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KEY=EQUATIONS - KLEIN JILLIAN

COMPUTATIONAL DIFFERENTIAL EQUATIONS

Cambridge University Press Textbook for teaching computational mathematics.

COMPUTATIONAL PARTIAL DIFFERENTIAL EQUATIONS

NUMERICAL METHODS AND DIFFPACK PROGRAMMING

Springer Science & Business Media Targeted at students and researchers in computational sciences who need to develop computer codes for solving PDEs, the exposition here is focused on numerics and software related to mathematical models in solid and fluid mechanics. The book teaches finite element methods, and basic finite difference methods from a computational point of view, with the main emphasis on developing flexible computer programs, using the numerical library Diffpack. Diffpack is explained in detail for problems including model equations in applied mathematics, heat transfer, elasticity, and viscous fluid flow. All the program examples, as well as Diffpack for use with this book, are available on the Internet. XXXXXXX NEUER TEXT This book is for researchers who need to develop computer code for solving PDEs. Numerical methods and the application of Diffpack are explained in detail. Diffpack is a modern C++ development environment that is widely used by industrial scientists and engineers working in areas such as oil exploration, groundwater modeling, and materials testing. All the program examples, as well as a test

version of Diffpack, are available for free over the Internet.

ADVANCED TOPICS IN COMPUTATIONAL PARTIAL DIFFERENTIAL EQUATIONS

NUMERICAL METHODS AND DIFFPACK PROGRAMMING

Springer Science & Business Media A gentle introduction to advanced topics such as parallel computing, multigrid methods, and special methods for systems of PDEs. The goal of all chapters is to 'compute' solutions to problems, hence algorithmic and software issues play a central role. All software examples use the Diffpack programming environment - some experience with Diffpack is required. There are also some chapters covering complete applications, i.e., the way from a model, expressed as systems of PDEs, through to discretization methods, algorithms, software design, verification, and computational examples. Suitable for readers with a background in basic finite element and finite difference methods for partial differential equations.

NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS

A COMPUTATIONAL APPROACH

CRC Press With emphasis on modern techniques, Numerical Methods for Differential Equations: A Computational Approach covers the development and application of methods for the numerical solution of ordinary differential equations. Some of the methods are extended to cover partial differential equations. All techniques covered in the text are on a program disk included with the book, and are written in Fortran 90. These programs are ideal for students, researchers, and practitioners because they allow for straightforward application of the numerical methods described in the text. The code is easily modified to solve new systems of equations. Numerical Methods for Differential Equations: A Computational Approach also contains a reliable and inexpensive global error code for those interested in global error estimation. This is a valuable text for students, who will find the derivations of the numerical methods extremely helpful and the programs themselves easy to use. It is also an excellent reference and source of software for researchers and practitioners who need computer solutions to differential equations.

COMPUTATIONAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

Ellis Horwood

COMPUTATIONAL PARTIAL DIFFERENTIAL EQUATIONS USING MATLAB

CRC Press This textbook introduces several major numerical methods for solving various partial differential equations (PDEs) in science and engineering, including elliptic, parabolic, and hyperbolic equations. It covers traditional techniques that include the classic finite difference method and the finite element method as well as state-of-the-art numerical methods, such as the high-order compact difference method and the radial basis function meshless method. Helps Students Better Understand Numerical Methods through Use of MATLAB® The authors uniquely emphasize both theoretical numerical analysis and practical implementation of the algorithms in MATLAB, making the book useful for students in computational science and engineering. They provide students with simple, clear implementations instead of sophisticated usages of MATLAB functions. All the Material Needed for a Numerical Analysis Course Based on the authors' own courses, the text only requires some knowledge of computer programming, advanced calculus, and difference equations. It includes practical examples, exercises, references, and problems, along with a solutions manual for qualifying instructors. Students can download MATLAB code from www.crcpress.com, enabling them to easily modify or improve the codes to solve their own problems.

INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS

A COMPUTATIONAL APPROACH

Springer Science & Business Media Combining both the classical theory and numerical techniques for partial differential equations, this thoroughly modern approach shows the significance of computations in PDEs and illustrates the strong interaction between mathematical theory and the development of numerical methods. Great care has been taken throughout the book to seek a sound balance between these techniques. The authors present the material at an easy pace and exercises ranging from the straightforward to the challenging have been included. In addition there are some "projects" suggested, either to refresh the students memory of results needed in this course, or to extend the theories developed in the text. Suitable for undergraduate and graduate students in mathematics and engineering.

COMPUTATIONAL PARTIAL DIFFERENTIAL EQUATIONS USING MATLAB®

CRC Press In this popular text for an Numerical Analysis course, the authors introduce several major methods of solving various partial differential equations (PDEs) including elliptic, parabolic, and hyperbolic equations. It covers

traditional techniques including the classic finite difference method, finite element method, and state-of-the-art numercial methods.The text uniquely emphasizes both theoretical numerical analysis and practical implementation of the algorithms in MATLAB. This new edition includes a new chapter, Finite Value Method, the presentation has been tightened, new exercises and applications are included, and the text refers now to the latest release of MATLAB. Key Selling Points: A successful textbook for an undergraduate text on numerical analysis or methods taught in mathematics and computer engineering. This course is taught in every university throughout the world with an engineering department or school. Competitive advantage broader numerical methods (including finite difference, finite element, meshless method, and finite volume method), provides the MATLAB source code for most popular PDEs with detailed explanation about the implementation and theoretical analysis. No other existing textbook in the market offers a good combination of theoretical depth and practical source codes.

DIFFERENTIAL EQUATIONS WITH SYMBOLIC COMPUTATION

Springer Science & Business Media This book presents the state-of-the-art in tackling differential equations using advanced methods and software tools of symbolic computation. It focuses on the symbolic-computational aspects of three kinds of fundamental problems in differential equations: transforming the equations, solving the equations, and studying the structure and properties of their solutions.

NUMERICAL METHODS FOR EVOLUTIONARY DIFFERENTIAL EQUATIONS

SIAM Develops, analyses, and applies numerical methods for evolutionary, or time-dependent, differential problems.

COMPUTATIONAL METHODS IN ORDINARY DIFFERENTIAL EQUATIONS

John Wiley & Sons Incorporated

COMPUTATIONAL TECHNIQUES FOR DIFFERENTIAL EQUATIONS

Elsevier Computational Techniques for Differential Equations

ESSENTIAL PARTIAL DIFFERENTIAL EQUATIONS

ANALYTICAL AND COMPUTATIONAL ASPECTS

Springer This volume provides an introduction to the analytical and numerical aspects of partial differential equations (PDEs). It unifies an analytical and computational approach for these; the qualitative behaviour of solutions being established using classical concepts: maximum principles and energy methods. Notable inclusions are the treatment of irregularly shaped boundaries, polar coordinates and the use of flux-limiters when approximating hyperbolic conservation laws. The numerical analysis of difference schemes is rigorously developed using discrete maximum principles and discrete Fourier analysis. A novel feature is the inclusion of a chapter containing projects, intended for either individual or group study, that cover a range of topics such as parabolic smoothing, travelling waves, isospectral matrices, and the approximation of multidimensional advection–diffusion problems. The underlying theory is illustrated by numerous examples and there are around 300 exercises, designed to promote and test understanding. They are starred according to level of difficulty. Solutions to odd-numbered exercises are available to all readers while even-numbered solutions are available to authorised instructors. Written in an informal yet rigorous style, Essential Partial Differential Equations is designed for mathematics undergraduates in their final or penultimate year of university study, but will be equally useful for students following other scientific and engi neering disciplines in which PDEs are of practical importance. The only prerequisite is a familiarity with the basic concepts of calculus and linear algebra.

