Download free Numerical partial differential equations finite difference methods 1st edition .pdf

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 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 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 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 this book provides a clear summary of the work of the author on the construction of nonstandard finite difference schemes for the numerical integration of differential equations the major thrust of the book is to show that discrete models of differential equations exist such that the elementary types of numerical instabilities do not occur a consequence of this result is that in general bigger step sizes can often be used in actual calculations and or finite difference schemes can be constructed that are conditionally stable in many instances whereas in using standard techniques no such schemes exist the theoretical basis of this work is centered on the concepts of exact and best finite difference schemes in addition a set of rules is given for the discrete modeling of derivatives and nonlinear expressions that occur in differential equations these rules often lead to a unique nonstandard finite difference model for a given differential equation 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 the finite difference and finite element methods are powerful tools for the approximate solution of differential equations governing diverse physical phenomena and there is extensive literature on these discre tization methods in the last two decades some extensions of the finite difference method to irregular networks have been described and applied to solving boundary value problems in science and engineering for instance box integration methods have been widely used in electro nics there are several papers on this topic but a comprehensive study of these methods does not seem to have been attempted the purpose of this book is to provide a systematic treatment of a generalized finite difference method on irregular networks for solving numerically elliptic boundary value problems thus several disadvan tages of the classical finite difference method can be removed irregular networks of triangles known from the finite element method can be applied and advantageous properties of the finite difference approxima tions will be obtained the book is written for advanced undergraduates and graduates in the area of numerical analysis as well as for mathematically inclined workers in engineering and science in preparing the material for this book the author has greatly benefited from discussions and collaboration with many colleagues who are concerned with finite difference or and finite element methods this text presents a comprehensive mathematical theory for elliptic parabolic and hyperbolic differential equations it compares finite element and finite difference methods and illustrates applications of generalized difference methods to elastic bodies electromagnetic fields underground water pollution and coupled sound heat flows one purpose of this report is to present a mathematical procedure which can be used to study and compare various numerical methods for integrating ordinary differential equations this procedure is relatively simple mathematically rigorous and of such a nature that matters of interest in digital computations such as machine memory and running time can be weighed against the accuracy and stability provided by the method under consideration briefly the procedure is as follows 1 find a single differential equation that is sufficiently representative this is fully defined in the report of an arbitrary number of nonhomogeneous linear ordinary differential equations with constant coefficients 2 solve this differential equation exactly 3 choose any given numerical method use it in its entirety to reduce the differential equation to difference equations and by means of operational techniques solve the latter exactly 4 study and compare the results of 2 and 3 conceptually there is nothing new in this procedure but the particular development presented in this report does not appear to have been carried out before another purpose is to use the procedure just described to analyze a variety of numerical methods ranging from classical predictor corrector systems to runge kutta techniques and including various combinations of the two this volume is the proceedings of the first conference on finite difference methods which was held at the university of rousse bulgaria 10 13 august 1997 the conference attracted more than 50 participants from 16 countries 10 invited talks and 26 contributed talks were delivered the volume contains 28 papers presented at the conference the most important and widely used methods for solution of differential equations are the finite difference methods the purpose of the conference was to bring together scientists working in the area of the finite difference methods and also people from the applications in physics chemistry and other natural and engineering sciences the main purpose of this book is to provide a concise introduction to the methods and philosophy of constructing nonstandard finite difference schemes and illustrate how such techniques can be applied to several important problems chapter i gives an overview of the subject and summarizes previous work chapters 2 and 3 consider in detail the construction and numerical implementation of schemes for physical problems involving convection diffusion reaction equations that arise in groundwater pollution and scattering of electromagnetic waves using maxwell s equations chapter 4 examines certain mathematical issues related to the nonstandard discretization of competitive and cooperative models for ecology the application chapters illustrate well the power of nonstandard methods in particular for the same accuracy as obtained by standard techniques larger step sizes can be used this volume will satisfy the needs of scientists engineers and mathematicians who wish to know how to construct nonstandard schemes and see how these are applied to obtain numerical solutions of the differential equations which arise in the study of nonlinear dynamical systems modeling important physical phenomena this book constitutes the refereed conference proceedings of the 7th international conference on finite difference methods fdm 2018 held in lozenetz bulgaria in june 2018 the 69 revised full papers presented together with 11 invited papers were carefully reviewed and selected from 94 submissions they deal with many

