Introductory Finite Difference Methods For Pdes

Finite Difference and Finite Volume Methods
Introduction to Groundwater Modeling
6th International Conference, FDM 2014, Lozenetz, Bulgaria, June 18-23, 2014, Revised Selected Papers
Numerical Partial Differential Equations: Finite Difference Methods
Waves and Ruptures
Finite Difference and Finite Element Methods
Numerical Solution of Differential Equations
Fractional Differential Equations
A Guide for Engineers and Scientists
Nonstandard Finite Difference Models of Differential Equations
Numerical Partial Differential Equations: Finite Difference Methods
Fractional Differential Equations
Finite Difference Methods in Financial Engineering
Steady-State and Time-Dependent Problems
Finite Difference Methods for Ordinary and Partial Differential Equations
Finite Difference Schemes and Partial Differential Equations
The Mimetic Finite Difference Method for Elliptic Problems
Time-Dependent Problems and Difference Methods
Finite Difference Methods
Numerical Methods for Elliptic and Parabolic Partial Differential Equations
Finite Difference Computing with PDEs
Finite Difference Methods
Introductory Finite Volume Methods for PDEs
Numerical Methods for Partial Differential Equations
Ocean Acoustic Propagation by Finite Difference Methods
Introduction to Approximate Solution Techniques, Numerical Modeling, and Finite Element Methods
Finite Difference Methods
Analytical Groundwater Mechanics
Introductory Finite Difference Methods for PDEs
Finite Difference Methods,Theory and Applications
Python Programming and Numerical Methods
The Finite-Difference Modelling of Earthquake Motions
An Introduction to Numerical Methods and Analysis
Introduction to Finite-difference Methods for Numerical Fluid Dynamics
Numerical Solution of Partial Differential Equations
Numerical Treatment of Partial Differential Equations
Introduction to Approximate Solution Techniques, Numerical Modeling, and Finite Element Methods
Finite difference methods with an implicit scheme

A Partial Differential Equation Approach

NIGEL REINA

Finite Difference and Finite Volume Methods CRC Press
Substantially revised, this authoritative study covers the standard finite difference methods of parabolic, hyperbolic, and elliptic equations, and includes the concomitant theoretical work on consistency, stability, and convergence. The new edition includes revised and greatly expanded sections on stability based on the Lax-Richtmeyer definition, the application of Pade approximants to systems of ordinary differential equations for parabolic and hyperbolic equations, and a considerably improved presentation of iterative methods. A fast-paced introduction to numerical methods, this will be a useful volume for students of mathematics and engineering, and for postgraduates and professionals who need a clear, concise grounding in this discipline.
Introduction to Groundwater Modeling Morgan & Claypool Publishers
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.
6th International Conference, FDM 2014, Lozenetz, Bulgaria, June 18-23, 2014, Revised Selected Papers Springer Science & Business Media
A practical and concise guide to finite difference and finite element methods. Well-tested MATLAB® codes are available online.
Numerical Partial Differential Equations: Finite Difference Methods Elsevier
Focusing on applications and real-world problems, this advanced textbook explains the fundamentals of groundwater flow for students and professionals.
Waves and Ruptures Springer Science & Business Media
What makes this book stand out from the competition is that it is more computational. Once done with both volumes, readers will have the tools to attack a wider variety of problems than those worked out in the competitors' books. The author stresses the use of technology throughout the text, allowing students to utilize it as much as possible.
Finite Difference and Finite Element Methods Academic Press
Introductory Finite Difference Methods for PDEsBookboonFinite Difference Methods for Ordinary and Partial Differential EquationsSteady-State and Time-Dependent ProblemsSIAM
Numerical Solution of Differential Equations Springer
Functions as a self-study guide for engineers and as a textbook for nonengineering students and engineering students, emphasizing generic forms of differential equations, applying approximate solution techniques to examples, and progressing to specific physical problems in modular, self-contained chapters that integrate into the text or can stand alone! This reference/text focuses on classical approximate solution techniques such as the finite difference method, the method of weighted residuals, and variation methods, culminating in an introduction to the finite element method (FEM). Discusses the general notion of approximate solutions and associated errors! With 1500 equations and more than 750 references, drawings, and tables, Introduction to Approximate Solution Techniques, Numerical Modeling, and Finite Element Methods: Describes the approximate solution of ordinary and partial differential equations using the finite difference method Covers the method of weighted residuals, including specific weighting and trial functions Considers variational methods Highlights all aspects associated with the formulation of finite element equations Outlines meshing of the solution domain, nodal specifications, solution of global equations, solution refinement, and assessment of results Containing appendices that present concise overviews of topics and serve as rudimentary tutorials for professionals and students without a background in computational mechanics, Introduction to Approximate Solution Techniques, Numerical Modeling, and Finite Element Methods is a blue-chip reference for civil, mechanical, structural, aerospace, and industrial engineers, and a practical text for upper-level undergraduate and graduate students studying approximate solution techniques and the FEM.
Fractional Differential Equations Springer Science & Business Media
Praise for the First Edition ". . . fills a considerable gap in the numerical analysisliterature by providing a self-contained treatment . . . this is animportant work written in a clear style . . . warmly recommended toany graduate student or researcher in the field of the numericalsolution of partial differential equations." —SIAM Review Time-Dependent Problems and Difference Methods, SecondEdition continues to provide guidance for the analysis ofdifference methods for computing approximate solutions to partialdifferential equations for time-dependent problems. The book treatsdifferential equations and difference methods with a paralleldevelopment, thus achieving a more useful analysis of numericalmethods. The Second Edition presents hyperbolic equations in greatdetail as well as new coverage on second-order systems of waveequations including acoustic waves, elastic waves, and Einsteinequations. Compared to first-order hyperbolic systems,initial-boundary value problems for such systems contain newproperties that must be taken into account when analyzingstability. Featuring the latest material in partial differentialequations with new theorems, examples, andillustrations,Time-Dependent Problems and Difference Methods,Second Edition also includes: High order methods on staggered grids Extended treatment of Summation By Parts operators and theirapplication to second-order derivatives Simplified presentation of certain parts and proofs Time-Dependent Problems and Difference Methods, SecondEdition is an ideal reference for physical scientists,engineers, numerical analysts, and mathematical modelers who usenumerical experiments to test designs and to predict andinvestigate physical phenomena. The book is also excellent forgraduate-level courses in applied mathematics and scientificcomputations.
A Guide for Engineers and Scientists Springer Science & Business Media
This text provides a very simple, initial introduction to the complete scientific computing pipeline: models, discretization, algorithms, programming, verification, and visualization. The pedagogical