NUMERICAL METHODS FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

Springer The description of many interesting phenomena in science and engineering leads to infinite-dimensional minimization or evolution problems that define nonlinear partial differential equations. While the development and analysis of numerical methods for linear partial differential equations is nearly complete, only few results are available in the case of nonlinear equations. This monograph devises numerical methods for nonlinear model problems arising in the mathematical description of phase transitions, large bending problems, image processing, and inelastic material behavior. For each of these problems the underlying mathematical model is discussed, the essential analytical properties are explained, and the proposed numerical method is rigorously analyzed. The practicality of the algorithms is illustrated by means of short implementations.

COMPUTATIONAL METHODS IN PARTIAL DIFFERENTIAL EQUATIONS

Report for Bachelor of Engineering (Ocean Engineering).

SCIENTIFIC COMPUTING WITH ORDINARY DIFFERENTIAL EQUATIONS

Springer Science & Business Media Well-known authors; Includes topics and results that have previously not been covered in a book; Uses many interesting examples from science and engineering; Contains numerous homework exercises; Scientific computing is a hot and topical area

PARTIAL DIFFERENTIAL EQUATIONS

MODELLING AND NUMERICAL SIMULATION

Springer Science & Business Media For more than 250 years partial di?erential equations have been clearly the most important tool available to mankind in order to understand a large variety of phenomena, natural at ?rst and then those originating from - man activity and technological development. Mechanics, physics and their engineering applications were the ?rst to bene?t from the impact of partial di?erential equations on modeling and design, but a little less than a century ago the Schr¨ odinger equation was the key opening the door to the application of partial di?erential equations to quantum chemistry, for small atomic and molecular systems at ?rst, but then for systems of fast growing complexity. The place of partial di?erential equations in mathematics is a very particular one: initially, the partial di?erential equations modeling natural phenomena were derived by combining calculus with physical reasoning in order to - press conservation laws and principles in partial di?erential equation form, leading to the wave equation, the heat equation, the equations of elasticity, the Euler and Navier–Stokes equations for ?uids, the Maxwell equations of electro-magnetics, etc. It is in order to solve 'constructively' the heat equation that Fourier developed the series bearing his name in the early 19th century; Fourier series (and later integrals) have played (and still play) a fundamental roleinbothpureandappliedmathematics,includingmanyareasquiteremote from partial di?erential equations. On the other hand, several areas of mathematics such as di?erential ge- etry have bene?ted from their interactions with partial di?erential equations.

A COMPUTATIONAL DIFFERENTIAL GEOMETRY APPROACH TO GRID GENERATION

Springer Science & Business Media The process of breaking up a physical domain into smaller sub-domains, known as meshing, facilitates the numerical solution of partial differential equations used to simulate physical systems. In an updated and expanded Second Edition, this monograph gives a detailed treatment based on the numerical solution of

inverted Beltramian and diffusion equations with respect to monitor metrics for generating both structured and unstructured grids in domains and on surfaces.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS ON PARALLEL COMPUTERS

Springer Science & Business Media Since the dawn of computing, the quest for a better understanding of Nature has been a driving force for technological development. Groundbreaking achievements by great scientists have paved the way from the abacus to the supercomputing power of today. When trying to replicate Nature in the computer's silicon test tube, there is need for precise and computable process descriptions. The scienti?c ?elds of Ma- ematics and Physics provide a powerful vehicle for such descriptions in terms of Partial Differential Equations (PDEs). Formulated as such equations, physical laws can become subject to computational and analytical studies. In the computational setting, the equations can be discreti ed for ef?cient solution on a computer, leading to valuable tools for simulation of natural and man-made processes. Numerical so- tion of PDE-based mathematical models has been an important research topic over centuries, and will remain so for centuries to come. In the context of computer-based simulations, the quality of the computed results is directly connected to the model's complexity and the number of data points used for the computations. Therefore, computational scientists tend to ?ll even the largest and most powerful computers they can get access to, either by increasing the si e of the data sets, or by introducing new model terms that make the simulations more realistic, or a combination of both. Today, many important simulation problems can not be solved by one single computer, but calls for parallel computing.

