Reduced Differential Transform Method For Generalized Kdv

GRIFFITH SELLERS

Partial Differential Equations and Solitary Waves Theory Academic Press
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.
Springer Nature
This book is an invaluable resource for applied researchers to find the analytical solution of differential equations describing the dynamical system with less computational effort and time. It describes the basic concepts of the differential transform method and solution of various real-world problems described by simple to complicated differential equations. It provides a computational technique that is not only conceptually simple and easy to use but also readily adaptable for computer coding. Different chapters of the book deal with the basic differential equations involved in the physical phenomena as well as a complicated system of differential equations described by the mathematical model. The book offers comprehensive coverage of the most essential topics, including Basic concepts and fundamental properties of the proposed technique with proof The solution of linear, nonlinear, homogeneous, and nonhomogeneous ordinary differential equations (ODEs) and partial differential equations (PDEs) The initial and boundary value problems Real-world ODE and PDE problems are also discussed Applications of Differential Transform to Real World Problems is primarily aimed at undergraduates, graduates, and researchers studying differential equations. Scientists dealing with complicated differential equations or systems of differential equations will also find this book useful.
Index-aware Model Order Reduction Methods Elsevier
This book provides a basic introduction to reduced basis (RB) methods for problems involving the repeated solution of partial differential equations (PDEs) arising from engineering and applied sciences, such as PDEs depending on several parameters and PDE-constrained optimization. The book presents a general mathematical formulation of RB methods, analyzes their fundamental theoretical properties, discusses the related algorithmic and implementation aspects, and highlights their built-in algebraic and geometric structures. More specifically, the authors discuss alternative strategies for constructing accurate RB spaces using greedy algorithms and proper orthogonal decomposition techniques, investigate their approximation properties and analyze offline-online decomposition strategies aimed at the reduction of computational complexity. Furthermore, they carry out both a priori and a posteriori error analysis. The whole mathematical presentation is made more stimulating by the use of representative examples of applicative interest in the context of both linear and nonlinear PDEs. Moreover, the inclusion of many pseudocodes allows the reader to easily implement the algorithms illustrated throughout the text. The book will be ideal for upper undergraduate students and, more generally, people interested in scientific computing. All these pseudocodes are in fact implemented in a MATLAB package that is freely available at https://github.com/redbkit
Fractional Calculus and its Applications in Physics Springer Science & Business Media
The book serves both as a reference for various scaled models with corresponding dimensionless numbers, and as a resource for learning the art of scaling. A special feature of the book is the emphasis on how to create software for scaled models, based on existing software for unscaled models. Scaling (or non-dimensionalization) is a mathematical technique that greatly simplifies the setting of input parameters in numerical simulations. Moreover, scaling enhances the understanding of how different physical processes interact in a differential equation model. Compared to the existing literature, where the topic of scaling is frequently encountered, but very often in only a brief and shallow setting, the present book gives much more thorough explanations of how to reason about finding the right scales. This process is highly problem dependent, and therefore the book features a lot of worked examples, from very simple ODEs to systems of PDEs, especially from fluid mechanics. The text is easily accessible and example-driven. The first part on ODEs fits even a lower undergraduate level, while the most advanced multiphysics fluid mechanics examples target the graduate level. The scientific literature is full of scaled models, but in most of the cases, the scales are just stated without thorough mathematical reasoning. This book explains how the scales are found mathematically. This book will be a valuable read for anyone doing numerical simulations based on ordinary or partial differential equations.
Solitons, Nonlinear Evolution Equations and Inverse Scattering Springer
Transform methods provide a bridge between the commonly used method of separation of variables and numerical techniques for solving linear partial differential equations. While in some ways similar to separation of variables, transform methods can be effective for a wider class of problems. Even when the inverse of the transform cannot be found ana
Wavelet Methods for Solving Partial Differential Equations and Fractional Differential Equations CRC Press
This is the practical introduction to the analytical approach taken in Volume 2. Based upon courses in partial differential equations over the last two decades, the text covers the classic canonical equations, with the method of separation of variables introduced at an early stage. The characteristic method for first order equations acts as an introduction to the classification of second order quasi-linear problems by characteristics. Attention then moves to different co-ordinate systems, primarily those with cylindrical or spherical symmetry. Hence a discussion of special functions arises quite naturally, and in each case the major properties are derived. The next section deals with the use of integral transforms and extensive methods for inverting them, and concludes with links to the use of Fourier series.
Riccati Differential Equations Springer
The subject of fractional calculus has gained considerable popularity and importance during the past three decades, mainly due to its validated applications in various fields of science and engineering. It is a generalization of ordinary differentiation and integration to arbitrary (non-integer) order. The fractional derivative has been used in various physical problems, such as frequency-dependent damping behavior of structures, biological systems, motion of a plate in a Newtonian fluid, λμ controller for the control of dynamical systems, and so on. It is challenging to obtain the solution (both analytical and numerical) of related nonlinear partial differential equations of fractional order. So for the last few decades, a great deal of attention has been directed towards the solution for these kind of problems. Different methods have been developed by other researchers to analyze the above problems with respect to crisp (exact) parameters. However, in real-life applications such as for biological problems, it is not always possible to get exact values of the associated parameters due to errors in measurements/experiments, observations, and many other errors. Therefore, the associated parameters and variables may be considered uncertain. Here, the uncertainties are considered interval/fuzzy. Therefore, the development of appropriate efficient methods and their use in solving the mentioned uncertain problems are the recent challenge. In view of the above, this book is a new attempt to rigorously present a variety of fuzzy (and interval) time-fractional dynamical models with respect to different biological systems using computationally efficient method. The authors believe this book will be helpful to undergraduates, graduates, researchers, industry, faculties, and others throughout the globe.
Ordinary and Delay Differential Equations Springer
Differential Transformation Method for Mechanical Engineering ProblemsAcademic Press
Wavelet Solutions for Reaction–Diffusion Problems in Science and Engineering Frontiers Media SA
This text explores the essentials of partial differential equations as applied to engineering and the physical sciences. Discusses

