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Domain Decomposition Methods - Algorithms and Theory - Andrea Toselli 2004-10-18
This book offers a comprehensive presentation of some of the most successful and popular domain decomposition preconditioners for finite and spectral element approximations of partial differential equations. It places strong emphasis on both algorithmic and mathematical aspects. It covers in detail important methods such as FETI and balancing Neumann-Neumann methods and algorithms for spectral element methods.
Decomposition Analysis Method in Linear and Nonlinear Differential Equations - Kansari Haldar 2015-10-22
A Powerful Methodology for Solving All Types of Differential Equations Decomposition Analysis Method in Linear and Non-Linear Differential Equations explains how the Adomian decomposition method can solve differential equations for the series solutions of fundamental problems in physics, astrophysics, chemistry, biology, medicine, and other scientific areas. This method is advantageous as it simplifies a real problem to reduce it to a mathematically tractable form. The book covers the four classes of the decomposition method: regular/ordinary decomposition, double decomposition, modified decomposition, and asymptotic decomposition. It applies these classes to Laplace and Navier–Stokes equations in Cartesian and polar coordinates for obtaining partial solutions of the equations. Examples of physical and physiological problems, such as tidal waves in a channel, fluids between plates and through tubes, the flow of blood through arteries, and the flow past a wave-shaped wall, demonstrate the applications. Drawing on the author's extensive research in fluid and gas dynamics, this book shows how the powerful decomposition methodology of Adomian can solve differential equations in a way comparable to any contemporary superfast computer.
Fifth International Symposium on Domain Decomposition Methods for Partial Differential Equations - David E. Keyes 1992-01-01
Papers presented at the May 1991 symposium reflect continuing interest in the role of domain decomposition in the effective utilization of parallel systems; applications in fluid mechanics, structures, biology, and design optimization; and maturation of analysis of elliptic equations, with theoretic
Domain Decomposition - Barry Smith 2004-03-25
Presents an easy-to-read discussion of domain

decomposition algorithms, their implementation and analysis. Ideal for graduate students about to embark on a career in computational science. It will also be a valuable resource for all those interested in parallel computing and numerical computational methods.

Parallel Numerical Algorithms - David E. Keyes 2012-12-06

In this volume, designed for computational scientists and engineers working on applications requiring the memories and processing rates of large-scale parallelism, leading algorithmicists survey their own field-defining contributions, together with enough historical and bibliographical perspective to permit working one's way to the frontiers. This book is distinguished from earlier surveys in parallel numerical algorithms by its extension of coverage beyond core linear algebraic methods into tools more directly associated with partial differential and integral equations - though still with an appealing generality - and by its focus on practical medium-granularity parallelism, approachable through traditional programming languages. Several of the authors used their invitation to participate as a chance to stand back and create a unified overview, which nonspecialists will appreciate.

Stochastic Systems - Adomian 1983-07-29

Stochastic Systems

Domain-Based Parallelism and Problem Decomposition Methods in Computational Science and Engineering - David E. Keyes 1995-01-01

This volume is one attempt to provide cross-disciplinary communication between heterogeneous computational groups developing solutions to problems of parallelization.

Stability Estimates for Hybrid Coupled Domain Decomposition Methods - Olaf Steinbach 2003-03-10

Domain decomposition methods are a well established tool for an efficient numerical solution of partial differential equations, in particular for the coupling of different model equations and of different discretization methods. Based on the approximate solution of local boundary value problems either by finite or boundary element methods, the global problem is reduced to an operator equation on the skeleton of the domain decomposition. Different variational formulations then lead to hybrid domain decomposition methods.

Computational Methods for Numerical Analysis with R - James P Howard, II 2017-07-12

Computational Methods for Numerical Analysis with R is an overview of traditional numerical analysis topics presented using R. This guide shows how common functions from linear algebra, interpolation, numerical integration, optimization, and differential equations can be implemented in pure R code. Every algorithm described is given with a complete function implementation in R, along with examples to demonstrate the function and its use. Computational Methods for Numerical Analysis with R is intended for those who already know R, but are interested in learning more about how the underlying algorithms work. As such, it is suitable for statisticians, economists, and engineers, and others with a computational and numerical background.