COMPUTATIONAL ORDINARY DIFFERENTIAL EQUATIONS

BASED ON THE PROCEEDINGS OF A CONFERENCE ON COMPUTATIONAL ORDINARY DIFFERENTIAL EQUATIONS

Oxford University Press, USA This collection of refereed papers from an international conference provides a comprehensive coverage of recent research on the numerical solution of ordinary differential equations. There are sections on initial value problems, boundary value problems, differential algebraic equations,applications to the solution of partial differential equations, parallel solution methods, and methods of conservation and global error calculation. Within each section the papers have been ordered so that the reader will perceive a gradual movement from the theoretical to the practical. Newchallenges such as the solution of differential-algebraic equations and the impact of parallelism are covered alongside currently topical aspects of older problems such as the interpolation of

Runge-Kutta methods and the development of formulas which conserve energy whilst preserving accuracy. Fornumerical analysts in academic and industrial research this book provides detailed coverage of this important subject.

SOLVING ORDINARY DIFFERENTIAL EQUATIONS I

NONSTIFF PROBLEMS

Springer Science & Business Media This book deals with methods for solving nonstiff ordinary differential equations. The first chapter describes the historical development of the classical theory, and the second chapter includes a modern treatment of Runge-Kutta and extrapolation methods. Chapter three begins with the classical theory of multistep methods, and concludes with the theory of general linear methods. The reader will benefit from many illustrations, a historical and didactic approach, and computer programs which help him/her learn to solve all kinds of ordinary differential equations. This new edition has been rewritten and new material has been included.

COMPUTATIONAL DIFFERENTIAL EQUATIONS

PARTIAL DIFFERENTIAL EQUATIONS

MODELING, ANALYSIS, COMPUTATION

SIAM Textbook with a unique approach that integrates analysis and numerical methods and includes modelling to address real-life problems.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING

John Wiley & Sons 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.

COMPUTATIONAL TECHNIQUES FOR ORDINARY DIFFERENTIAL EQUATIONS

COMPUTATIONAL OPTIMIZATION OF SYSTEMS GOVERNED BY PARTIAL DIFFERENTIAL EQUATIONS

SIAM This book provides a bridge between continuous optimization and PDE modelling and focuses on the numerical solution of the corresponding problems. Intended for graduate students in PDE-constrained optimization, it is also suitable as an introduction for researchers in scientific computing or optimization.

DOMAIN DECOMPOSITION METHODS FOR THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

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

GREEN'S FUNCTIONS AND LINEAR DIFFERENTIAL EQUATIONS

THEORY, APPLICATIONS, AND COMPUTATION

CRC Press Green's Functions and Linear Differential Equations: Theory, Applications, and Computation presents a variety of methods to solve linear ordinary differential equations (ODEs) and partial differential equations (PDEs). The

text provides a sufficient theoretical basis to understand Green's function method, which is used to solve initial and boundary

IMPLEMENTING SPECTRAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

ALGORITHMS FOR SCIENTISTS AND ENGINEERS

Springer Science & Business Media This book explains how to solve partial differential equations numerically using single and multidomain spectral methods. It shows how only a few fundamental algorithms form the building blocks of any spectral code, even for problems with complex geometries.