modern and new numerical techniques like splitting techniques green s function method multigrid methods and immersed interface method finite difference methods in heat transfer second edition focuses on finite difference methods and their application to the solution of heat transfer problems such methods are based on the discretization of governing equations initial and boundary conditions which then replace a continuous partial differential problem by a system of algebraic equations finite difference methods are a versatile tool for scientists and for engineers this updated book serves university students taking graduate level coursework in heat transfer as well as being an important reference for researchers and engineering features provides a self contained approach in finite difference methods for students and professionals covers the use of finite difference methods in convective conductive and radiative heat transfer presents numerical solution techniques to elliptic parabolic and hyperbolic problems includes hybrid analytical numerical approaches 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 this book develops a systematic and rigorous mathematical theory of finite difference methods for linear elliptic parabolic and hyperbolic partial differential equations with nonsmooth solutions finite difference methods are a classical class of techniques for the numerical approximation of partial differential equations traditionally their convergence analysis presupposes the smoothness of the coefficients source terms initial and boundary data and of the associated solution to the differential equation this then enables the application of elementary analytical tools to explore their stability and accuracy the assumptions on the smoothness of the data and of the associated analytical solution are however frequently unrealistic there is a wealth of boundary and initial value problems arising from various applications in physics and engineering where the data and the corresponding solution exhibit lack of regularity in such instances classical techniques for the error analysis of finite difference schemes break down the objective of this book is to develop the mathematical theory of finite difference schemes for linear partial differential equations with nonsmooth solutions analysis of finite difference schemes is aimed at researchers and graduate students interested in the mathematical theory of numerical methods for the approximate solution of partial differential equations finite difference methods in heat transfer second edition focuses on finite difference methods and their application to the solution of heat transfer problems such methods are based on the discretization of governing equations initial and boundary conditions which then replace a continuous partial differential problem by a system of algebraic equations finite difference methods are a versatile tool for scientists and for engineers this updated book serves university students taking graduate level coursework in heat transfer as well as being an important reference for researchers and engineering features provides a self contained approach in finite difference methods for students and professionals covers the use of finite difference methods in convective conductive and radiative heat transfer presents numerical solution techniques to elliptic parabolic and hyperbolic problems includes hybrid analytical numerical approaches introduces recent research results of finite difference methods including important nonlinear evolution equations in applied science the presented difference schemes include nonlinear difference schemes and linearized difference schemes features widely used nonlinear evolution equations such as burgers equation regular long wave equation schrodinger equation and more each pde model includes details on efficiency stability and convergence extensively revised edition of computational methods in partial differential equations a more general approach has been adopted for the splitting of operators for parabolic and hyperbolic equations to include richtmyer and strang type splittings in addition to alternating direction implicit and locally one dimensional methods a description of the now standard factorization and sor adi iterative techniques for solving elliptic difference equations has been supplemented with an account or preconditioned conjugate gradient methods which are currently gaining in popularity prominence is also given to the galerkin method using different test and trial functions as a means of constructing difference approximations to both elliptic and time dependent problems the applications of finite difference methods have been revised and contain examples involving the treatment of singularities in elliptic equations free and moving boundary problems as well as modern developments in computational fluid dynamics emphasis throughout is on clear exposition of the construction and solution of difference equations material is reinforced with theoretical results when appropriate this new book deals with the construction of finite difference fd algorithms for three main types of equations elliptic equations heat equations and gas dynamic equations in lagrangian form these methods can be applied to domains of arbitrary shapes the construction of fd algorithms for all types of equations is done on the basis of the support operators method som this method constructs the fd analogs of main invariant differential operators of first order such as the divergence the gradient and the curl this book is unique because it is the first book not in russian to present the support operators ideas conservative finite difference methods on general grids is completely self contained presenting all the background material necessary for understanding the book provides the tools needed by scientists and engineers to solve a wide range of practical engineering problems an abundance of tables and graphs support and explain methods the book details all algorithms needed for implementation a 3 5 ibm compatible computer diskette with the main algorithms in fortran accompanies text for easy use this second volume in the progress in electromagnetic research series examines recent advances in computational electromagnetics with emphasis on scattering as brought about by new formulations and algorithms which use finite element or finite difference techniques containing contributions by some of the world s leading experts the papers thoroughly review and analyze this rapidly evolving area of computational electromagnetics covering topics ranging from the new finite element based formulation for representing time harmonic vector fields in 3 d inhomogeneous media using two coupled scalar potentials to the consideration of conforming boundary elements and leap frog time marching in transient field problems involving corners and wedges in two and three dimensions the volume will provide an indispensable reference source for practitioners and students of computational electromagnetics 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 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 this book is mainly devoted to finite difference numerical methods for solving partial differential equations pdes models of pricing a wide variety of financial derivative securities with this objective the book is divided into two main parts in the first part after an introduction concerning the basics on derivative securities the authors explain how to establish the adequate pde boundary value problems for different sets of derivative products vanilla and exotic options and interest rate derivatives for many option problems the analytic solutions are also derived with details the second part is devoted to explaining and analyzing the application of finite differences techniques to the financial models stated in

