Automated Solution Of Differential Equations By T

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DANIELLE MCKEE

Nuclear Science Abstracts Springer
Numerical Methods for Differential Systems: Recent Developments in Algorithms, Software, and Applications reviews developments in algorithms, software, and applications of numerical methods for differential systems. Topics covered include numerical algorithms for ordinary and partial differential equations (ODE/PDEs); theoretical approaches to the solution of nonlinear algebraic and boundary value problems via associated differential systems; integration algorithms for initial-value ODEs with particular emphasis on stiff systems; finite difference algorithms; and general- and special-purpose computer codes for ODE/PDEs. Comprised of 15 chapters, this book begins with an introduction to high-order A-stable averaging algorithms for stiff differential systems, followed by a discussion on second derivative multistep formulas based on g-splines; numerical integration of linearized stiff ODEs; and numerical solution of large systems of stiff ODEs in a modular simulation framework. Subsequent chapters focus on numerical methods for mass action kinetics; a systematized collection of codes for solving two-point boundary value problems; general software for PDEs; and the choice of algorithms in automated method of lines solution of PDEs. The final chapter is devoted to quality software for ODEs. This monograph should be of interest to mathematicians, chemists, and chemical engineers.
Methods of Applied Mathematics with a Software Overview Apress
"Geared toward advanced undergraduates or graduate students of chemical engineering studying applied mathematics, this text introduces the quantitative treatment of differential equations arising from modeling physical phenomena in chemical engineering. Coverage includes topics such as ODE-IVPs, placing emphasis on numerical methods and modeling implemented in commercial mathematical software available in 1985"--
Automated Solution of Partial Differential Equations with Discontinuities Using the Partition of Unity Method Springer Nature
Numerical Python by Robert Johansson shows you how to leverage the numerical and mathematical modules in Python and its Standard Library as well as popular open source numerical Python packages like NumPy, FiPy, matplotlib and more to numerically compute solutions and mathematically model applications in a number of areas like big data, cloud computing, financial engineering, business management and more. After reading and using this book, you'll get some takeaway case study examples of applications that can be found in areas like business management, big data/cloud computing, financial engineering (i.e., options trading investment alternatives), and even games. Up until very recently, Python was mostly regarded as just a web scripting language. Well, computational scientists and engineers have recently discovered the flexibility and power of Python to do more. Big data analytics and cloud computing programmers are seeing Python's immense use. Financial engineers are also now employing Python in their work. Python seems to be evolving as a language that can even rival C++, Fortran, and Pascal/Delphi for numerical and mathematical computations.
Numerical Python Courier Corporation
This book deals with numerical simulations and computations of the turbulent flow around high-lift configurations commonly used in aircraft. It is devoted to the Computational Fluids Dynamics (CFD) method using full Navier-Stokes solvers typically used in the simulation of high-lift configuration. With the increase of computational resources in the aeronautical industry, the computation of complex flows such as the aerodynamics of high-lift configurations has become an active field not only in academic but also in industrial environments. The scope of the book includes applications and topics of interest related to the simulation of high-lift configurations such as: lift and drag prediction, unsteady aerodynamics, low Reynolds effects, high performance computing, turbulence modelling, flow feature visualization, among others. This book gives a description of the state-of-the-art of computational models for simulation of high-lift configurations. It also shows and discusses numerical results and validation of these computational models. Finally, this book is a good reference for graduate students and researchers interested in the field of simulation of high-lift configurations.
Introduction to the Tools of Scientific Computing Birkhäuser
Broadly organized around the applications of Fourier analysis, "Methods of Applied Mathematics with a MATLAB Overview" covers both classical applications in partial differential equations and boundary value problems, as well as the concepts and methods associated to the Laplace, Fourier, and discrete transforms. Transform inversion problems are also examined, along with the necessary background in complex variables. A final chapter treats wavelets, short-time Fourier analysis, and geometrically-based transforms. The computer program MATLAB is emphasized throughout, and an introduction to MATLAB is provided in an appendix. Rich in examples, illustrations, and exercises of varying difficulty, this text can be used for a one- or two-semester course and is ideal for students in pure and applied mathematics, physics, and engineering.
