Maple Code For Homotopy Analysis Method

Homotopy Analysis Method in Nonlinear Differential EquationsBeyond PerturbationAdvances In The Homotopy Analysis MethodHomotopy-Based Methods in Water EngineeringModified Homotopy Analysis MethodModifications of Homotopy Analysis Method for Differential EquationsNonlinear Flow Phenomena and Homotopy AnalysisSolving Nonlinear Boundary Value Problems Using the Homotopy Analysis MethodNotes on the Solution of Certain Functional Equations Using Homotopy AnalysisModified Homotopy Analysis MethodRaising and Lowering Vibration Isolator via Asymmetric Damping AdjustmentComputational Fractional Dynamical SystemsFractional Calculus: New Applications in Understanding Nonlinear PhenomenaComputational Mathematics, Nanoelectronics, and AstrophysicsAdvances in Fuzzy Integral and Differential EquationsMethods of Mathematical ModellingThe Application of Discrete Homotopy Analysis Method in One-dimensional Thermal ProblemIntroduction to Homotopy TheoryEncyclopedia of Ocean EngineeringHomotopy Analysis of Algebraic Structures Shijun Liao Shijun Liao Shijun Liao Manotosh Kumbhakar Ahmad El-Ajou A. K. Alomari Kuppalapalle Vajravelu Ghada Ayed Janem Rob Shorten Ahmad Mohammad El-Ajou Jialing Yao Snehashish Chakraverty Mehmet Yavuz Shaibal Mukherjee Tofigh Allahviranloo Harendra Singh Qian Fen Ooi Aneta Hajek Weicheng Cui Ravi

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Kumbhakar Ahmad El-Ajou A. K. Alomari Kuppalapalle Vajravelu Ghada Ayed Janem Rob Shorten Ahmad Mohammad El-Ajou Jialing Yao Snehashish Chakraverty Mehmet Yavuz Shaibal Mukherjee Tofigh Allahviranloo Harendra Singh Qian Fen Ooi Aneta Hajek Weicheng Cui Ravi

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

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

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

most complex physical phenomena can be described by nonlinear equations specifically differential equations in water engineering nonlinear differential equations play a vital role in modeling physical processes analytical solutions to strong nonlinear problems are not easily tractable and existing techniques are problem specific and applicable for specific types of equations exploring the concept of homotopy from topology different kinds of homotopy based methods have been proposed for analytically solving nonlinear differential equations given by approximate series solutions homotopy based methods in water engineering attempts to present the wide applicability of these methods to water engineering problems it solves all kinds of nonlinear equations namely algebraic transcendental equations ordinary differential equations odes systems of odes partial differential equations pdes systems of pdes and integro differential equations using the homotopy based methods the content of the book deals with some selected problems of hydraulics of open channel flow with or without sediment transport groundwater hydrology surface water hydrology general burger s equation and water quality features provides analytical treatments to some key problems in water engineering describes the applicability of homotopy based methods for solving nonlinear equations particularly differential equations compares different approaches in dealing with issues of nonlinearity

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

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

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

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 $\hbar$ then the error is controlled by monitoring the value of the solution at a specific point for different values of $\hbar$ this produces what is known as the $\hbar$ 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

this book introduces an approach of controlling vehicle height and attitude by actively raising and lowering vibration isolators via asymmetric damping adjustment the first section of this book identifies the theoretical foundation of asymmetric damping adjustment and discusses practical applications and the significance of this advancement the second section discusses the mechanics and laws governing the active raising and lowering of the vibration isolator the final two sections present the application of this method by incorporating a number of control strategies including model predictive control hybrid model predictive control and active disturbance rejection control the methodology is validated through simulation and co simulation under various vehicle conditions this book will be of interest to automotive engineers and those interested in the field of mechanics vibration and control

computational fractional dynamical systems 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

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 formodelling 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 word 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

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

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

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

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

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

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Introduction

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