THE COMPUTATIONAL COMPLEXITY OF DIFFERENTIAL AND INTEGRAL EQUATIONS

AN INFORMATION-BASED APPROACH

Oxford University Press on Demand Complexity theory has become an increasingly important theme in mathematical research. This book deals with an approximate solution of differential or integral equations by algorithms using incomplete information. This situation often arises for equations of the form Lu = f where f is some function defined on a domain and L is a differential operator. We do not have complete information about f. For instance, we might only know its value at a finite number of points in the domain, or the values of its inner products with a finite set of known functions. Consequently the best that can be hoped for is to solve the equation to within a given accuracy at minimal cost or complexity. In this book, the theory of the complexity of the solution to differential and integral equations is developed. The relationship between the worst case setting and other (sometimes more tractable) related settings, such as the average case, probabilistic, asymptotic, and randomized settings, is also discussed. The author determines the inherent complexity of the problem and finds optimal algorithms (in the sense of having minimal cost). Furthermore, he studies to what extent standard algorithms (such as finite element methods for elliptic problems) are optimal. This approach is discussed in depth in the context of two-point boundary value problems, linear elliptic partial differential equations, integral equations, ordinary differential equations, and ill-posed problems. As a result, this volume should appeal to mathematicians and numerical analysts working on the approximate solution of differential and integral equations, as well as to complexity theorists addressing related questions in this area.

COMPUTATIONAL ASPECTS OF LINEAR CONTROL

Springer Science & Business Media The main objective of this volume is to create a bridge between control theory and its numerical analysis aspects. It is unique because it presents both subjects in a single volume. The book combines an exposition of linear control theory and the corresponding modern relevant computational techniques such as orthogonal polynomials, Padé approximation, numerical linear algebra, and some topics on nonlinear differential equations. It can be considered as an introduction to control theory for numerical analysts looking for a wide area of applications and as an introduction to recent numerical methods for control specialists. Audience: Aimed at advanced students at a doctoral or post-doctoral level, engineers, and researchers in control theory and numerical analysis.

AUTOMATED SOLUTION OF DIFFERENTIAL EQUATIONS BY THE FINITE ELEMENT METHOD

THE FENICS BOOK

Springer Science & Business Media 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.

NUMERICAL METHODS IN COMPUTATIONAL FINANCE

A PARTIAL DIFFERENTIAL EQUATION (PDE/FDM) APPROACH

John Wiley & Sons This book is a detailed and step-by-step introduction to the mathematical foundations of ordinary and partial differential equations, their approximation by the finite difference method and applications to computational finance. The book is structured so that it can be read by beginners, novices and expert users. Part A Mathematical Foundation for One-Factor Problems Chapters 1 to 7 introduce the mathematical and numerical analysis

concepts that are needed to understand the finite difference method and its application to computational finance. Part B Mathematical Foundation for Two-Factor Problems Chapters 8 to 13 discuss a number of rigorous mathematical techniques relating to elliptic and parabolic partial differential equations in two space variables. In particular, we develop strategies to preprocess and modify a PDE before we approximate it by the finite difference method, thus avoiding ad-hoc and heuristic tricks. Part C The Foundations of the Finite Difference Method (FDM) Chapters 14 to 17 introduce the mathematical background to the finite difference method for initial boundary value problems for parabolic PDEs. It encapsulates all the background information to construct stable and accurate finite difference schemes. Part D Advanced Finite Difference Schemes for Two-Factor Problems Chapters 18 to 22 introduce a number of modern finite difference methods to approximate the solution of two factor partial differential equations. This is the only book we know of that discusses these methods in any detail. Part E Test Cases in Computational Finance Chapters 23 to 26 are concerned with applications based on previous chapters. We discuss finite difference schemes for a wide range of one-factor and two-factor problems. This book is suitable as an entry-level introduction as well as a detailed treatment of modern methods as used by industry quants and MSc/MFE students in finance. The topics have applications to numerical analysis, science and engineering. More on computational finance and the author’s online courses, see www.datasim.nl.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS ON PARALLEL COMPUTERS

