Numerical Algorithms

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Numerical Algorithms:

Numerical Algorithms with C Giesela Engeln-Müllges,Frank Uhlig,1996-07-02 CD ROM contains all computer codes a compiler and a test bed of programs and data for most of the algorithms   **Numerical Algorithms** Justin Solomon,2015-06-24 Numerical Algorithms Methods for Computer Vision Machine Learning and Graphics presents a new approach to numerical analysis for modern computer scientists Using examples from a broad base of computational tasks including data processing computational photography and animation the textbook introduces numerical modeling and algorithmic desig   **Numerical Algorithms with C** Giesela Engeln-Müllges,Frank Uhlig,2013-11-21 More scientists now use C than any other programming language This book contains practical computer ready algorithms for many standard methods of numerical mathematics It describes the principles of the various methods and provides support in choosing the appropriate method for a given task Topics given special emphasis include converging methods for solving nonlinear equations methods for solving systems of linear equations for many special matrix structures and the Shepard method for multidimensional interpolation The CD contains C programs for almost all the algorithms given in the book and a compiler together with software for graphical printing   *Numerical Algorithms* J. L. Mohamed,Joan E. Walsh,1986 The aim of this book is to provide for a wide range of applied computational problems descriptions of those algorithms which give cheap reliable and stable solution procedures   *Accuracy and Stability of Numerical Algorithms* Nicholas J. Higham,2002-08-01 Accuracy and Stability of Numerical Algorithms gives a thorough up to date treatment of the behavior of numerical algorithms in finite precision arithmetic It combines algorithmic derivations perturbation theory and rounding error analysis all enlivened by historical perspective and informative quotations This second edition expands and updates the coverage of the first edition 1996 and includes numerous improvements to the original material Two new chapters treat symmetric indefinite systems and skew symmetric systems and nonlinear systems and Newton s method Twelve new sections include coverage of additional error bounds for Gaussian elimination rank revealing LU factorizations weighted and constrained least squares problems and the fused multiply add operation found on some modern computer architectures   Accuracy and Stability of Numerical Algorithms Nicholas J. Higham,2002-01-01 Accuracy and Stability of Numerical Algorithms gives a thorough up to date treatment of the behavior of numerical algorithms in finite precision arithmetic It combines algorithmic derivations perturbation theory and rounding error analysis all enlivened by historical perspective and informative quotations This second edition expands and updates the coverage of the first edition 1996 and includes numerous improvements to the original material Two new chapters treat symmetric indefinite systems and skew symmetric systems and nonlinear systems and Newton s method Twelve new sections include coverage of additional error bounds for Gaussian elimination rank revealing LU factorizations weighted and constrained least squares problems and the fused multiply add operation found on some modern computer architectures   *The Developments and the Applications of the Numerical Algorithms in Simulating*

the Incompressible Magnetohydrodynamics with Complex Boundaries and Free Surfaces Jie Zhang,2018-05-25 This thesis presents an accurate and advanced numerical methodology to remedy difficulties such as direct numerical simulation of magnetohydrodynamic MHD flow in computational fluid dynamics CFD grid generation processes in tokamak fusion facilities and the coupling between the surface tension force and Lorentz force in the metallurgical industry In addition on the basis of the numerical platform it establishes it also investigates selected interesting topics e g single bubble motion under the influence of either vertical or horizontal magnetic fields Furthermore it confirms the relation between the bubble s path instability and wake instability and observes the anisotropic isotropic effect of the vertical horizontal magnetic field on the vortex structures which determines the dynamic behavior of the rising bubble The direct numerical simulation of magnetohydrodynamic MHD flows has proven difficult in the field of computational fluid dynamic CFD research because it not only concerns the coupling of the equations governing the electromagnetic field and the fluid motion but also calls for suitable numerical methods for computing the electromagnetic field In tokamak fusion facilities where the MHD effect is significant and the flow domain is complex the process of grid generation requires considerable time and effort Moreover in the metallurgical industry where multiphase MHD flows are usually encountered the coupling between the surface tension force and Lorentz force adds to the difficulty of deriving direct numerical simulations **Control Perspectives on Numerical Algorithms and Matrix Problems** Amit Bhaya,Eugenius Kaszkurewicz,2006-03-01 This book organizes the analysis and design of iterative numerical methods from a control perspective A variety of applications are discussed including iterative methods for linear and nonlinear systems of equations neural networks for linear and quadratic programming problems and integration and shooting methods for ordinary differential equations *Parallel Numerical Algorithms* David E. Keyes,Ahmed Sameh,V. Venkatakrishnan,2012-12-06 In this volume designed for computational scientists and engineers working on applications requiring the memories and processing rates of large scale parallelism leading algorithmicists survey their own field defining contributions together with enough historical and bibliographical perspective to permit working one s way to the frontiers This book is distinguished from earlier surveys in parallel numerical algorithms by its extension of coverage beyond core linear algebraic methods into tools more directly associated with partial differential and integral equations though still with an appealing generality and by its focus on practical medium granularity parallelism approachable through traditional programming languages Several of the authors used their invitation to participate as a chance to stand back and create a unified overview which nonspecialists will appreciate