ordinary differential equations, integral curves and surfaces of vector fields, the Cauchy-Kovalevsky theory, more. Problems and answers.

Fractional Differential Equations Springer Science & Business Media

This book describes several techniques, first invented in physics for solving problems of heat and mass transfer, and applies them to various problems of mathematical finance defined in domains with moving boundaries. These problems include: (a) semi-closed form pricing of options in the one-factor models with time-dependent barriers (Bachelier, Hull-White, CIR, CEV); (b) analyzing an interconnected banking system in the structural credit risk model with default contagion; (c) finding first hitting time density for a reducible diffusion process; (d) describing the exercise boundary of American options; (e) calculating default boundary for the structured default problem; (f) deriving a semi-closed form solution for optimal mean-reverting trading strategies; to mention but some.The main methods used in this book are generalized integral transforms and heat potentials. To find a semi-closed form solution, we need to solve a linear or nonlinear Volterra equation of the second kind and then represent the option price as a one-dimensional integral. Our analysis shows that these methods are computationally more efficient than the corresponding finite-difference methods for the backward or forward Kolmogorov PDEs (partial differential equations) while providing better accuracy and stability.We extend a large number of known results by either providing solutions on complementary or extended domains where the solution is not known yet or modifying these techniques and applying them to new types of equations, such as the Bessel process. The book contains several novel results broadly applicable in physics, mathematics, and engineering.

Mathematics and Computing Springer Nature

This book presents various computational and cognitive modeling approaches in the areas of health, education, finance, theenvironment, engineering, commerce and industry. Gathering selected conference papers presented atthe International Conference on Trends in Computational and Cognitive Engineering (TCCE), it sharescutting-edge insights and ideas from mathematicians, engineers, scientists and researchers anddiscusses fresh perspectives on problem solving in a range of research areas.

Proceedings of International Conference on Trends in Computational and Cognitive Engineering CRC Press

The book is a collection of best selected research papers presented at the Third International Conference on “Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE 2022),” organized by the University of Technology Sydney, Australia, in association with the Department of Mathematics, Pandit Deendayal Energy University, India, and Forum for Interdisciplinary Mathematics. This book presents new knowledge and recent developments in all aspects of computational techniques, mathematical modeling, energy systems, applications of fuzzy sets and intelligent computing. The book provides innovative works of researchers, academicians and students in the area of interdisciplinary mathematics, statistics, computational intelligence and renewable energy.

An Introduction to Fast Fourier Transform Methods for Partial Differential Equations with Applications Academic Press

This book comprehensively discusses the modeling of real-world industrial problems and innovative optimization techniques such as heuristics, finite methods, operation research techniques, intelligent algorithms, and agent- based methods. Discusses advanced techniques such as key cell, Mobius inversion, and zero suffix techniques to find initial feasible solutions to optimization problems. Provides a useful guide toward the development of a sustainable model for disaster management. Presents optimized hybrid block method techniques to solve mathematical problems existing in the industries. Covers mathematical techniques such as Laplace transformation, stochastic process, and differential techniques related to reliability theory. Highlights application on smart agriculture, smart healthcare, techniques for disaster management, and smart manufacturing. Advanced Mathematical Techniques in Computational and Intelligent Systems is primarily written for graduate and senior undergraduate students, as well as academic researchers in electrical engineering, electronics and communications engineering, computer engineering, and mathematics.

Certified Reduced Basis Methods for Parametrized Partial Differential Equations Elsevier

This book comprises select peer-reviewed articles submitted for the proceedings of the International Conference on Mathematics and Computing (ICMC 2022), held by the School of Advanced Sciences, Vellore Institute of Technology, Vellore, India, in association with Ramanujan Mathematical Society, India, Cryptology Research Society of India and Society for Electronic Transactions and Security, India, from 6–8 January 2022. With an aim to identify the existing challenges in the areas of mathematics and computing, the book emphasizes the importance of establishing new methods and algorithms to address these challenges. The book includes topics on diverse applications of cryptology, network security, cyber security, block chain, IoT, mobile network, data analytics, applied algebra, mathematical analysis, mathematical modelling, fluid dynamics, fractional calculus, multi-optimization, integral equations, dynamical systems, numerical analysis and scientific computing. Divided into five major parts—applied algebra and analysis, fractional calculus and integral equations, mathematical modelling and fluid dynamics, numerical analysis, and computer science and applications—the book is a useful resource for students, researchers and faculty as well as practitioners.