the first part of the book for this the authors recall some basics on finite difference methods initial boundary value problems and having in view financial products with early exercise feature linear complementarity and free boundary problems in each chapter the techniques related to these mathematical and numerical subjects are applied to a wide variety of financial products this is a textbook for graduate students following a mathematical finance program as well as a valuable reference for those researchers working in numerical methods in financial derivatives for this new edition the book has been updated throughout with many new problems added more details about numerical methods for some options for example asian options with discrete sampling are provided and the proof of solution uniqueness of derivative security problems and the complete stability analysis of numerical methods for two dimensional problems are added review of first edition the book is highly well designed and structured as a textbook for graduate students following a mathematical finance program which includes black scholes dynamic hedging methodology to price financial derivatives also it is a very valuable reference for those researchers working in numerical methods in financial derivatives either with a more financial or mathematical background mathematical reviews 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 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 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 a practical and concise guide to finite difference and finite element methods well tested matlab codes are available online containing an extensive illustration of the use of finite difference method in solving boundary value problem numerically a wide class of differential equations have been numerically solved in this book

Finite Difference Methods for Ordinary and Partial Differential Equations

2007-01-01

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

Numerical Partial Differential Equations: Finite Difference Methods

2013-12-01

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

Numerical Solution of Partial Differential Equations

1985

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

Introductory Finite Difference Methods for PDEs

2015-06-16

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

Finite Difference Methods,Theory and Applications

1994

this book provides a clear summary of the work of the author on the construction of nonstandard finite difference schemes for the numerical integration of differential equations the major thrust of the book is to show that discrete models of differential equations exist such that the elementary types of numerical instabilities do not occur a consequence of this result is that in general bigger step sizes can often be used in actual calculations and or finite difference schemes can be constructed that are conditionally stable in many instances whereas in using standard techniques no such schemes exist the theoretical basis of this work is centered on the concepts of exact and best finite difference schemes in addition a set of rules is given for the discrete modeling of derivatives and nonlinear expressions that occur in differential equations these rules often lead to a unique nonstandard finite difference model for a given differential equation