Decomposition Methods for Differential Equations - Juergen Geiser 2017-06-14

Decomposition Methods for Differential Equations: Theory and Applications describes the analysis of numerical methods for evolution equations based on temporal and spatial decomposition methods. It covers real-life problems, the underlying decomposition and discretization, the stability and consistency analysis of the decomposition methods, and numerical results. The book focuses on the modeling of selected multi-physics problems, before introducing decomposition analysis. It presents time and space discretization, temporal decomposition, and the combination of time and spatial decomposition methods for parabolic and hyperbolic equations. The author then applies these methods to numerical problems, including test examples and real-world problems in physical and engineering applications. For the computational results, he uses various software tools, such as MATLAB�, R3T, WIAS-HiTNIHS, and OPERA-SPLITT. Exploring iterative operator-splitting methods, this book shows how to use higher-order discretization methods to solve differential equations. It discusses decomposition methods and their effectiveness, combination possibility with discretization methods, multi-scaling possibilities, and stability to initial and boundary values problems.

Third International Symposium on Domain Decomposition Methods for Partial Differential Equations - Jacques Periaux 1990

Partial Differential Equations and Solitary Waves Theory - Abdul-Majid Wazwaz 2010-05-28

"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.

Dirichlet-Dirichlet Domain Decomposition Methods for Elliptic Problems - Vadim Glebovich Korneev 2015

Domain decomposition (DD) methods provide powerful tools for constructing parallel numerical solution algorithms for large scale systems of algebraic equations arising from the discretization of partial differential equations. These methods are well-established and belong to a fast developing area. In this volume, the reader will find a brief historical overview, the basic results of the general theory of domain and space decomposition methods as well as the description and analysis of practical DD algorithms for parallel computing. It is typical to find in this volume that most of the presented DD solvers belong to the family of fast algorithms, where each component is efficient with respect to the arithmetical work. Readers will discover new analysis results for both the well-known basic DD solvers and some DD methods recently devised by the authors, e.g., for elliptic problems with varying chaotically piecewise constant orthotropism without restrictions on the finite aspect ratios.The hp finite element discretizations, in particular, by spectral elements of elliptic equations are given significant attention in current research and applications. This volume is the first to feature all components of Dirichlet-Dirichlet-type DD solvers for hp discretizations devised as numerical procedures which result in DD solvers that are almost optimal with respect to the computational work. The most important DD solvers are presented in the matrix/vector form algorithms that are convenient for practical use.

Multiple Shooting and Time Domain Decomposition Methods - Thomas Carraro 2015-10-26

This book offers a comprehensive collection of the most advanced numerical techniques for the efficient and effective solution of simulation and optimization problems governed by systems of time-dependent differential equations. The contributions present various approaches to time domain decomposition, focusing on multiple shooting and parareal algorithms. The range of topics covers theoretical analysis of the methods, as well as their algorithmic formulation and guidelines for practical implementation. Selected examples show that the discussed approaches are mandatory for the solution of challenging practical problems. The practicability and efficiency of the presented methods is illustrated by several case studies from fluid dynamics, data compression, image processing and computational biology, giving rise to possible new research topics. This volume, resulting from the workshop Multiple Shooting and Time Domain Decomposition Methods, held in Heidelberg in May 2013, will be of great interest to applied mathematicians, computer scientists and all scientists using mathematical methods.

Meshfree Methods for Partial Differential Equations IX - Michael Griebel 2019-06-19

This volume collects selected papers presented at the Ninth International Workshop on Meshfree Methods held in Bonn, Germany in September 2017. They address various aspects of this very active research field and cover topics from applied mathematics, physics and engineering. The numerical treatment of partial differential equations with meshfree discretization techniques has been a very active research area in recent years. While the fundamental theory of meshfree methods has been developed and considerable advances of the various methods have been made, many challenges in the mathematical analysis and practical implementation of meshfree methods remain. This symposium aims to promote collaboration among engineers, mathematicians, and computer scientists and industrial researchers to address the development, mathematical analysis, and application of meshfree and particle methods especially to multiscale phenomena. It continues the 2-year-cycled Workshops on Meshfree Methods for Partial Differential Equations.