Numerical Simulation of the Aerodynamics of High-Lift Configurations Cambridge University Press
Supplies the most essential concepts and methods necessary to capitalize on the innovations of industrial automation, including mathematical fundamentals, ergonometrics, industrial robotics, government safety regulations, and economic analyses.
Monte Carlo Methods for Partial Differential Equations With Applications to Electronic Design Automation Springer Nature
With this hands-on introduction readers will learn what SDEs are all about and how they should use them in practice.
Applied Stochastic Differential Equations CRC Press
Master the finite element method with this masterful and practical volume An Introduction to the Finite Element Method (FEM) for Differential Equations provides readers with a practical and approachable examination of the use of the finite element method in mathematics. Author Mohammad Asadzadeh covers basic FEM theory, both in one-dimensional and higher dimensional cases. The book is filled with concrete strategies and useful methods to simplify its complex mathematical contents. Practically written and carefully detailed, An Introduction to the Finite Element Method covers topics including: An introduction to basic ordinary and partial differential equations The concept of fundamental solutions using Green's function approaches Polynomial approximations and interpolations, quadrature rules, and iterative numerical methods to solve linear systems of equations Higher-dimensional interpolation procedures Stability and convergence analysis of FEM for differential equations This book is ideal for upper-level undergraduate and graduate students in natural science and engineering. It belongs on the shelf of anyone seeking to improve their understanding of differential equations.
Model Reduction of Complex Dynamical Systems Springer
This text provides an application oriented introduction to the numerical methods for partial differential equations. It covers finite difference, finite element, and finite volume methods, interweaving theory and applications throughout. The book examines modern topics such as adaptive methods, multilevel methods, and methods for convection-dominated problems and includes detailed illustrations and extensive exercises.
Numerical Methods for Differential Systems BoD – Books on Demand
This advanced textbook is tailored for an introductory course in Systems Biology and is well-suited for biologists as well as engineers and computer scientists. It comes with student-friendly reading lists and a companion website featuring a short exam prep version of the book and educational modeling programs. The text is written in an easily accessible style and includes numerous worked examples and study questions in each chapter. For this edition, a section on medical systems biology has been included.
Systems Biology Springer
The book provides an introduction to common programming tools and methods in numerical mathematics and scientific computing. Unlike standard approaches, it does not focus on any specific language, but aims to explain the underlying ideas. Typically, new concepts are first introduced in the particularly user-friendly Python language and then transferred and extended in various programming environments from C/C++, Julia and MATLAB to Maple and Mathematica. This includes various approaches to distributed computing. By examining and comparing different languages, the book is also helpful for mathematicians and practitioners in deciding which programming language to use for which purposes. At a more advanced level, special tools for the automated solution of partial differential equations using the finite element method are discussed. On a more experimental level, the basic methods of scientific machine learning in artificial neural networks are explained and illustrated.
The FORSIM VI Simulation Package for the Automated Solution Arbitrarily Defined Partial And/or Ordinary Differential Equation Systems Springer Science & Business Media
New finite elements are needed as well in research as in industry environments for thedevelopment of virtual prediction techniques. The design and implementation of novel finiteelements for specific purposes is a tedious and time consuming task, especially for nonlinearformulations. The automation of this process can help to speed up this processconsiderably since the generation of the final computer code can be accelerated by order ofseveral magnitudes.This book provides the reader with the required knowledge needed to employ modernautomatic tools like AceGen within solid mechanics in a successful way. It covers the rangefrom the theoretical background, algorithmic treatments to many different applications. Thebook is written for advanced students in the engineering field and for researchers ineducational and industrial environments.
An Introduction to the Finite Element Method for Differential Equations Springer Nature
There has been a considerable progress made during the recent past on mathematical techniques for studying dynamical systems that arise in science and engineering. This progress has been, to a large extent, due to our increasing ability to mathematically model physical processes and to analyze and solve them, both analytically and numerically. With its eleven chapters, this book brings together important contributions from renowned international researchers to provide an excellent survey of recent advances in dynamical systems theory and applications. The first section consists of seven chapters that focus on analytical techniques, while the next section is composed of four chapters that center on computational techniques.
FORISM John Wiley & Sons
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.