Nonstandard Finite Difference Models of Differential Equations

2020-08-24

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

2013

the finite difference and finite element methods are powerful tools for the approximate solution of differential equations governing diverse physical phenomena and there is extensive literature on these discre tization methods in the last two decades some extensions of the finite difference method to irregular networks have been described and applied to solving boundary value problems in science and engineering for instance box integration methods have been widely used in electro nics there are several papers on this topic but a comprehensive study of these methods does not seem to have been attempted the purpose of this book is to provide a systematic treatment of a generalized finite difference method on irregular networks for solving numerically elliptic boundary value problems thus several disadvan tages of the classical finite difference method can be removed irregular networks of triangles known from the finite element method can be applied and advantageous properties of the finite difference approxima tions will be obtained the book is written for advanced undergraduates and graduates in the area of numerical analysis as well as for mathematically inclined workers in engineering and science in preparing the material for this book the author has greatly benefited from discussions and collaboration with many colleagues who are concerned with finite difference or and finite element methods

Finite-difference Methods for Partial Differential Equations

2013-03-13

this text presents a comprehensive mathematical theory for elliptic parabolic and hyperbolic differential equations it compares finite element and finite difference methods and illustrates applications of generalized difference methods to elastic bodies electromagnetic fields underground water pollution and coupled sound heat flows

Finite Difference Methods on Irregular Networks

2000-01-03

one purpose of this report is to present a mathematical procedure which can be used to study and compare various numerical methods for integrating ordinary differential equations this procedure is relatively simple mathematically rigorous and of such a nature that matters of interest in digital computations such as machine memory and running time can be weighed against the accuracy and stability provided by the method under consideration briefly the procedure is as follows 1 find a single differential equation that is sufficiently representative this is fully defined in the report of an arbitrary number of nonhomogeneous linear ordinary differential equations with constant coefficients 2 solve this differential equation exactly 3 choose any given numerical method use it in its entirety to reduce the differential equation to difference equations and by means of operational techniques solve the latter exactly 4 study and compare the results of 2 and 3 conceptually there is nothing new in this procedure but the particular development presented in this report does not appear to have been carried out before another purpose is to use the procedure just described to analyze a variety of numerical methods ranging from classical predictor corrector systems to runge kutta techniques and including various combinations of the two

Generalized Difference Methods for Differential Equations

1967

this volume is the proceedings of the first conference on finite difference methods which was held at the university of rousse bulgaria 10 13 august 1997 the conference attracted more than 50 participants from 16 countries

10 invited talks and 26 contributed talks were delivered the volume contains 28 papers presented at the conference the most important and widely used methods for solution of differential equations are the finite difference methods the purpose of the conference was to bring together scientists working in the area of the finite difference methods and also people from the applications in physics chemistry and other natural and engineering sciences

An Operational Unification of Finite Difference Methods for the Numerical Integration of Ordinary Differential Equations

1999

the main purpose of this book is to provide a concise introduction to the methods and philosophy of constructing nonstandard finite difference schemes and illustrate how such techniques can be applied to several important problems chapter i gives an overview of the subject and summarizes previous work chapters 2 and 3 consider in detail the construction and numerical implementation of schemes for physical problems involving convection diffusion reaction equations that arise in groundwater pollution and scattering of electromagnetic waves using maxwell s equations chapter 4 examines certain mathematical issues related to the nonstandard discretization of competitive and cooperative models for ecology the application chapters illustrate well the power of nonstandard methods in particular for the same accuracy as obtained by standard techniques larger step sizes can be used this volume will satisfy the needs of scientists engineers and mathematicians who wish to know how to construct nonstandard schemes and see how these are applied to obtain numerical solutions of the differential equations which arise in the study of nonlinear dynamical systems modeling important physical phenomena

Finite Difference Methods

2000

this book constitutes the refereed conference proceedings of the 7th international conference on finite difference methods fdm 2018 held in lozenetz bulgaria in june 2018 the 69 revised full papers presented together with 11 invited papers were carefully reviewed and selected from 94 submissions they deal with many modern and new numerical techniques like splitting techniques green s function method multigrid methods and immersed interface method