Solving Frontier Problems of Physics: The Decomposition Method - G. Adomian 1993-12-31

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.

Third International Symposium on Domain Decomposition Methods for Partial Differential Equations - Tony F. Chan 1990-01-01

Partial Differential Equations - Abdul-Majid Wazwaz 2002-01-01

This text gathers, revises and explains the newly developed Adomian decomposition method along with its modification and some traditional techniques.

Fractional Differential Equations - Juan J. Nieto 2019-11-19

Fractional calculus provides the possibility of introducing integrals and derivatives of an arbitrary order in the mathematical modelling of physical processes, and it has become a relevant subject with applications to various fields, such as anomalous diffusion, propagation in different media, and propogation in relation to materials with different properties. However, many aspects from theoretical and practical points of view have still to be developed in relation to models based on fractional operators. This Special Issue is related to new developments on different aspects of fractional differential equations, both from a theoretical point of view and in terms of applications in different fields such as physics, chemistry, or control theory, for instance. The topics of the Issue include fractional calculus, the mathematical analysis of the properties of the solutions to fractional equations, the extension of classical approaches, or applications of fractional equations to several fields.

Domain Decomposition Methods in Scientific and Engineering Computing - David E. Keyes 1994

This book contains proceedings from the Seventh International Conference on Domain Decomposition Methods, held at Pennsylvania State University in October 1993. The term "domain decomposition" has for nearly a decade been associated with the partly iterative, partly direct algorithms explored in the proceedings of this conference. Noteworthy trends in the current volume include progress in dealing with so-called "bad parameters" in elliptic partial differential equation problems, as well as developments in partial differential equations outside of the elliptically-dominated framework. Also described here are convergence and complexity results for novel discretizations, which bring with them new challenges in the derivation of appropriate operators for coarsened spaces. Implementations and architectural considerations are discussed, as well as partitioning tools and environments. In addition, the book describes a wide array of applications, from semiconductor device simulation to structural mechanics to aerodynamics. Presenting many of the latest results in the field, this book offers readers an up-to-date guide to the many facets of the theory and practice of domain decomposition.

Hodge Decomposition - A Method for Solving Boundary Value Problems - Gunter Schwarz 1995-07-14

Hodge theory is a standard tool in characterizing differ- ential complexes and the topology of manifolds. This book is a study of the Hodge-Kodaira and related decompositions on manifolds with boundary under mainly analytic aspects. It aims at developing a method for solving boundary value problems. Analysing a Dirichlet form on the exterior algebra bundle allows to give a refined version of the classical decomposition results of Morrey. A projection technique leads to existence and regularity theorems for a wide class of boundary value problems for differential forms and vector fields. The book links aspects of the geometry of manifolds with the theory of partial differential equations. It is intended to be comprehensible for graduate students and mathematicians working in either of these fields.

PETSc for Partial Differential Equations: Numerical Solutions in C and Python - Ed Bueler 2020-10-22

The Portable, Extensible Toolkit for Scientific Computation (PETSc) is an open-source library of advanced data structures and methods for solving linear and nonlinear equations and for managing discretizations. This book uses these modern numerical tools to demonstrate how to solve nonlinear partial differential equations (PDEs) in parallel. It starts from key mathematical concepts, such as Krylov space methods, preconditioning, multigrid, and Newton’s method. In PETSc these components are composed at run time into fast solvers. Discretizations are introduced from the beginning, with an emphasis on finite difference and finite element methodologies. The example C programs of the first 12 chapters, listed on the inside front cover, solve (mostly) elliptic and parabolic PDE problems. Discretization leads to large, sparse, and generally nonlinear systems of algebraic equations. For such problems, mathematical solver concepts are explained and illustrated through the examples, with sufficient context to speed further development. PETSc for Partial Differential Equations addresses both discretizations and fast solvers for PDEs, emphasizing practice more than theory. Well-structured examples lead to run-time choices that result in high solver performance and parallel scalability. The last two chapters build on the reader’s understanding of fast solver concepts when applying the Firedrake Python finite element solver library. This textbook, the first to cover PETSc programming for nonlinear PDEs, provides an on-ramp for graduate students and researchers to a major area of high-performance computing for science and engineering. It is suitable as a supplement for courses in scientific computing or numerical methods for differential equations.