strategy is to use one case study – an ordinary differential equation describing exponential decay processes – to illustrate fundamental concepts in mathematics and computer science. The book is easy to read and only requires a command of one-variable calculus and some very basic knowledge about computer programming. Contrary to similar texts on numerical methods and programming, this text has a much stronger focus on implementation and teaches testing and software engineering in particular.
Bookboon
This book covers high order finite difference methods for time dependent PDE. It gives an overview of the basic theory and construction principles by using model examples. The book also contains a general presentation of the techniques and results for well-posedness and stability, with inclusion of the three fundamental methods of analysis both for PDE in its original and discretized form: the Fourier transform, the eneregy method and the Laplace transform.
Nonstandard Finite Difference Models of Differential Equations Birkhäuser
The world of quantitative finance (QF) is one of the fastest growing areas of research and its practical applications to derivatives pricing problem. Since the discovery of the famous Black-Scholes equation in the 1970's we have seen a surge in the number of models for a wide range of products such as plain and exotic options, interest rate derivatives, real options and many others. Gone are the days when it was possible to price these derivatives analytically. For most problems we must resort to some kind of approximate method. In this book we employ partial differential equations (PDE) to describe a range of one-factor and multi-factor derivatives products such as plain European and American options, multi-asset options, Asian options, interest rate options and real options. PDE techniques allow us to create a framework for modeling complex and interesting derivatives products. Having defined the PDE problem we then approximate it using the Finite Difference Method (FDM). This method has been used for many application areas such as fluid dynamics, heat transfer, semiconductor simulation and astrophysics, to name just a few. In this book we apply the same techniques to pricing real-life derivative products. We use both traditional (or well-known) methods as well as a number of advanced schemes that are making their way into the QF literature: Crank-Nicolson, exponentially fitted and higher-order schemes for one-factor and multi-factor options Early exercise features and approximation using front-fixing, penalty and variational methods Modelling stochastic volatility models using Splitting methods Critique of ADI and Crank-Nicolson schemes; when they work and when they don't work Modelling jumps using Partial Integro Differential Equations (PIDE) Free and moving boundary value problems in QF Included with the book is a CD containing information on how to set up FDM algorithms, how to map these algorithms to C++ as well as several working programs for one-factor and two-factor models. We also provide source code so that you can customize the applications to suit your own needs.
Numerical Partial Differential Equations: Finite Difference Methods Springer
Starting with an introduction to fractional derivatives and numerical approximations, this book presents finite difference methods for fractional differential equations, including time-fractional sub-diffusion equations, time-fractional wave equations, and space-fractional differential equations, among others. Approximation methods for fractional derivatives are developed and approximate accuracies are analyzed in detail.
Fractional Differential Equations Oxford University Press
This book introduces finite difference methods for both ordinary differential equations (ODEs) and partial differential equations (PDEs) and discusses the similarities and differences between algorithm design and stability analysis for different types of equations. A unified view of stability theory for ODEs and PDEs is presented, and the interplay between ODE and PDE analysis is stressed. The text emphasizes standard classical methods, but several newer approaches also are introduced and are described in the context of simple motivating examples.
Finite Difference Methods in Financial Engineering Springer Science & Business Media
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.
Steady-State and Time-Dependent Problems Walter de Gruyter GmbH & Co KG
This book describes the theoretical and computational aspects of the mimetic finite difference method for a wide class of multidimensional elliptic problems, which includes diffusion, advection-diffusion, Stokes, elasticity, magnetostatics and plate bending problems. The modern mimetic discretization technology developed in part by the Authors allows one to solve these equations on unstructured polygonal, polyhedral and generalized polyhedral meshes. The book provides a practical guide for those scientists and engineers that are interested in the computational properties of the mimetic finite difference method such as the accuracy, stability, robustness, and efficiency. Many examples are provided to help the reader to understand and implement this method. This monograph also provides the essential background material and describes basic mathematical tools required to develop further the mimetic discretization technology and to extend it to various applications.
Finite Difference Methods for Ordinary and Partial Differential Equations CRC Press
Starting with an introduction to fractional derivatives and numerical approximations, this book presents finite difference methods for fractional differential equations, including time-fractional sub-diffusion equations, time-fractional wave equations, and space-fractional differential equations, among others. Approximation methods for fractional derivatives are developed and approximate accuracies are analyzed in detail.
Finite Difference Schemes and Partial Differential Equations CRC Press
A concise guide to the theory and application of numerical methods for predicting ocean acoustic propagation, also providing an introduction to numerical methods, with an overview of those methods presently in use. An in-depth development of the implicit-finite-difference technique is presented together with bench-mark test examples included to demonstrate its application to realistic ocean environments. Other applications include atmospheric acoustics, plasma physics, quantum mechanics, optics and seismology.
The Mimetic Finite Difference Method for Elliptic Problems CRC Press
The dramatic advances in the efficiency of digital computers during the past decade have provided hydrologists with a powerful tool for numerical modeling of groundwater systems. Introduction to

