing importance in many other areas.

Computational Mathematics, Nanoelectronics, and Astrophysics Jun 21 2023 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.

- Homotopy Analysis Method In Nonlinear Differential Equations
- Beyond Perturbation
- Advanced Numerical And Semi Analytical Methods For Differential Equations
- Beyond Perturbation
- Advances In The Homotopy Analysis Method

- Nonlinear Flow Phenomena And Homotopy Analysis
- The Optimal Homotopy Asymptotic Method
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