Applications of Nonstandard Finite Difference Schemes

2019-01-28

finite difference methods in heat transfer second edition focuses on finite difference methods and their application to the solution of heat transfer problems such methods are based on the discretization of governing equations initial and boundary conditions which then replace a continuous partial differential problem by a system of algebraic equations finite difference methods are a versatile tool for scientists and for engineers this updated book serves university students taking graduate level coursework in heat transfer as well as being an important reference for researchers and engineering features provides a self contained approach in finite difference methods for students and professionals covers the use of finite difference methods in convective conductive and radiative heat transfer presents numerical solution techniques to elliptic parabolic and hyperbolic problems includes hybrid analytical numerical approaches

Finite Difference Methods. Theory and Applications

2017-07-20

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 Methods in Heat Transfer

1968

this book develops a systematic and rigorous mathematical theory of finite difference methods for linear elliptic parabolic and hyperbolic partial differential equations with nonsmooth solutions finite difference methods are a classical class of techniques for the numerical approximation of partial differential equations traditionally their convergence analysis presupposes the smoothness of the coefficients source terms initial and boundary data and of the associated solution to the differential equation this then enables the application of elementary analytical tools to explore their stability and accuracy the assumptions on the smoothness of the data and of the associated analytical solution are however frequently unrealistic there is a wealth of boundary and initial value problems arising from various applications in physics and engineering where the data and the corresponding solution exhibit lack of regularity in such instances classical techniques for the error analysis of finite difference schemes break down the objective of this book is to develop the mathematical theory of finite difference schemes for linear partial differential equations with nonsmooth solutions analysis of finite difference schemes is aimed at researchers and graduate students interested in the mathematical theory of numerical methods for the approximate solution of partial differential equations

Accuracy Study of Finite Difference Methods

1998-11-06

finite difference methods in heat transfer second edition focuses on finite difference methods and their application to the solution of heat transfer problems such methods are based on the discretization of governing equations initial and boundary conditions which then replace a continuous partial differential problem by a system of algebraic equations finite difference methods are a versatile tool for scientists and for engineers this updated book serves university students taking graduate level coursework in heat transfer as well as being an important reference for researchers and engineering features provides a self contained approach in finite difference methods for students and professionals covers the use of finite difference methods in convective conductive and radiative heat transfer presents numerical solution techniques to elliptic parabolic and hyperbolic problems includes hybrid analytical numerical approaches

Numerical Partial Differential Equations: Finite Difference Methods

2013-10-31

introduces recent research results of finite difference methods including important nonlinear evolution equations in applied science the presented difference schemes include nonlinear difference schemes and linearized difference schemes features widely used nonlinear evolution equations such as burgers equation regular long wave equation schrodinger equation and more each pde model includes details on efficiency stability and convergence

Analysis of Finite Difference Schemes

1965

extensively revised edition of computational methods in partial differential equations a more general approach has been adopted for the splitting of operators for parabolic and hyperbolic equations to include richtmyer and strang type splittings in addition to alternating direction implicit and locally one dimensional methods a description of the now standard factorization and sor adi iterative techniques for solving elliptic difference equations has been supplemented with an account or preconditioned conjugate gradient methods which are currently gaining in popularity prominence is also given to the galerkin method using different test and trial functions as a means of constructing difference approximations to both elliptic and time dependent problems the applications of finite difference methods have been revised and contain examples involving the treatment of singularities in elliptic equations free and moving boundary problems as well as modern developments in computational fluid dynamics emphasis throughout is on clear exposition of the construction and solution of difference equations material is reinforced with theoretical results when appropriate

Finite-difference Methods for Partial Differential Equations

2017-07-20

this new book deals with the construction of finite difference fd algorithms for three main types of equations elliptic equations heat equations and gas dynamic equations in lagrangian form these methods can be applied to domains of arbitrary shapes the construction of fd algorithms for all types of equations is done on the basis of the support operators method som this method constructs the fd analogs of main invariant differential operators of first order such as the divergence the gradient and the curl this book is unique because it is the first book not in russian to present the support operators ideas conservative finite difference methods on general grids is completely self contained presenting all the background material necessary for understanding the book provides the tools needed by scientists and engineers to solve a wide range of practical engineering problems an abundance of tables and graphs support and explain methods the book details all algorithms needed for implementation a 3 5 ibm compatible computer diskette with the main algorithms in fortran accompanies text for easy use

