Explicit And Implicit Methods In Solving Differential

If you ally craving such a referred **Explicit And Implicit Methods In Solving Differential** book that will manage to pay for you worth, get the unquestionably best seller from us currently from several preferred authors. If you want to funny books, lots of novels, tale, jokes, and more fictions collections are also launched, from best seller to one of the most current released.

You may not be perplexed to enjoy all book collections Explicit And Implicit Methods In Solving Differential that we will definitely offer. It is not almost the costs. Its nearly what you infatuation currently. This Explicit And Implicit Methods In Solving Differential , as one of the most committed sellers here will totally be accompanied by the best options to review.

Fundamentals of Engineering Numerical Analysis - Parviz Moin 2001-08-20
Engineers need hands-on experience in solving complex engineering problems with computers. This text introduces numerical methods and shows how to develop, analyze, and use them. A thorough and practical book, it is is intended as a first course in numerical analysis, primarily for beginning graduate students in engineering and physical science. Along with mastering the fundamentals of numerical methods, students will learn to write their own computer programs using standard numerical methods. They will learn what factors affect accuracy, stability, and convergence. A special feature is the numerous examples and exercises that are included to give students first-hand experience.
Numerical Methods for Engineers and Scientists - Joe D. Hoffman 2018-10-03
Emphasizing the finite difference approach for solving differential equations, the second edition of Numerical Methods for Engineers and Scientists presents a methodology for systematically constructing individual computer programs. Providing easy access to accurate solutions to complex scientific and engineering problems, each chapter begins with objectives, a discussion of a representative application, and an outline of special features, summing up with a list of tasks students should be able to complete after reading the chapter- perfect for use as a study guide or for review. The AIAA Journal calls the book "...a good, solid instructional text on the basic tools of numerical analysis."
Computational Fluid Mechanics and Heat Transfer, Second Edition - Richard H. Pletcher 1997-04-01
This comprehensive text provides basic fundamentals of computational theory and computational methods. The book is divided into two parts. The first part covers material fundamental to the understanding and application of finite-difference methods. The second part illustrates the use of such methods in solving different types of complex problems encountered in fluid mechanics and heat transfer. The book is replete with worked examples and problems provided at the end of each chapter.
Numerical Methods for Partial Differential Equations - William F. Ames 2014-05-10
Numerical Methods for Partial Differential Equations, Second Edition deals with the use of numerical methods to solve partial differential equations. In addition to numerical fluid mechanics, hopscotch and other explicit-implicit methods are also considered, along with Monte Carlo techniques, lines, fast Fourier transform, and fractional steps methods. Comprised of six chapters, this volume

begins with an introduction to numerical calculation, paying particular attention to the classification of equations and physical problems, asymptotics, discrete methods, and dimensionless forms. Subsequent chapters focus on parabolic and hyperbolic equations, elliptic equations, and special topics ranging from singularities and shocks to Navier-Stokes equations and Monte Carlo methods. The final chapter discuss the general concepts of weighted residuals, with emphasis on orthogonal collocation and the Bubnov-Galerkin method. The latter procedure is used to introduce finite elements. This book should be a valuable resource for students and practitioners in the fields of computer science and applied mathematics.

Studies of Implicit and Explicit Solution Techniques in Transient Thermal Analysis of Structures - Howard M. Adelman 1982

Computational Mathematics - Dimitrios Mitsotakis 2023-06-19

This textbook is a comprehensive introduction to computational mathematics and scientific computing suitable for undergraduate and postgraduate courses. It presents both practical and theoretical aspects of the subject, as well as advantages and pitfalls of classical numerical methods alongside with computer code and experiments in Python. Each chapter closes with modern applications in physics, engineering, and computer science. Features: No previous experience in Python is required. Includes simplified computer code for fast-paced learning and transferable skills development. Includes practical problems ideal for project assignments and distance learning. Presents both intuitive and rigorous faces of modern scientific computing. Provides an introduction to neural networks and machine learning.

