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TIME-DEPENDENT PROBLEMS AND DIFFERENCE METHODS

SECOND EDITION

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Time Dependent Problems And Difference Methods

Heinz-Otto Kreiss

Time Dependent Problems And Difference Methods:

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Finite Difference Methods for Ordinary and Partial Differential Equations Randall J. LeVeque, 2007-09-06. Introductory textbook from which students can approach more advance topics relating to finite difference methods.

Methods for the Approximate Solution of Time Dependent Problems Heinz Kreiss, Joseph Oliger, 1973. The theoretical analysis of numerical methods presented in this monograph will fill the need for systematic treatments in formulating finite difference methods for geophysical fluid dynamics problems forward.

High Order Difference Methods for Time Dependent PDE Bertil Gustafsson, 2007-12-06. Many books have been written on finite difference methods (FDM) but there are good reasons to write still another one. The main reason is that even if higher order methods have been known for a long time the analysis of stability, accuracy and effectiveness is missing to a large extent. For example the definition of the formal high order accuracy is based on the assumption that the true solution is smooth or expressed differently that the grid is fine enough such that all variations in the solution are well resolved. In many applications this assumption is not fulfilled and then it is interesting to know if a high order method is still effective. Another problem that needs thorough analysis is the construction of boundary conditions such that both accuracy and stability is upheld. And finally there has been quite a strong development during the last years in particular when it comes to very general and stable difference operators for application on initial boundary value problems. The content of the book is not purely theoretical neither is it a set of recipes for various types of applications. The idea is to give an overview of the basic theory and construction principles for difference methods without going into all details. For example certain theorems are presented but the proofs are in most cases left out. The explanation and application of the theory is illustrated by using simple model examples.

Difference Methods for Initial-Boundary-Value Problems and Flow Around Bodies You-lan Zhu, Xi-chang Zhong, Bing-mu Chen, Zuo-min Zhang, 2013-06-29. Since the appearance of computers numerical methods for discontinuous solutions of quasi linear hyperbolic systems of partial differential equations have been among the most important research subjects in numerical analysis. The authors have developed a new difference method named the singularity separating method for quasi linear hyperbolic systems of partial differential equations. Its most important feature is that it possesses a high accuracy even for problems with singularities such as shocks, contact discontinuities, rarefaction waves and detonations. Besides the thorough description of the method itself its mathematical foundation, stability

convergence theory of difference schemes for initial boundary value hyperbolic problems and its application to supersonic flow around bodies are discussed. Further the method of lines and its application to blunt body problems and conical flow problems are described in detail. This book should soon be an important working basis for both graduate students and researchers in the field of partial differential equations as well as in mathematical physics.

Numerical Methods for Solving Time-dependent Problems for Partial Differential Equations Heinz-Otto Kreiss, 1978

Numerical Time-Dependent Partial Differential Equations for Scientists and Engineers Moysey Brio, Gary M. Webb, Aramais R. Zakharian, 2010-09-21

It is the first text that in addition to standard convergence theory treats other necessary ingredients for successful numerical simulations of physical systems encountered by every practitioner. The book is aimed at users with interests ranging from application modeling to numerical analysis and scientific software development. It is strongly influenced by the authors' research in space physics, electrical and optical engineering, applied mathematics, numerical analysis, and professional software development. The material is based on a year long graduate course taught at the University of Arizona since 1989. The book covers the first two semesters of a three semester series. The second semester is based on a semester long project while the third semester requirement consists of a particular methods course in specific disciplines like computational fluid dynamics, finite element method in mechanical engineering, computational physics, biology, chemistry, photonics, etc. The first three chapters focus on basic properties of partial differential equations including analysis of the dispersion relation, symmetries, particular solutions and instabilities of the PDEs, methods of discretization and convergence theory for initial value problems. The goal is to progress from observations of simple numerical artifacts like diffusion, damping, dispersion, and anisotropies to their analysis and management technique as it is not always possible to completely eliminate them. In the second part of the book we cover topics for which there are only sporadic theoretical results while they are an integral part and often the most important part for successful numerical simulation. We adopt a more heuristic and practical approach using numerical methods of investigation and validation. The aim is to teach students subtle key issues in order to separate physics from numerics. The following topics are addressed: Implementation of transparent and absorbing boundary conditions, Practical stability analysis in the presence of the boundaries and interfaces, Treatment of problems with different temporal spatial scales either explicit or implicit, Preservation of symmetries and additional constraints, Physical regularization of singularities, Resolution enhancement using adaptive mesh refinement and moving meshes, Self-contained presentation of key issues in successful numerical simulation. Accessible to scientists and engineers with diverse background. Provides analysis of the dispersion relation, symmetries, particular solutions and instabilities of the partial differential equations.

The Finite Difference Method in Partial Differential Equations A. R. Mitchell, D. F. Griffiths, 1980-03-10

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 of 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 Fractional Diffusion Equations Ercília Sousa,2026-01-11 This book provides a self contained introduction to finite difference methods for time dependent space fractional diffusion equations emphasizing their theoretical properties and practical computational implementation It collects results previously dispersed throughout the literature presenting them within a coherent unified framework In addition to covering numerical methods for fractional diffusion equations their exact solutions and their connection to L^{vy} flights it also offers an accessible overview of fundamental concepts related to Riemann Liouville fractional derivatives By presenting a comprehensive treatment of the fundamental techniques of finite difference methods the book lays a solid foundation for mastering the intricacies of finite differences for fractional differential equations The final chapters address scenarios with boundary conditions filling a gap in the existing literature Each chapter concludes with exercises designed to help deepen the reader's understanding and prepare them for further specialized study Written from the perspective of a mathematician who enjoys physics and computation the volume is intended as a starting point for any researcher who wants to enter into this exciting subject It will appeal to graduate students and experts from different backgrounds who enjoy digging into mathematical physical and computational ideas

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Mathematical Papers ,1974 **AIAA 26th Aerospace Sciences Meeting** ,1988 **AICA International Association for**
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1980-86 ,1987 These five volumes bring together a wealth of bibliographic information in the area of numerical analysis
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