Advanced Mathematical Techniques in Computational and Intelligent Systems Cambridge University Press

Our understanding of the fundamental processes of the natural world is based to a large extent on partial differential equations (PDEs). The second edition of Partial Differential Equations provides an introduction to the basic properties of PDEs and the ideas and techniques that have proven useful in analyzing them. It provides the student a broad perspective on the subject, illustrates the incredibly rich variety of phenomena encompassed by it, and imparts a working knowledge of the most important techniques of analysis of the solutions of the equations. In this book mathematical jargon is minimized. Our focus is on the three most classical PDEs: the wave, heat and Laplace equations. Advanced concepts are introduced frequently but with the least possible technicalities. The book is flexibly designed for juniors, seniors or beginning graduate students in science, engineering or mathematics.

Fuzzy Differential Equations in Various Approaches CRC Press

Differential Transformation Method for Mechanical Engineering Problems focuses on applying DTM to a range of mechanical engineering applications. The authors modify traditional DTM to produce two additional methods, multi-step differential transformation method (Ms-DTM) and the hybrid differential transformation method and finite difference method (Hybrid DTM-FDM). It is then demonstrated how these can be a suitable series solution for engineering and physical problems, such as the motion of a spherical particle, nanofluid flow and heat transfer, and micropolar fluid flow and heat transfer. Presents the differential transformation method and why it holds an advantage over higher-order Taylor series methods Includes a full mathematical introduction to DTM, Ms-DTM, and Hybrid DTM Covers the use of these methods for solving a range of problems in areas such as nanofluid flow, heat transfer, and motion of a spherical particle in different conditions Provides numerous examples and exercises which will help the reader fully grasp the practical applications of these new methods

Analytic Methods for Partial Differential Equations CRC Press

In this book, we study theoretical and practical aspects of computing methods for mathematical modelling of nonlinear systems. A number of computing techniques are considered, such as methods of operator approximation with any given accuracy; operator interpolation techniques including a non-Lagrange interpolation; methods of system representation subject to constraints associated with concepts of causality, memory and stationarity; methods of system representation with an accuracy that is the best within a given class of models; methods of covariance matrix estimation; methods for low-rank matrix approximations; hybrid methods based on a combination of iterative procedures and best operator approximation; and methods for information compression and filtering under condition that a filter model should satisfy restrictions associated with causality and different types of memory. As a result, the book represents a blend of new methods in general computational analysis, and specific, but also generic, techniques for study of systems theory ant its particular branches, such as optimal filtering and information compression. - Best operator approximation, - Non-Lagrange interpolation, - Generic Karhunen-Loeve transform - Generalised low-rank matrix approximation - Optimal data compression - Optimal nonlinear filtering

Ordinary Differential Equations and Their Solutions Springer Science & Business Media

The book focuses on how to implement discrete wavelet transform methods in order to solve problems of reaction–diffusion equations and fractional-order differential equations that arise when modelling real physical phenomena. It explores the analytical and numerical approximate solutions obtained by wavelet methods for both classical and fractional-order differential equations; provides comprehensive information on the conceptual basis of wavelet theory and its applications; and strikes a sensible balance between mathematical rigour and the practical applications of wavelet theory. The book is divided into 11 chapters, the first three of which are devoted to the mathematical foundations and basics of wavelet theory. The remaining chapters provide wavelet-based numerical methods for linear, nonlinear, and fractional reaction–diffusion problems. Given its scope and format, the book is ideally suited as a text for undergraduate and graduate students of mathematics and engineering.

Differential Transformation Method for Mechanical Engineering Problems Springer Nature

Applications of Nanofluid for Heat Transfer Enhancement explores recent progress in computational fluid dynamic and nonlinear science and its applications to nanofluid flow and heat transfer. The opening chapters explain governing equations and then move on to discussions of free and forced convection heat transfers of nanofluids. Next, the effect of nanofluid in the presence of an electric field, magnetic field, and thermal radiation are investigated, with final sections devoted to nanofluid flow in porous media and application of nanofluid for solidification. The models discussed in the book have applications in various fields, including mathematics, physics, information science, biology, medicine, engineering, nanotechnology, and materials science. Presents the latest information on nanofluid free and force convection heat transfer, of nanofluid in the presence of thermal radiation, and nanofluid in the presence of an electric field Provides an understanding of the fundamentals in new numerical and analytical methods Includes codes for each modeling method discussed, along with advice on how to best apply them

Time-Fractional Order Biological Systems with Uncertain Parameters Springer Nature

This book will be a valuable addition to the growing literature in the area and essential reading for all researchers in the field of soliton theory.