Springer Science & Business Media Since the dawn of computing, the quest for a better understanding of Nature has been a driving force for technological development. Groundbreaking achievements by great scientists have paved the way from the abacus to the supercomputing power of today. When trying to replicate Nature in the computer’s silicon test tube, there is need for precise and computable process descriptions. The scienti?c ?elds of Ma- ematics and Physics provide a powerful vehicle for such descriptions in terms of Partial Differential Equations (PDEs). Formulated as such equations, physical laws can become subject to computational and analytical studies. In the computational setting, the equations can be discreti ed for ef?cient solution on a computer, leading to valuable tools for simulation of natural and man-made processes. Numerical so- tion of PDE-based mathematical models has been an important research topic over centuries, and will remain so for centuries to come. In the context of computer-based simulations, the quality of the computed results is directly connected to the model’s complexity and the number of data points used for the computations. Therefore, computational scientists tend to ?ll even the largest and most powerful computers they can get access to, either by increasing the si e of the data sets, or by introducing new model terms that make the

simulations more realistic, or a combination of both. Today, many important simulation problems can not be solved by one single computer, but calls for parallel computing.

NUMERICAL APPROXIMATION OF PARTIAL DIFFERENTIAL EQUATIONS

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

AN INTRODUCTION TO COMPUTATIONAL STOCHASTIC PDES

Cambridge University Press This book gives a comprehensive introduction to numerical methods and analysis of stochastic processes, random fields and stochastic differential equations, and offers graduate students and researchers powerful tools for understanding uncertainty quantification for risk analysis. Coverage includes traditional stochastic ODEs with white noise forcing, strong and weak approximation, and the multi-level Monte Carlo method. Later chapters apply the theory of random fields to the numerical solution of elliptic PDEs with correlated random data, discuss the Monte Carlo method, and introduce stochastic Galerkin finite-element methods. Finally, stochastic parabolic PDEs are developed. Assuming little previous exposure to probability and statistics, theory is developed in tandem with state-of-the-art computational methods through worked examples, exercises, theorems and proofs. The set of MATLAB codes included (and downloadable) allows readers to perform computations themselves and solve the test problems discussed. Practical examples are drawn from finance, mathematical biology, neuroscience, fluid flow modelling and materials science.

ESSENTIAL PARTIAL DIFFERENTIAL EQUATIONS

ANALYTICAL AND COMPUTATIONAL ASPECTS

Springer This volume provides an introduction to the analytical and numerical aspects of partial differential equations (PDEs). It unifies an analytical and computational approach for these; the qualitative behaviour of solutions being established using classical concepts: maximum principles and energy methods. Notable inclusions are the treatment of irregularly shaped boundaries, polar coordinates and the use of flux-limiters when approximating hyperbolic conservation laws. The numerical analysis of difference schemes is rigorously developed using discrete maximum principles and discrete Fourier analysis. A novel feature is the inclusion of a chapter containing projects, intended for either individual or group study, that cover a range of topics such as parabolic smoothing, travelling waves, isospectral matrices, and the approximation of multidimensional advection–diffusion problems. The underlying theory is illustrated by numerous examples and there are around 300 exercises, designed to promote and test understanding. They are starred according to level of difficulty. Solutions to odd-numbered exercises are available to all readers while even-numbered solutions are available to authorised instructors. Written in an informal yet rigorous style, Essential Partial Differential Equations is designed for mathematics undergraduates in their final or penultimate year of university study, but will be equally useful for students following other scientific and engineering disciplines in which PDEs are of practical importance. The only prerequisite is a familiarity with the basic concepts of calculus and linear algebra.

ADAPTIVE COMPUTATIONAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

SIAM List of participants; Elliptic equations; Parabolic equations; Hyperbolic equations.

STABILITY AND IMPLEMENTATION PROBLEMS FOR COMPUTATIONAL DIFFERENTIAL EQUATIONS

SOLVING ORDINARY DIFFERENTIAL EQUATIONS II

STIFF AND DIFFERENTIAL - ALGEBRAIC PROBLEMS

Springer Science & Business Media "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.