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Computer Methods for Ordinary Differential Equations and Differential-Algebraic Equations Uri M. Ascher, Linda R. Petzold, 1998-01-01 Designed for those people who want to gain a practical knowledge of modern techniques this book contains all the material necessary for a course on the numerical solution of differential equations Written by two of the field's leading authorities it provides a unified presentation of initial value and boundary value problems in ODEs as well as differential algebraic equations The approach is aimed at a thorough understanding of the issues and methods for practical computation while avoiding an extensive theorem proof type of exposition It also addresses reasons why existing software succeeds or fails This book is a practical and mathematically well informed introduction that emphasizes basic methods and theory issues in the use and development of mathematical software and examples from scientific engineering applications Topics requiring an extensive amount of mathematical development such as symplectic methods for Hamiltonian systems are introduced motivated and included in the exercises but a complete and rigorous mathematical presentation is referenced rather than included

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Differential Equations is a self contained introduction to a fundamental field of numerical analysis and scientific computation. Written for undergraduate students with a mathematical background this book focuses on the analysis of numerical methods without losing sight of the practical nature of the subject. It covers the topics traditionally treated in a first course but also highlights new and emerging themes. Chapters are broken down into lecture sized pieces motivated and illustrated by numerous theoretical and computational examples. Over 200 exercises are provided and these are starred according to their degree of difficulty. Solutions to all exercises are available to authorized instructors. The book covers key foundation topics o Taylor series methods o Runge Kutta methods o Linear multistep methods o Convergence o Stability and a range of modern themes o Adaptive stepsize selection o Long term dynamics o Modified equations o Geometric integration o Stochastic differential equations. The prerequisite of a basic university level calculus class is assumed although appropriate background results are also summarized in appendices. A dedicated website for the book containing extra information can be found via www.springer.com

Numerical Solution of Ordinary Differential Equations Kendall Atkinson, Weimin Han, David E. Stewart, 2011-10-24. A concise introduction to numerical methods and the mathematical framework needed to understand their performance. Numerical Solution of Ordinary Differential Equations presents a complete and easy to follow introduction to classical topics in the numerical solution of ordinary differential equations. The book's approach not only explains the presented mathematics but also helps readers understand how these numerical methods are used to solve real world problems. Unifying perspectives are provided throughout the text bringing together and categorizing different types of problems in order to help readers comprehend the applications of ordinary differential equations. In addition the authors collective academic experience ensures a coherent and accessible discussion of key topics including Euler's method Taylor and Runge Kutta methods General error analysis for multi step methods Stiff differential equations Differential algebraic equations Two point boundary value problems Volterra integral equations. Each chapter features problem sets that enable readers to test and build their knowledge of the presented methods and a related Web site features MATLAB programs that facilitate the exploration of numerical methods in greater depth. Detailed references outline additional literature on both analytical and numerical aspects of ordinary differential equations for further exploration of individual topics.

Numerical Solution of Ordinary Differential Equations is an excellent textbook for courses on the numerical solution of differential equations at the upper undergraduate and beginning graduate levels. It also serves as a valuable reference for researchers in the fields of mathematics and engineering.

Numerical Methods for Differential Equations J.R. Dormand, 2018-05-04. 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

Modern Numerical Methods for Ordinary Differential Equations G. Hall, James Murray Watt, 1976 Numerical Solution of Ordinary Differential Equations Nik Pachis, 2016-04-01 Numerical methods for ordinary differential equations are methods used to find numerical approximations to the solutions of ordinary differential equations ODEs Their use is also known as numerical integration although this term is sometimes taken to mean the computation of integrals An ordinary differential equation or ODE is a differential equation containing one or more functions of one independent variable and its derivatives The term ordinary is used in contrast with the term partial differential equation which may be with respect to more than one independent variable Ordinary differential equations are ubiquitous in science and engineering in geometry and mechanics from the first examples onwards Newton Leibniz Euler Lagrange in chemical reaction kinetics molecular dynamics electronic circuits population dynamics and many more application areas They also arise after semi discretization in space in the numerical treatment of time dependent partial differential equations which are even more impressively omnipresent in our technologically developed and financially controlled world The book Numerical Solution of Ordinary Differential Equations offers a complete and easy to follow introduction to classical topics in the numerical solution of ordinary differential equations The book's approach not only explains the presented mathematics but also helps readers understand how these numerical methods are used to solve real world problems

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Numerical Methods for Ordinary Differential Equations David F. Griffiths, Desmond J. Higham, 2011-03-30 [Computational Methods in Ordinary Differential Equations](#) John Denholm Lambert, 1973-02-16

Numerical Methods for Ordinary Differential Equations with Programs ASHOK KUMAR. SINGH SINGH (ARVIND KUMAR.), Arvind Kumar Singh, 2018 [A First Course in Ordinary Differential Equations](#) Martin Hermann, Masoud Saravi, 2014-04-22 This book presents a modern introduction to analytical and numerical techniques for solving ordinary differential equations ODEs Contrary to the traditional format the theorem and proof format the book is focusing on analytical and numerical methods The book supplies a variety of problems and examples ranging from the elementary to the advanced level to introduce and study the mathematics of ODEs The analytical part of the book deals with solution

techniques for scalar first order and second order linear ODEs and systems of linear ODEs with a special focus on the Laplace transform operator techniques and power series solutions In the numerical part theoretical and practical aspects of Runge Kutta methods for solving initial value problems and shooting methods for linear two point boundary value problems are considered The book is intended as a primary text for courses on the theory of ODEs and numerical treatment of ODEs for advanced undergraduate and early graduate students It is assumed that the reader has a basic grasp of elementary calculus in particular methods of integration and of numerical analysis Physicists chemists biologists computer scientists and engineers whose work involves solving ODEs will also find the book useful as a reference work and tool for independent study The book has been prepared within the framework of a German Iranian research project on mathematical methods for ODEs which was started in early 2012

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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

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