Differential Equations Workbook For Dummies - Steven Holzner 2009-06-29

Make sense of these difficult equations Improve your problem-solving skills Practice with clear, concise examples Score higher on standardized tests and exams Get the confidence and the skills you need to master differential equations! Need to know how to solve differential equations? This easy-to-follow, hands-on workbook helps you master the basic concepts and work through the types of problems you'll encounter in your coursework. You get valuable exercises, problem-solving shortcuts, plenty of workspace, and step-by-step solutions to every equation. You'll also memorize the most-common types of differential equations, see how to avoid common mistakes, get tips and tricks for advanced problems, improve your exam scores, and much more! More than 100 Problems! Detailed, fully worked-out solutions to problems The inside scoop on first, second, and higher order differential equations A wealth of advanced techniques, including power series THE DUMMIES WORKBOOK WAY Quick, refresher explanations Step-by-step procedures Hands-on practice exercises Ample workspace to work out problems Online Cheat Sheet A dash of humor and fun

Differential Equations with Mathematica - Martha L. Abell 2022-04-18

Differential Equations with Mathematica, Fifth Edition uses the fundamental concepts of the popular platform to solve (analytically, numerically, and/or graphically) differential equations of interest to students, instructors, and scientists. Mathematica's diversity makes it particularly well suited to performing calculations encountered when solving many ordinary and partial differential equations. In some cases, Mathematica's built-in functions can immediately solve a differential equation by providing an explicit, implicit, or numerical solution. In other cases, Mathematica can be used to perform the calculations encountered when solving a differential equation. Because one goal of elementary differential equations courses is to introduce students to basic methods and algorithms so that they gain proficiency in them, nearly every topic covered this book introduces basic commands, also including typical examples of their application. A study of differential equations relies on concepts

from calculus and linear algebra, so this text also includes discussions of relevant commands useful in those areas. In many cases, seeing a solution graphically is most meaningful, so the book relies heavily on Mathematica's outstanding graphics capabilities. Demonstrates how to take advantage of the advanced features of Mathematica Introduces the fundamental theory of ordinary and partial differential equations using Mathematica to solve typical problems of interest to students, instructors, scientists, and practitioners in many fields Showcases practical applications and case studies drawn from biology, physics, and engineering

Numerical methods basics with Programming examples - Tchavdar Marinov

Thermal Stresses IV - R.B. Hetnarski 1996-05-10

This is the fourth volume of the handbook Thermal Stresses. Following the principles established when the first volume was published in 1986, the fourth volume consists of six separate chapters prepared by specialists in the field. Each chapter is devoted to a different topic in the area of Thermal Stresses. Many results have been published for the first time in Thermal Stresses IV. The exposition of the material is on the state-of-the art level, which should be appropriate for graduate students, researchers, and engineers specializing in the field of stress analysis. In most cases the material is presented with some historical perspective. A large number of references provided will allow the readers to augment their knowledge, after studying a particular chapter.

Finite Difference Methods in Heat Transfer - M. Necati Özişik 2017-07-12

Finite Difference Methods in Heat Transfer presents a clear, step-by-step delineation of finite difference methods for solving engineering problems governed by ordinary and partial differential equations, with emphasis on heat transfer applications. The finite difference techniques presented apply to the numerical solution of problems governed by similar differential equations encountered in many other fields. Fundamental concepts are introduced in an easy-to-follow manner. Representative examples illustrate the application of a variety of powerful and widely used finite difference techniques. The physical situations considered include the steady state and transient heat conduction, phase-change involving melting and solidification, steady and transient forced convection inside ducts, free convection over a flat plate, hyperbolic heat conduction, nonlinear diffusion, numerical grid generation techniques, and hybrid numerical-analytic solutions.

Richardson Extrapolation - Zahari Zlatev 2017-11-07

Scientists and engineers are mainly using Richardson extrapolation as a computational tool for increasing the accuracy of various numerical algorithms for the treatment of systems of ordinary and partial differential equations and for improving the computational efficiency of the solution process by the automatic variation of the time-stepsizes. A third issue, the stability of the computations, is very often the most important one and, therefore, it is the major topic studied in all chapters of this book. Clear explanations and many examples make this text an easy-to-follow handbook for applied mathematicians, physicists and engineers working with scientific models based on differential equations. Contents The basic properties of Richardson extrapolation Richardson extrapolation for explicit Runge-Kutta methods Linear multistep and predictor-corrector methods Richardson extrapolation for some implicit methods Richardson extrapolation for splitting techniques Richardson extrapolation for advection problems Richardson extrapolation for some other problems General conclusions

Partial Differential Equations for Scientists and Engineers - Stanley J. Farlow 2012-03-08

Practical text shows how to formulate and solve partial differential equations. Coverage of diffusion-type problems, hyperbolic-type problems, elliptic-type problems, numerical and approximate

methods. Solution guide available upon request. 1982 edition.

