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TIME-DEPENDENT PROBLEMS AND DIFFERENCE METHODS

SECOND EDITION

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Time Dependent Problems And Difference Methods

Randall J. LeVeque



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

LeVeque,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 Computational Partial Differential Equations

Hans P. Langtangen,2012-12-06 The second edition features lots of improvements and new material The most significant additions include finite difference methods and implementations for a 1D time dependent heat equation Chapter 1 7 6 a solver for vibration of elastic structures Chapter 5 1 6 a step by step instruction of how to develop and test Diffpack programs for a physical application Chapters 3 6 and 3 13 construction of non trivial grids using super elements Chapters 3 5 4 3 6 4 and 3 13 4 additional material on local mesh refinements Chapter 3 7 coupling of Diffpack with other types of software Appendix B 3 high level programming offinite difference solvers utilizing the new stencil finite difference operator concept in Diffpack Appendix D 8 Many of the examples projects and exercises from the first edition have been revised and improved Some new exercises and projects have also been added A hopefully very useful new feature is the compact overview of all the program examples in the book and the associated software files presented in Chapter 1 2 Errors have been corrected many explanations have been extended and the text has been upgraded to be compatible with Diffpack version 4 0 The major difficulty when developing programs for numerical solution of partial differential equations is to debug and verify the implementation This requires an interplay between understanding the mathematical model the in volved numerics and the programming tools **The Finite Element Method** A. J. Davies,2011-09-08 An introduction to the application of the finite element method to the solution of boundary and initial value problems posed in terms of partial differential equations Contains worked examples throughout and each chapter has a set of exercises with detailed solutions

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