Operator Theory and Numerical Methods - H. Fujita 2001-07-03

In accordance with the developments in computation, theoretical studies on numerical schemes are now fruitful and highly needed. In 1991 an article on the finite element method applied to evolutionary problems was published. Following the method, basically this book studies various schemes from operator theoretical points of view. Many parts are devoted to the finite element method, but other schemes and problems (charge simulation method, domain decomposition method, nonlinear problems, and so forth) are also discussed, motivated by the observation that practically useful schemes have fine mathematical structures and the converses are also true.

The Mathematical Theory of Finite Element Methods - Susanne Brenner 2002-04-12

A rigorous and thorough mathematical

introduction to the subject; A clear and concise treatment of modern fast solution techniques such as multigrid and domain decomposition algorithms; Second edition contains two new chapters, as well as many new exercises; Previous edition sold over 3000 copies worldwide

Domain Decomposition Methods in Science and Engineering XVI - Olof B. Widlund 2007-01-19

Domain decomposition is an active research area concerned with the development, analysis, and implementation of coupling and decoupling strategies in mathematical and computational models of natural and engineered systems. The present volume sets forth new contributions in areas of numerical analysis, computer science, scientific and industrial applications, and software development.

Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations - R. Glowinski 1991-01-01

Focuses on the notion that by breaking the domain of the original problem into subdomains, such an approach can, if properly implemented, lead to a considerable speedup. The methods are particularly well suited for parallel computers.

Iterative Splitting Methods for Differential Equations - Juergen Geiser 2011-06-01

Iterative Splitting Methods for Differential Equations explains how to solve evolution equations via novel iterative-based splitting methods that efficiently use computational and memory resources. It focuses on systems of parabolic and hyperbolic equations, including convection-diffusion-reaction equations, heat equations, and wave equations. In the theoretical part of the book, the author discusses the main theorems and results of the stability and consistency analysis for ordinary differential equations. He then presents extensions of the iterative splitting methods to partial differential equations and spatial- and time-dependent differential equations. The practical part of the text applies the methods to benchmark and real-life problems, such as waste disposal, elastics wave propagation, and complex flow phenomena. The book also examines the benefits of equation decomposition. It concludes with a discussion on several useful software packages, including r3t and FIDOS. Covering a wide range of theoretical and practical issues in multiphysics and multiscale problems, this book explores the benefits of using iterative splitting schemes to solve physical problems. It illustrates how iterative operator splitting methods are excellent decomposition methods for obtaining higher-order accuracy.

Domain Decomposition Methods in Optimal Control of Partial Differential Equations - John E. Lagnese 2012-12-06

While domain decomposition methods have a long history dating back well over one hundred years, it is only during the last decade that they have become a major tool in numerical analysis of partial differential equations. This monograph emphasizes domain decomposition methods in the context of so-called virtual optimal control problems and treats optimal control problems for partial differential equations and their decompositions using an all-at-once approach.