Group Explicit Methods for the Numerical Solution of Partial Differential Equations - David J. Evans 1997-05-22

A new class of methods, termed "group explicit methods," is introduced in this text. Their applications to solve parabolic, hyperbolic and elliptic equations are outlined, and the advantages for their implementation on parallel computers clearly portrayed. Also included are the introductory and fundamental concepts from which the new methods are derived, and on which they are dependent. With the increasing advent of parallel computing into all aspects of computational mathematics, there is no doubt that the new methods will be widely used.

Open-Channel Flow - Subhash C. Jain 2000-10-24

A clear, up-to-date presentation of the principles of flow in open channels A fundamental knowledge of flow in open channels is essential for the planning and design of systems to manage water resources. Open-Channel Flow conveys this knowledge through the use of practical problems that can be solved either analytically or by simple numerical methods that do not require the use of computer software. This completely up-to-date text includes several features not found in any other book on the subject. It derives one- dimensional equations of motion using both a simplified approach and a rigorous approach, and it explains the distinction between the momentum and mechanical energy equations. The author places great emphasis on identifying the types and locations of the control sections that are essential in analyzing flow profiles, and he includes a section on recently recognized nonunique flow profiles. Offering numerous worked examples that are helpful in understanding the basic principles and their practical applications, this book: * Presents the latest computational methods for profiling spatially varied and unsteady flow * Includes end-of-section exercises that measure and build understanding * Fully explains governing equations in algebraic and differential form * Brings sluice-gate analysis completely up to date * Covers artificial channel controls such as weirs, spillways, and gates, and special topics such as transitions in supercritical flow and flow through culverts Written in metric units throughout, this excellent learning tool for senior- and graduate-level students in civil and environmental engineering programs is also a useful reference for practicing civil and environmental engineers.

The Numerical Solution of Ordinary and Partial Differential Equations - Granville Sewell 2014-05-10

The Numerical Solution of Ordinary and Partial Differential Equations is an introduction to the numerical solution of ordinary and partial differential equations. Finite difference methods for solving partial differential equations are mostly classical low order formulas, easy to program but not ideal for problems with poorly behaved solutions or (especially) for problems in irregular multidimensional regions. FORTRAN77 programs are used to implement many of the methods studied. Comprised of six chapters, this book begins with a review of direct methods for the solution of linear systems, with emphasis on the special features of the linear systems that arise when differential equations are solved. The next four chapters deal with the more commonly used finite difference methods for solving a variety of problems, including both ordinary differential equations and partial differential equations, and both initial value and boundary value problems. The final chapter is an overview of the basic ideas behind the finite element method and covers the Galerkin method for boundary value problems. Examples using piecewise linear trial functions, cubic hermite trial functions, and triangular elements are presented. This monograph is appropriate for senior-level undergraduate or first-year graduate students of mathematics.

Power Engineering - Viorel Badescu 2018-12-07

Traditionally, power engineering has been a subfield of energy engineering and electrical

engineering which deals with the generation, transmission, distribution and utilization of electric power and the electrical devices connected to such systems including generators, motors and transformers. Implicitly this perception is associated with the generation of power in large hydraulic, thermal and nuclear plants and distributed consumption. Faced with the climate change phenomena, humanity has had to now contend with changes in attitudes in respect of environment protection and depletion of classical energy resources. These have had consequences in the power production sector, already faced with negative public opinions on nuclear energy and favorable perception of renewable energy resources and about distributed power generation. The objective of this edited book is to review all these changes and to present solutions for future power generation. Future energy systems must factor in the changes and developments in technology like improvements of natural gas combined cycles and clean coal technologies, carbon dioxide capture and storage, advancements in nuclear reactors and hydropower, renewable energy engineering, power-to-gas conversion and fuel cells, energy crops, new energy vectors biomass-hydrogen, thermal energy storage, new storage systems diffusion, modern substations, high voltage engineering equipment and compatibility, HVDC transmission with FACTS, advanced optimization in a liberalized market environment, active grids and smart grids, power system resilience, power quality and cost of supply, plug-in electric vehicles, smart metering, control and communication technologies, new key actors as prosumers, smart cities. The emerging research will enhance the security of energy systems, safety in operation, protection of environment, improve energy efficiency, reliability and sustainability. The book reviews current literature in the advances, innovative options and solutions in power engineering. It has been written for researchers, engineers, technicians and graduate and doctorate students interested in power engineering.