Automated Deduction in Geometry Springer
This book constitutes thoroughly revised selected papers of the 6th International Conference on Numerical Analysis and Its Applications, NAA 2016, held in Lozenetz, Bulgaria, in June 2016. The 90 revised papers presented were carefully reviewed and selected from 98 submissions. The conference offers a wide range of the following topics: Numerical Modeling; Numerical Stochastics; Numerical Approx-imation and Computational Geometry; Numerical Linear Algebra and Numer-ical Solution of Transcendental Equations; Numerical Methods for Differential Equations; High Performance Scientific Computing; and also special topics such as Novel methods in computational finance based on the FP7 Marie Curie Action,Project Multi-ITN STRIKE - Novel Methods in Compu-tational Finance, Grant Agreement Number 304617; Advanced numerical and applied studies of fractional differential equations.
Computational Partial Differential Equations Using MATLAB® Springer
This book presents a comprehensive mathematical approach for solving stochastic magnetic field problems. It discusses variability in material properties and geometry, with an emphasis on the preservation of structural physical and mathematical properties. It especially addresses uncertainties in the computer simulation of magnetic fields originating from the manufacturing process. Uncertainties are quantified by approximating a stochastic reformulation of the governing partial differential equation, demonstrating how statistics of physical quantities of interest, such as Fourier harmonics in accelerator magnets, can be used to achieve robust designs. The book covers a number of key methods and results such as: a stochastic model of the geometry and material properties of magnetic devices based on measurement data; a detailed description of numerical algorithms based on sensitivities or on a higher-order collocation; an analysis of convergence and efficiency; and the application of the developed model and algorithms to uncertainty quantification in the complex magnet systems used in particle accelerators.
Introduction to the Tools of Scientific Computing Springer
The book provides an introduction to common programming tools and methods in numerical mathematics and scientific computing. Unlike widely used standard approaches, it does not focus on any particular language but aims to explain the key underlying concepts. In general, new concepts are first introduced in the particularly user-friendly Python language and then transferred and expanded in various scientific programming environments from C / C ++, Julia and MATLAB to Maple. This includes different approaches to distributed computing. The fact that different languages are studied and compared also makes the book useful for mathematicians and practitioners trying to decide which programming language to use for which purposes.
Solving PDEs in Python Springer Science & Business Media
This book offers a concise and gentle introduction to finite element programming in Python based on the popular FEniCS software library. Using a series of examples, including the Poisson equation, the equations of linear elasticity, the incompressible Navier–Stokes equations, and systems of nonlinear advection–diffusion–reaction equations, it guides readers through the essential steps to quickly solving a PDE in FEniCS, such as how to define a finite variational problem, how to set boundary conditions, how to solve linear and nonlinear systems, and how to visualize solutions and structure finite element Python programs. This book is open access under a CC BY license.
A Primer on Scientific Programming with Python Springer
This edited monograph offers a summary of future mathematical methods supporting the recent energy sector transformation. It collects current contributions on innovative methods and algorithms. Advances in mathematical techniques and scientific computing methods are presented centering around economic aspects, technical realization and large-scale networks. Over twenty authors focus on the mathematical modeling of such future systems with careful analysis of desired properties and arising scales. Numerical investigations include efficient methods for the simulation of possibly large-scale interconnected energy systems and modern techniques for optimization purposes to guarantee stable and reliable future operations. The target audience comprises research scientists, researchers in the R&D field, and practitioners. Since the book highlights possible future research directions, graduate students in the field of mathematical modeling or electrical engineering may also benefit strongly.
PETSc for Partial Differential Equations: Numerical Solutions in C and Python Springer Nature
This book is a tutorial written by researchers and developers behind the FEniCS Project and explores an advanced, expressive approach to the development of mathematical software. The presentation spans mathematical background, software design and the use of FEniCS in applications. Theoretical aspects are complemented with computer code which is available as free/open source software. The book begins with a special introductory tutorial for beginners. Following are chapters in Part I addressing fundamental aspects of the approach to automating the creation of finite element solvers. Chapters in Part II address the design and implementation of the FEnicS software. Chapters in Part III present the application of FEniCS to a wide range of applications, including fluid flow, solid mechanics, electromagnetics and geophysics.