

Numerical Mathematics:

Theory, Methods and Applications



Pearson Education, Inc.

Numerical Mathematics

H. Rutishauser



Numerical Mathematics:

Numerical Mathematics Alfio Quarteroni, Riccardo Sacco, Fausto Saleri, 2010-11-30 This book provides the mathematical foundations of numerical methods and demonstrates their performance on examples exercises and real life applications This is done using the MATLAB software environment which allows an easy implementation and testing of the algorithms for any specific class of problems The book is addressed to students in Engineering Mathematics Physics and Computer Sciences In the second edition of this extremely popular textbook on numerical analysis the readability of pictures tables and program headings has been improved Several changes in the chapters on iterative methods and on polynomial approximation have also been

Concise Numerical Mathematics Robert Plato, 2003 This book succinctly covers the key topics of numerical methods While it is basically a survey of the subject it has enough depth for the student to walk away with the ability to implement the methods by writing computer programs or by applying them to problems in physics or engineering The author manages to cover the essentials while avoiding redundancies and using well chosen examples and exercises The exposition is supplemented by numerous figures Work estimates and pseudo codes are provided for many algorithms which can be easily converted to computer programs Topics covered include interpolation the fast Fourier transform iterative methods for solving systems of linear and nonlinear equations numerical methods for solving ODEs numerical methods for matrix eigenvalue problems approximation theory and computer arithmetic In general the author assumes only a knowledge of calculus and linear algebra The book is suitable as a text for a first course in numerical methods for mathematics students or students in neighboring fields such as engineering physics and computer science

Basic Numerical Mathematics J. Todd, 2013-03-13 There is no doubt nowadays that numerical mathematics is an essential component of any educational program It is probably more efficient to present such material after a strong grasp of at least linear algebra and calculus has already been attained but at this stage those not specializing in numerical mathematics are often interested in getting more deeply into their chosen field than in developing skills for later use An alternative approach is to incorporate the numerical aspects of linear algebra and calculus as these subjects are being developed Long experience has persuaded us that a third attack on this problem is the best and this is developed in the present two volumes which are however easily adaptable to other circumstances The approach we prefer is to treat the numerical aspects separately but after some theoretical background This is often desirable because of the shortage of persons qualified to present the combined approach and also because the numerical approach provides an often welcome change which however in addition can lead to better appreciation of the fundamental concepts For instance in a 6 quarter course in Calculus and Linear Algebra the material in Volume 1 can be handled in the third quarter and that in Volume 2 in the fifth or sixth quarter

An Introduction to Numerical Mathematics Eduard L. Stiefel, 2014-05-12 An Introduction to Numerical Mathematics provides information pertinent to the fundamental aspects of numerical mathematics This book covers a variety of topics including linear

programming linear and nonlinear algebra polynomials numerical differentiation and approximations Organized into seven chapters this book begins with an overview of the solution of linear problems wherein numerical mathematics provides very effective algorithms consisting of finitely many computational steps This text then examines the method for the direct solution of a definite problem Other chapters consider the determination of frequencies in freely oscillating mechanical or electrical systems This book discusses as well eigenvalue problems for oscillatory systems of finitely many degrees of freedom which can be reduced to algebraic equations The final chapter deals with the approximate representation of a function $f(x)$ given by I values as in the form of a table This book is a valuable resource for physicists mathematicians theoreticians engineers and research workers

The Concept of Stability in Numerical Mathematics Wolfgang Hackbusch, 2014-02-06 In this book the author compares the meaning of stability in different subfields of numerical mathematics Concept of Stability in numerical mathematics opens by examining the stability of finite algorithms A more precise definition of stability holds for quadrature and interpolation methods which the following chapters focus on The discussion then progresses to the numerical treatment of ordinary differential equations ODEs While one step methods for ODEs are always stable this is not the case for hyperbolic or parabolic differential equations which are investigated next The final chapters discuss stability for discretisations of elliptic differential equations and integral equations In comparison among the subfields we discuss the practical importance of stability and the possible conflict between higher consistency order and stability