Financial Engineering and Computation - Yuh-Dauh Lyuu 2002

A comprehensive text and reference, first published in 2002, on the theory of financial engineering with numerous algorithms for pricing, risk management, and portfolio management.

Solving Differential Equations in R - Karline Soetaert 2012-06-06

Mathematics plays an important role in many scientific and engineering disciplines. This book deals with the numerical solution of differential equations, a very important branch of mathematics. Our aim is to give a practical and theoretical account of how to solve a large variety of differential equations, comprising ordinary differential equations, initial value problems and boundary value problems, differential algebraic equations, partial differential equations and delay differential equations. The solution of differential equations using R is the main focus of this book. It is therefore intended for the practitioner, the student and the scientist, who wants to know how to use R for solving differential equations. However, it has been our goal that non-mathematicians should at least understand the basics of the methods, while obtaining entrance into the relevant literature that provides more mathematical background. Therefore, each chapter that deals with R examples is preceded by a chapter where the theory behind the numerical methods being used is introduced. In the sections that deal with the use of R for solving differential equations, we have taken examples from a variety of disciplines, including biology, chemistry, physics, pharmacokinetics. Many examples are well-known test examples, used frequently in the field of numerical analysis.

Numerical Methods for Ordinary Differential Equations - J. C. Butcher 2004-08-20

This new book updates the exceptionally popular Numerical Analysis of Ordinary Differential Equations. "This book is...an indispensible reference for any researcher."-American Mathematical Society

on the First Edition. Features: * New exercises included in each chapter. * Author is widely regarded as the world expert on Runge-Kutta methods * Didactic aspects of the book have been enhanced by interspersing the text with exercises. * Updated Bibliography.

On the Performance of Explicit and Implicit Algorithms for Transient Thermal Analysis - 1980

Traffic Flow Dynamics - Martin Treiber 2012-10-11
This textbook provides a comprehensive and instructive coverage of vehicular traffic flow dynamics and modeling. It makes this fascinating interdisciplinary topic, which to date was only documented in parts by specialized monographs, accessible to a broad readership. Numerous figures and problems with solutions help the reader to quickly understand and practice the presented concepts. This book is targeted at students of physics and traffic engineering and, more generally, also at students and professionals in computer science, mathematics, and interdisciplinary topics. It also offers material for project work in programming and simulation at college and university level. The main part, after presenting different categories of traffic data, is devoted to a mathematical description of the dynamics of traffic flow, covering macroscopic models which describe traffic in terms of density, as well as microscopic many-particle models in which each particle corresponds to a vehicle and its driver. Focus chapters on traffic instabilities and model calibration/validation present these topics in a novel and systematic way. Finally, the theoretical framework is shown at work in selected applications such as traffic-state and travel-time estimation, intelligent transportation systems, traffic operations management, and a detailed physics-based model for fuel consumption and emissions.

Introduction to Finite Element Analysis and Design - Nam H. Kim 2018-06-15
Introduces the basic concepts of FEM in an easy-to-use format so that students and professionals can use the method efficiently and interpret results properly Finite element method (FEM) is a powerful tool for solving engineering problems both in solid structural mechanics and fluid mechanics. This book presents all of the theoretical aspects of FEM that students of engineering will need. It eliminates overlong math equations in favour of basic concepts, and reviews of the mathematics and mechanics of materials in order to illustrate the concepts of FEM. It introduces these concepts by including examples using six different commercial programs online. The all-new, second edition of Introduction to Finite Element Analysis and Design provides many more exercise problems than the first edition. It includes a significant amount of material in modelling issues by using several practical examples from engineering applications. The book features new coverage of buckling of beams and frames and extends heat transfer analyses from 1D (in the previous edition) to 2D. It also covers 3D solid element and its application, as well as 2D. Additionally, readers will find an increase in coverage of finite element analysis of dynamic problems. There is also a companion website with examples that are concurrent with the most recent version of the commercial programs. Offers elaborate explanations of basic finite element procedures Delivers clear explanations of the capabilities and limitations of finite element analysis Includes application examples and tutorials for commercial finite element software, such as MATLAB, ANSYS, ABAQUS and NASTRAN Provides numerous examples and exercise problems Comes with a complete solution manual and results of several engineering design projects Introduction to Finite Element Analysis and Design, 2nd Edition is an excellent text for junior and senior level undergraduate students and beginning graduate students in mechanical, civil, aerospace, biomedical engineering, industrial engineering and engineering mechanics.