Coupled Systems - Juergen Geiser 2014-02-14

Efficient Methods to Solve Complex Coupled Systems Coupled Systems: Theory, Models, and Applications in Engineering explains how to solve complicated coupled models in engineering using analytical and numerical methods. It presents splitting multiscale methods to solve multiscale and multiphysics problems and describes analytical and numerical methods in time and space for evolution equations arising in engineering problems. The book discusses the effectiveness, simplicity, stability, and consistency of the methods in solving problems that occur in real-life engineering tasks. It shows how MATLAB® and Simulink® are used to implement the methods. The author also covers the coupling of separate, multiple, and logical scales in applications, including microscale, macroscale, multiscale, and multiphysics problems. Covering mathematical, algorithmic, and practical aspects, this book brings together innovative ideas in coupled systems and extends standard engineering tools to coupled models in materials and flow problems with respect to their scale dependencies and their influence on each time and spatial scale.

Numerical Approximation of Partial Differential Equations - Alfio Quarteroni 2008-09-24

Everything is more simple than one thinks but at the same time more complex than one can understand Johann Wolfgang von Goethe To reach the point that is unknown to you, you must take the road that is unknown to you St. John of the Cross This is a book on the numerical approximation ofpartial differential equations (PDEs). Its scope is to provide a thorough illustration of numerical methods (especially those stemming from the variational formulation of PDEs), carry out their stability and convergence analysis, derive error bounds, and discuss the algorithmic aspects relative to their implementation. A sound balancing of theoretical analysis, description of algorithms and discussion of applications is our primary concern. Many kinds of problems are addressed: linear and nonlinear, steady and time-dependent, having either smooth or non-smooth solutions. Besides model equations, we consider a number of (initial-) boundary value problems of interest in several fields of applications. Part I is devoted to the description and analysis of general numerical methods for the discretization of partial differential equations. A comprehensive theory of Galerkin methods and its variants (Petrov Galerkin and generalized Galerkin), as wellas ofcollocationmethods, is devel oped for the spatial discretization. This theory is then specified to two numer ical subspace realizations of remarkable interest: the finite element method (conforming, non-conforming, mixed, hybrid) and the spectral method (Leg endre and Chebyshev expansion).

Numerical Solution of Partial Differential Equations: Theory, Algorithms, and Their Applications - Oleg P. Iliev 2013-06-04

One of the current main challenges in the area of scientific computing is the design and implementation of accurate numerical models for complex physical systems which are described by time dependent coupled systems of nonlinear PDEs. This volume integrates the works of experts in computational mathematics and its applications, with a focus on modern algorithms which are at the heart of accurate modeling: adaptive finite element methods, conservative finite difference methods and finite volume methods, and multilevel solution techniques. Fundamental theoretical results are revisited in survey articles and new techniques in numerical analysis are introduced. Applications showcasing the efficiency, reliability and robustness of the algorithms in porous media, structural mechanics and electromagnetism are presented. Researchers and graduate students in numerical analysis and numerical solutions of PDEs and their scientific computing applications will find this book useful.

Handbook of Linear Partial Differential Equations for Engineers and Scientists - Andrei D. Polyanin 2001-11-28

Following in the footsteps of the authors' bestselling Handbook of Integral Equations and Handbook of Exact Solutions for Ordinary Differential Equations, this handbook presents brief formulations and exact solutions for more than 2,200 equations and problems in science and engineering. Parabolic, hyperbolic, and elliptic equations with

Proper Orthogonal Decomposition Methods for Partial Differential Equations - Zhendong Luo 2018-11-26

Proper Orthogonal Decomposition Methods for Partial Differential Equations evaluates the potential applications of POD reduced-order numerical methods in increasing computational efficiency, decreasing calculating load and alleviating the accumulation of truncation error in the computational process. Introduces the foundations of finite-differences, finite-elements and finite-volume-elements. Models of time-dependent PDEs are presented, with detailed numerical procedures, implementation and error analysis. Output numerical data are plotted in graphics and compared using standard traditional methods. These models contain parabolic, hyperbolic and nonlinear systems of PDEs, suitable for the user to learn and adapt methods to their own R&D problems. Explains ways to reduce order for PDEs by means of the POD method so that reduced-order models have few unknowns Helps readers speed up computation and reduce computation load and memory requirements while numerically capturing system characteristics Enables readers to apply and adapt the methods to solve similar problems for PDEs of hyperbolic, parabolic and nonlinear types

Domain Decomposition Methods for the Numerical Solution of Partial Differential Equations - Tarek Mathew 2008-06-25

Domain decomposition methods are divide and conquer computational methods for the parallel solution of partial differential equations of elliptic or parabolic type. The methodology includes iterative algorithms, and techniques for non-matching grid discretizations and heterogeneous approximations. This book serves as a matrix oriented introduction to domain decomposition methodology. A wide range of topics are discussed include hybrid formulations, Schwarz, and many more.