Finite Difference Methods in Heat Transfer

2023-05-08

this second volume in the progress in electromagnetic research series examines recent advances in computational electromagnetics with emphasis on scattering as brought about by new formulations and algorithms which use finite element or finite difference techniques containing contributions by some of the world s leading experts the papers thoroughly review and analyze this rapidly evolving area of computational electromagnetics covering topics ranging from the new finite element based formulation for representing time harmonic vector fields in 3 d inhomogeneous media using two coupled scalar potentials to the consideration of conforming boundary elements and leap frog time marching in transient field problems involving corners and wedges in two and three dimensions the volume will provide an indispensable reference source for practitioners and students of computational electromagnetics

Finite Difference Methods for Nonlinear Evolution Equations

1980-03-10

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

The Finite Difference Method in Partial Differential Equations

2018-02-06

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

Conservative Finite-Difference Methods on General Grids

1987

this book is mainly devoted to finite difference numerical methods for solving partial differential equations pdes models of pricing a wide variety of financial derivative securities with this objective the book is divided into two main parts in the first part after an introduction concerning the basics on derivative securities the authors explain how to establish the adequate pde boundary value problems for different sets of derivative products vanilla and exotic options and interest rate derivatives for many option problems the analytic solutions are also derived with details the second part is devoted to explaining and analyzing the application of finite differences techniques to the financial models stated in the first part of the book for this the authors recall some basics on finite difference methods initial boundary value problems and having in view financial products with early exercise feature linear complementarity and free boundary problems in each chapter the techniques related to these mathematical and numerical subjects are applied to a wide variety of financial products this is a textbook for graduate students following a mathematical finance program as well as a valuable reference for those researchers working in numerical methods in financial derivatives for this new edition the book has been updated throughout with many new problems added more details about numerical methods for some options for example asian options with discrete sampling are provided and the proof of solution uniqueness of derivative security problems and the complete stability analysis of numerical methods for two dimensional problems are added review of first edition the book is highly well designed and structured as a textbook for graduate students following a mathematical finance program which includes black scholes dynamic hedging methodology to price financial derivatives also it is a very valuable reference for those researchers working in numerical methods in financial derivatives either with a more financial or mathematical background mathematical reviews

The Finite Difference Method in Partial Differential Equations

2007

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

Finite Difference Methods for Ordinary and Partial Differential Equations

2013-10-22

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

Finite Element and Finite Difference Methods in Electromagnetic Scattering

2007-12-06

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

High Order Difference Methods for Time Dependent PDE

1956

a practical and concise guide to finite difference and finite element methods well tested matlab codes are available online

Finite Difference Methods for the First Boundary Value Problem of [delta]u(x, Y)

2017-07-12

containing an extensive illustration of the use of finite difference method in solving boundary value problem numerically a wide class of differential equations have been numerically solved in this book

Finite Difference Methods in Heat Transfer

2013-04

Finite Difference Methods for Partial Differential Equations

2013-07-04

Derivative Securities and Difference Methods

2017-06-21

Finite Difference Computing with PDEs

2014-06-28

Ocean Acoustic Propagation by Finite Difference Methods

1998

Second International Conference "Finite-Difference Methods, Theory and Application" (CFDM98)

1968

Finite Difference Methods for Solving Partial Differential Equations

1991

Applications of Discrete Functional Analysis to the Finite Difference Method

2013-10-28

Finite Difference Methods in Financial Engineering

2017-11-30

Numerical Solution of Differential Equations

2018-09-05

Numerical Solutions of Boundary Value Problems with Finite Difference Method

1984

Numerical Solution of Partial Differential Equations

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