The Numerical Solution of Differential-Algebraic

Systems by Runge-Kutta Methods - Ernst Hairer 2006-11-14

The term differential-algebraic equation was coined to comprise differential equations with constraints (differential equations on manifolds) and singular implicit differential equations. Such problems arise in a variety of applications, e.g. constrained mechanical systems, fluid dynamics, chemical reaction kinetics, simulation of electrical networks, and control engineering. From a more theoretical viewpoint, the study of differential-algebraic problems gives insight into the behaviour of numerical methods for stiff ordinary differential equations. These lecture notes provide a self-contained and comprehensive treatment of the numerical solution of differential-algebraic systems using Runge-Kutta methods, and also extrapolation methods. Readers are expected to have a background in the numerical treatment of ordinary differential equations. The subject is treated in its various aspects ranging from the theory through the analysis to implementation and applications.

Computational Epidemiology - Ellen Kuhl 2021-09-22

This innovative textbook brings together modern concepts in mathematical epidemiology, computational modeling, physics-based simulation, data science, and machine learning to understand one of the most significant problems of our current time, the outbreak dynamics and outbreak control of COVID-19. It teaches the relevant tools to model and simulate nonlinear dynamic systems in view of a global pandemic that is acutely relevant to human health. If you are a student, educator, basic scientist, or medical researcher in the natural or social sciences, or someone passionate about big data and human health: This book is for you! It serves as a textbook for undergraduates and graduate students, and a monograph for researchers and scientists. It can be used in the mathematical life sciences suitable for courses in applied mathematics, biomedical engineering, biostatistics, computer science, data science, epidemiology, health sciences, machine learning, mathematical biology, numerical methods, and probabilistic programming. This book is a personal reflection on the role of data-driven modeling during the COVID-19 pandemic, motivated by the curiosity to understand it.

Optimization in Food Engineering - Ferruh Erdogdu 2008-12-09

While mathematically sophisticated methods can be used to better understand and improve processes, the nonlinear nature of food processing models can make their dynamic optimization a daunting task. With contributions from a virtual who's who in the food processing industry, Optimization in Food Engineering evaluates the potential uses and limitations of optimization techniques for food processing, including classical methods, artificial intelligence-genetic algorithms, multi-objective optimization procedures, and computational fluid dynamics. The book begins by delineating the fundamentals and methods for analytical and numerical procedures. It then covers optimization techniques and how they specifically apply to food processing. The final section digs deep into fundamental food processes and provides detailed explanation and examples from the most experienced and published authors in the field. This includes a range of processes from optimization strategies for improving the performance of batch reactors to the optimization of conventional thermal processing, microwave heating, freeze drying, spray drying, and refrigeration systems, to structural optimization techniques for developing beverage containers, optimization approaches for impingement processing, and optimal operational planning methodologies. Each chapter presents the required parameters for the given process with the optimization procedure to apply. An increasing part of the food processor's job is to optimize systems to squeeze more dollars out of overhead to offset rising utility and transportation costs. Logically combining optimization techniques from many sources into a single volume focused on food production processes, this book provides real solutions to increases in

energy, healthcare, and product liability costs that impact the bottom line in food production.

Recent Trends in Numerical Analysis - D. Trigiante 2000

The contributions for this volume, dedicated to honour the 65th birthday of Professor I Galligani, have been numerous and cover a wide range of topics of the current Numerical Analysis and of its applications.