Groundwater Modeling presents a broad, comprehensive overview of the fundamental concepts and applications of computerized groundwater modeling. The book covers both finite difference and finite element methods and includes practical sample programs that demonstrate theoretical points described in the text. Each chapter is followed by problems, notes, and references to additional information. This volume will be indispensable to students in introductory groundwater modeling courses as well as to groundwater professionals wishing to gain a complete introduction to this vital subject. Key Features * Systematic exposition of the basic ideas and results of Hilbert space theory and functional analysis * Great variety of applications that are not available in comparable books * Different approach to the Lebesgue integral, which makes the theory easier, more intuitive, and more accessible to undergraduate students

Time-Dependent Problems and Difference Methods John Wiley & Sons
Exceptionally clear exposition of an important mathematical discipline and its applications to sociology, economics, and psychology. Topics include calculus of finite differences, difference equations, matrix methods, and more. 1958 edition.

Finite Difference Methods Courier Corporation
This book constitutes the thoroughly refereed post-conference proceedings of the 6th International Conference on Finite Difference Methods, FDM 2014, held in Lozenetz, Bulgaria, in June 2014. The 36 revised full papers were carefully reviewed and selected from 62 submissions. These papers together with 12 invited papers cover topics such as finite difference and combined finite difference methods as well as finite element methods and their various applications in physics, chemistry, biology and finance.