An Introduction to Numerical Methods and Analysis James F. Epperson, 2007-09-17 Praise for the First Edition outstandingly appealing with regard to its style contents considerations of requirements of practice choice of examples and exercises Zentrablatt Math carefully structured with many detailed worked examples The Mathematical Gazette an up to date and user friendly account Mathematika An Introduction to Numerical Methods and Analysis addresses the mathematics underlying approximation and scientific computing and successfully explains where approximation methods come from why they sometimes work or don't work and when to use one of the many techniques that are available Written in a style that emphasizes readability and usefulness for the numerical methods novice the book begins with basic elementary material and gradually builds up to more advanced topics A selection of concepts required for the study of computational mathematics is introduced and simple approximations using Taylor's Theorem are also treated in some depth The text includes exercises that run the gamut from simple hand computations to challenging derivations and minor proofs to programming exercises A greater emphasis on applied exercises as well as the cause and effect associated with numerical mathematics is featured throughout the book An Introduction to Numerical Methods and Analysis is the ideal text for students in advanced undergraduate mathematics and engineering courses who are interested in gaining an understanding of numerical methods and numerical analysis

Lectures on Numerical Mathematics H. Rutishauser, 2012-12-06 The present book is an edition of the manuscripts to the courses Numerical Methods I and Numerical Mathematics I and II which

Professor H Rutishauser held at the E T H in Zurich The first named course was newly conceived in the spring semester of 1970 and intended for beginners while the two others were given repeatedly as elective courses in the sixties For an understanding of most chapters the fundamentals of linear algebra and calculus suffice In some places a little complex variable theory is used in addition However the reader can get by without any knowledge of functional analysis The first seven chapters discuss the direct solution of systems of linear equations the solution of nonlinear systems least squares problems interpolation by polynomials numerical quadrature and approximation by Chebyshev series and by Remez algorithm The remaining chapters include the treatment of ordinary and partial differential equations the iterative solution of linear equations and a discussion of eigen value problems In addition there is an appendix dealing with the qd algorithm and with an axiomatic treatment of computer arithmetic

A Survey of Numerical Mathematics, Volume I David M.

Young, Robert Todd Gregory, 2012-08-09 Volume 1 of two volume set Broad self contained coverage of computer oriented numerical algorithms for solving various types of mathematical problems in linear algebra ordinary and partial differential equations much more Exercises

Fundamentals of Numerical Mathematics for Physicists and Engineers Alvaro Meseguer, 2020-05-14 Introduces the fundamentals of numerical mathematics and illustrates its applications to a wide variety of disciplines in physics and engineering Applying numerical mathematics to solve scientific problems this book helps readers understand the mathematical and algorithmic elements that lie beneath numerical and computational methodologies in order to determine the suitability of certain techniques for solving a given problem It also contains examples related to problems arising in classical mechanics thermodynamics electricity and quantum physics Fundamentals of Numerical Mathematics for Physicists and Engineers is presented in two parts Part I addresses the root finding of univariate transcendental equations polynomial interpolation numerical differentiation and numerical integration Part II examines slightly more advanced topics such as introductory numerical linear algebra parameter dependent systems of nonlinear equations numerical Fourier analysis and ordinary differential equations initial value problems and univariate boundary value problems Chapters cover Newton's method Lebesgue constants conditioning barycentric interpolatory formula Clenshaw Curtis quadrature GMRES matrix free Krylov linear solvers homotopy numerical continuation differentiation matrices for boundary value problems Runge Kutta and linear multistep formulas for initial value problems Each section concludes with Matlab hands on computer practicals and problem and exercise sets This book Provides a modern perspective of numerical mathematics by introducing top notch techniques currently used by numerical analysts Contains two parts each of which has been designed as a one semester course Includes computational practicals in Matlab with solutions at the end of each section for the instructor to monitor the student's progress through potential exams or short projects Contains problem and exercise sets also with solutions at the end of each section Fundamentals of Numerical Mathematics for Physicists and Engineers is an excellent book for advanced undergraduate or graduate students in physics mathematics or engineering It will also benefit students in

other scientific fields in which numerical methods may be required such as chemistry or biology *Numerical Mathematics*
Günther Hämmerlin, Karl-Heinz Hoffmann, 2012-12-06 In truth it is not knowledge but learning not possessing but production
not being there but travelling there which provides the greatest pleasure When I have completely understood something then
I turn away and move on into the dark indeed so curious is the insatiable man that when he has completed one house rather
than living in it peacefully he starts to build another Letter from C F Gauss to W Bolyai on Sept 2 1808 This textbook adds a
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