Nonlinear Differential Equations in Ordered Spaces - S. Carl 2000-06-14

Extremality results proved in this Monograph for an abstract operator equation provide the theoretical framework for developing new methods that allow the treatment of a variety of discontinuous initial and boundary value problems for both ordinary and partial differential equations, in explicit and implicit forms. By means of these extremality results, the authors prove the existence of extremal solutions between appropriate upper and lower solutions of first and second order discontinuous implicit and explicit ordinary and functional differential equations. They then study the dependence of these extremal solutions on the data. The authors begin by developing an existence theory for an abstract operator equation in ordered spaces and offer new tools for dealing with different kinds of discontinuous implicit and explicit differential equation problems. They present a unified approach to the existence of extremal solutions of quasilinear elliptic and parabolic problems and extend the upper and lower solution method to elliptic and parabolic inclusion of hemivariation type using variational and nonvariational methods. Nonlinear Differential Equations in Ordered Spaces includes research that appears for the first time in book form and is designed as a source book for pure and applied mathematicians. Its self-contained presentation along with numerous worked examples and complete, detailed proofs also make it accessible to researchers in engineering as well as advanced students in these fields.

Solving Ordinary Differential Equations II - Ernst Hairer 2013-03-14

"Whatever regrets may be, we have done our best." (Sir Ernest Shackleton, turning back on 9 January 1909 at 88°23' South.) Brahms struggled for 20 years to write his first symphony. Compared to this, the 10 years we have been working on these two volumes may even appear short. This second volume treats stiff differential equations and differential alge braic equations. It contains three chapters: Chapter IV on one-step (Runge Kutta) methods for stiff problems, Chapter Von multistep methods for stiff problems, and Chapter VI on singular perturbation and differential-algebraic equations. Each chapter is divided into sections. Usually the first sections of a chapter are of an introductory nature, explain numerical phenomena and exhibit numerical results. Investigations of a more theoretieal nature are presented in the later sections of each chapter. As in Volume I, the formulas, theorems, tables and figures are numbered consecutively in each section and indicate, in addition, the section num ber. In cross references to other chapters the (latin) chapter number is put first. References to the bibliography are again by "author" plus "year" in parentheses. The bibliography again contains only those papers which are discussed in the text and is in no way meant to be complete.

Computational Fluid Dynamics and Energy Modelling in Buildings - Parham A. Mirzaei 2022-11-14

COMPUTATIONAL FLUID DYNAMICS AND ENERGY MODELLING IN BUILDINGS A Comprehensive Overview of the Fundamentals of Heat and Mass Transport Simulation and Energy Performance in Buildings In the first part of Computational Fluid Dynamics and Energy Modelling in Buildings: Fundamentals and Applications, the author explains the fundamentals of fluid mechanics, thermodynamics, and heat transfer, with a specific focus on their application in buildings. This background knowledge sets the scene to further model heat and mass transport in

buildings, with explanations of commonly applied simplifications and assumptions. In the second part, the author elaborates how the fundamentals explained in part 1 can be used to model energy flow in buildings, which is the basis of all commercial and educational building energy simulation tools. An innovative illustrative nodal network concept is introduced to help readers comprehend the basics of conservation laws in buildings. The application of numerical techniques to form dynamic simulation tools are then introduced. In general, understanding these techniques will help readers to identify and justify their choices when working with building energy simulation tools, rather than using default settings. Detailed airflow information in buildings cannot be obtained in building energy simulation techniques. Therefore, part three is focused on introducing computational fluid dynamics (CFD) as a detailed modelling technique for airflow in buildings. This part starts with an introduction to the fundamentals of the finite volume method used to solve the governing fluid equations and the related challenges and considerations are discussed. The last chapter of this part covers the solutions to some practical problems of airflow within and around buildings. The key aspect of Computational Fluid Dynamics and Energy Modelling in Buildings: Fundamentals and Applications is that it is tailored for audiences without extensive past experience of numerical methods. Undergraduate or graduate students in architecture, urban planning, geography, architectural engineering, and other engineering fields, along with building performance and simulation professionals, can use this book to gain additional clarity on the topics of building energy simulation and computational fluid dynamics.

Proceedings of International Joint Conference on Advances in Computational Intelligence - Mohammad Shorif Uddin 2021-05-17

This book gathers outstanding research papers presented at the International Joint Conference on Advances in Computational Intelligence (IJCACI 2020), organized by Daffodil International University (DIU) and Jahangirnagar University (JU) in Bangladesh and South Asian University (SAU) in India. These proceedings present novel contributions in the areas of computational intelligence and offer valuable reference material for advanced research. The topics covered include collective intelligence, soft computing, optimization, cloud computing, machine learning, intelligent software, robotics, data science, data security, big data analytics, and signal and natural language processing.