Hodge Decomposition - A Method for Solving Boundary Value Problems - Günter Schwarz 2006-11-14

Hodge theory is a standard tool in characterizing differ- ential complexes and the topology of manifolds. This book is a study of the Hodge-Kodaira and related decompositions on manifolds with boundary under mainly analytic aspects. It aims at developing a method for solving boundary value problems. Analysing a Dirichlet form on the exterior algebra bundle allows to give a refined version of the classical decomposition results of Morrey. A projection technique leads to existence and regularity theorems for a wide class of boundary value problems for differential forms and vector fields. The book links aspects of the geometry of manifolds with the theory of partial differential equations. It is intended to be comprehensible for graduate students and mathematicians working in either of these fields.

An Introduction to Domain Decomposition Methods: Algorithms, Theory, and Parallel Implementation - Victorita Dolean 2015-12-08

The purpose of this book is to offer an overview of the most popular domain decomposition methods for partial differential equations (PDEs). These methods are widely used for numerical simulations in solid mechanics, electromagnetism, flow in porous media, etc., on parallel machines from tens to hundreds of thousands of cores. The appealing feature of domain decomposition methods is that, contrary to direct methods, they are naturally parallel. The authors focus on parallel linear solvers. The authors present all popular algorithms, both at the PDE level and at the discrete level in terms of matrices, along with systematic scripts for sequential implementation in a free open-source finite element package as well as some parallel scripts. Also included is a new coarse space construction (two-level method) that adapts to highly heterogeneous problems.?

Eddy Current Approximation of Maxwell Equations - Ana Alonso Rodriguez 2010-07-19

This book deals with the mathematical analysis and the numerical approximation of eddy current problems in the time-harmonic case. It takes into account all the most used formulations, placing the problem in a rigorous functional framework.

Decomposition Methods for Differential Equations - Juergen Geiser 2009-05-20

Decomposition Methods for Differential Equations: Theory and Applications describes the analysis of numerical methods for evolution equations based on temporal and spatial decomposition methods. It covers real-life problems, the underlying decomposition and discretization, the stability and consistency analysis of the decomposition methods, and numerical results. The book focuses on the modeling of selected multi-physics problems, before introducing decomposition analysis. It presents time and space discretization, temporal decomposition, and the combination of time and spatial decomposition methods for parabolic and hyperbolic equations. The author then applies these methods to numerical problems, including test examples and real-world problems in physical and engineering applications. For the computational results, he uses various software tools, such as MATLAB®, R3T, WIAS-HiTNIHS, and OPERA-SPLITT. Exploring iterative operator-splitting methods, this book shows how to use higher-order discretization methods to solve differential equations. It discusses decomposition methods and their effectiveness, combination possibility with discretization methods, multi-scaling possibilities, and stability to initial and boundary values problems.

Domain Decomposition Methods in Science and Engineering XXIV - Petter E. Bjørstad 2019-01-05

These are the proceedings of the 24th International Conference on Domain Decomposition Methods in Science and Engineering, which was held in Svalbard, Norway in February 2017. Domain decomposition methods are iterative methods for solving the often very large systems of equations that arise when engineering problems are discretized, frequently using finite elements or other modern techniques. These methods are specifically designed to make effective use of massively parallel, high-performance computing systems. The book presents both theoretical and computational advances in this domain, reflecting the state of art in 2017.

Solving Frontier Problems of Physics: The Decomposition Method - G. Adomian 2013-06-29

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.