Solution of Implicit Differential Equations Using Desingularization Theory - Héctor Castejón Díaz 2012

Our goal in this work is to give an algorithmic method to find solutions of a LSS. To accomplish this objective, we will give a geometric description of the problem and use some geometric tools to transform the equation and the manifold (the "ambient space") into a new set of equations, each one being an explicit ODE. When this is accomplished, one may apply Picard's theorem to these new systems to obtain the solutions. It is important to notice that (as many other theoretical results) Picard's theorem proves the existence of a solution but does not give an explicit method to nd it. Usually, in problems which require to nd explicit solutions, numerical methods are used. There also exist numerical methods for solving LSS, so one may think that (since we will use numerical methods anyway to nd the explicit solution) we could use them directly instead of wasting time implementing a method that will still depend on numerical approximations. The main point of using alternative methods for this kind of problem is (beyond the theoretical value of the algorithm) that, while numerical methods for explicit ODEs are usually accurate (in the sense that it is easy to control the error of the calculations), numerical approximations for an arbitrary LSS require (as it is explained in [RR02]) numerical inversions of quasi-

singular matrices; these operations are numerically unstable. Therefore, the desingularization procedure studied here may allow to transform a numerically unstable problem into a new stable one.

Using Diagonally Implicit Multistage Integration Methods for Solving Ordinary Differential Equations - Jack VanWieren 1997-01-01

A survey of theoretical results for the recently invented and highly promising class of diagonally implicit multistage integration methods (DIMSIMs) is provided. New results are obtained that provide improved implementation and simplified analysis. Particular attention is given to issues affecting use on parallel computers in waveform relaxation. The process of implementation parameter derivation and testing for the second and fifth order members of the DIMEX family of ordinary differential equation solver computer codes using explicit DIMSIMs is described. Extensive test results using the standard suite DETEST are reported that show considerable promise. A listing of the FORTRAN 77 research code DIMEX5 is provided.

Numerical Solution of Partial Differential Equations in Science and Engineering - Leon Lapidus 2011-02-14

From the reviews of Numerical Solution of PartialDifferential Equations in Science and Engineering: "The book by Lapidus and Pinder is a very comprehensive, evenexhaustive, survey of the subject . . . [It] is unique in that itcovers equally finite difference and finite element methods." Burrelle's "The authors have selected an elementary (but not simplistic)mode of presentation. Many different computational schemes aredescribed in great detail . . . Numerous practical examples andapplications are described from beginning to the end, often withcalculated results given." Mathematics of Computing "This volume . . . devotes its considerable number of pages tolucid developments of the methods [for solving partial differentialequations] . . . the writing is very polished and I found it apleasure to read!" Mathematics of Computation Of related interest . . . NUMERICAL ANALYSIS FOR APPLIED SCIENCE Myron B. Allen andEli L. Isaacson. A modern, practical look at numerical analysis,this book guides readers through a broad selection of numericalmethods, implementation, and basic theoretical results, with anemphasis on methods used in scientific computation involvingdifferential equations. 1997 (0-471-55266-6) 512 pp. APPLIED MATHEMATICS Second Edition, J. David Logan.Presenting an easily accessible treatment of mathematical methodsfor scientists and engineers, this acclaimed work covers fluidmechanics and calculus of variations as well as more modernmethods-dimensional analysis and scaling, nonlinear wavepropagation, bifurcation, and singular perturbation. 1996(0-471-16513-1) 496 pp.

Using Diagonally Implicit Multistage Integration Methods for Solving Ordinary Differential Equations. Part 1: Introduction and Explicit Methods - 1997

A survey of theoretical results for the recently invented and highly promising class of diagonally implicit multistage integration methods (DIMSIMs) is provided. New results are obtained that provide improved implementation and simplified analysis. Particular attention is given to issues affecting use on parallel computers in waveform relaxation. The process of implementation parameter derivation and testing for the second and fifth order members of the DIMEX family of ordinary differential equation solver computer codes using explicit DIMSIMs is described. Extensive test results using the standard suite DETEST are reported that show considerable promise. A listing of the FORTRAN 77 research code DIMEX5 is provided.

Introduction to Numerical Methods for Time Dependent Differential Equations - Heinz-Otto Kreiss 2014-04-24

Introduces both the fundamentals of time dependent differential equations and their numerical solutions Introduction to Numerical Methods for Time Dependent Differential Equations delves into the underlying mathematical theory

needed to solve time dependent differential equations numerically. Written as a self-contained introduction, the book is divided into two parts to emphasize both ordinary differential equations (ODEs) and partial differential equations (PDEs). Beginning with ODEs and their approximations, the authors provide a crucial presentation of fundamental notions, such as the theory of scalar equations, finite difference approximations, and the Explicit Euler method. Next, a discussion on higher order approximations, implicit methods, multistep methods, Fourier interpolation, PDEs in one space dimension as well as their related systems is provided. Introduction to Numerical Methods for Time Dependent Differential Equations features: A step-by-step discussion of the procedures needed to prove the stability of difference approximations Multiple exercises throughout with select answers, providing readers with a practical guide to understanding the approximations of differential equations A simplified approach in a one space dimension Analytical theory for difference approximations that is particularly useful to clarify procedures Introduction to Numerical Methods for Time Dependent Differential Equations is an excellent textbook for upper-undergraduate courses in applied mathematics, engineering, and physics as well as a useful reference for physical scientists, engineers, numerical analysts, and mathematical modelers who use numerical experiments to test designs or predict and investigate phenomena from many disciplines.

Finite Difference Computing with PDEs - Hans Petter Langtangen 2017-06-21

This book is open access under a CC BY 4.0 license. This easy-to-read book introduces the basics of solving partial differential equations by means of finite difference methods. Unlike many of the traditional academic works on the topic, this book was written for practitioners. Accordingly, it especially addresses: the construction of finite difference schemes, formulation and implementation of algorithms, verification of implementations, analyses of physical behavior as implied by the numerical solutions, and how to apply the methods and software to solve problems in the fields of physics and biology.

Numerical Solution of Ordinary Differential Equations - 1971-03-31

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

Fundamentals of Engineering Numerical Analysis - Parviz Moin 2010-08-23

Since the original publication of this book, available computer power has increased greatly. Today, scientific computing is playing an ever more prominent role as a tool in scientific discovery and engineering analysis. In this second edition, the key addition is an introduction to the finite element method. This is a widely used technique for solving

partial differential equations (PDEs) in complex domains. This text introduces numerical methods and shows how to develop, analyse, and use them. Complete MATLAB programs for all the worked examples are now available at www.cambridge.org/Moin, and more than 30 exercises have been added. This thorough and practical book is intended as a first course in numerical analysis, primarily for new graduate students in engineering and physical science. Along with mastering the fundamentals of numerical methods, students will learn to write their own computer programs using standard numerical methods.

A Course in Ordinary Differential Equations - Stephen A. Wirkus 2014-12-15

A Course in Ordinary Differential Equations, Second Edition teaches students how to use analytical and numerical solution methods in typical engineering, physics, and mathematics applications. Lauded for its extensive computer code and student-friendly approach, the first edition of this popular textbook was the first on ordinary differential equations (ODEs) to include instructions on using MATLAB®, Mathematica®, and MapleTM. This second edition reflects the feedback of students and professors who used the first edition in the classroom. New to the Second Edition Moves the computer codes to Computer Labs at the end of each chapter, which gives professors flexibility in using the technology Covers linear systems in their entirety before addressing applications to nonlinear systems Incorporates the latest versions of MATLAB, Maple, and Mathematica Includes new sections on complex variables, the exponential response formula for solving nonhomogeneous equations, forced vibrations, and nondimensionalization Highlights new applications and modeling in many fields Presents exercise sets that progress in difficulty Contains color graphs to help students better understand crucial concepts in ODEs Provides updated and expanded projects in each chapter Suitable for a first undergraduate course, the book includes all the basics necessary to prepare students for their future studies in mathematics, engineering, and the sciences. It presents the syntax from MATLAB, Maple, and Mathematica to give students a better grasp of the theory and gain more insight into real-world problems. Along with covering traditional topics, the text describes a number of modern topics, such as direction fields, phase lines, the Runge-Kutta method, and epidemiological and ecological models. It also explains concepts from linear algebra so that students acquire a thorough understanding of differential equations.