Structure-Exploiting Numerical Algorithms for Optimal Control Isak Nielsen,2017-04-20 Numerical algorithms for efficiently solving optimal control problems are important for commonly used advanced control strategies such as model predictive control MPC but can also be useful for advanced estimation techniques such as moving horizon estimation MHE In MPC the control input is computed by solving a constrained finite time optimal control CFTOC problem on line and in MHE

the estimated states are obtained by solving an optimization problem that often can be formulated as a CFTOC problem Common types of optimization methods for solving CFTOC problems are interior point IP methods sequential quadratic programming SQP methods and active set AS methods In these types of methods the main computational effort is often the computation of the second order search directions This boils down to solving a sequence of systems of equations that correspond to unconstrained finite time optimal control UFTOC problems Hence high performing second order methods for CFTOC problems rely on efficient numerical algorithms for solving UFTOC problems Developing such algorithms is one of the main focuses in this thesis When the solution to a CFTOC problem is computed using an AS type method the aforementioned system of equations is only changed by a low rank modification between two AS iterations In this thesis it is shown how to exploit these structured modifications while still exploiting structure in the UFTOC problem using the Riccati recursion Furthermore direct non iterative parallel algorithms for computing the search directions in IP SQP and AS methods are proposed in the thesis These algorithms exploit and retain the sparse structure of the UFTOC problem such that no dense system of equations needs to be solved serially as in many other algorithms The proposed algorithms can be applied recursively to obtain logarithmic computational complexity growth in the prediction horizon length For the case with linear MPC problems an alternative approach to solving the CFTOC problem on line is to use multiparametric quadratic programming mp QP where the corresponding CFTOC problem can be solved explicitly off line This is referred to as explicit MPC One of the main limitations with mp QP is the amount of memory that is required to store the parametric solution In this thesis an algorithm for decreasing the required amount of memory is proposed The aim is to make mp QP and explicit MPC more useful in practical applications such as embedded systems with limited memory resources The proposed algorithm exploits the structure from the QP problem in the parametric solution in order to reduce the memory footprint of general mp QP solutions and in particular of explicit MPC solutions The algorithm can be used directly in mp QP solvers or as a post processing step to an existing solution *Numerical Simulation Algorithm of Electromagnetic Field for Grounding Problems in Power System Substation Grounding Grids* Zhong-Xin Li,2025-04-01 This book focuses on numerical methods for grounding problems in substation grounding systems which are rooted in horizontal multilayered earth models The book discusses both theories and engineering applications and provides case studies to verify the accuracy of the methods introduced Up to ten horizontal multilayered soil models were considered This book employs numerical algorithms for Galerkin s method including Galerkin s method of moments Galerkin s boundary element method and hybrid algorithms based on a variety of basis functions that have emerged as a result of simplifying Galerkin s method of moments These numerical methods include both frequency and time domain algorithms that can be used to numerically simulate transient and steady state grounding problems in substation grounding grids The most outstanding feature of this book is the incorporation of the frequency and time domain quasi static complex imaging method QSCIM for point current sources in

layered conducting media and its closed form Green s function as well as analytical algorithms for calculating the spatial two dimensional line integrals of mutual impedances and inductances into numerical algorithmic modeling of electromagnetic fields which greatly improves computational speed and accuracy **Condition** Peter Bürgisser,Felipe Cucker,2013-08-15 This book gathers threads that have evolved across different mathematical disciplines into seamless narrative It deals with condition as a main aspect in the understanding of the performance regarding both stability and complexity of numerical algorithms While the role of condition was shaped in the last half century so far there has not been a monograph treating this subject in a uniform and systematic way The book puts special emphasis on the probabilistic analysis of numerical algorithms via the analysis of the corresponding condition The exposition s level increases along the book starting in the context of linear algebra at an undergraduate level and reaching in its third part the recent developments and partial solutions for Smale s 17th problem which can be explained within a graduate course Its middle part contains a condition based course on linear programming that fills a gap between the current elementary expositions of the subject based on the simplex method and those focusing on convex programming **Numerical Algorithms for Modern Parallel Computer Architectures** Martin Schultz,2012-12-06 Parallel computers have started to completely revolutionize scientific computation Articles in this volume represent applied mathematics computer science and application aspects of parallel scientific computing Major advances are discussed dealing with multiprocessor architectures parallel algorithm development and analysis parallel systems and programming languages The optimization of the application of massively parallel architectures to real world problems will provide the impetus for the development of entirely new approaches to these technical situations *Reliable Implementation of Real Number Algorithms: Theory and Practice* Peter Hertling,Christoph M. Hoffmann,Wolfram Luther,Nathalie Revol,2008-08-28 This book constitutes the revised papers of the International Seminar on Reliable Implementation of Real Number Algorithms held at Dagstuhl Castle Germany in January 2006 The Seminar was inteded to stimulate an exchange of ideas between the different communities that deal with the problem of reliable implementation of real number algorithms Topics included formal proofs software libraries systems and platforms as well as computational geometry and solid modelling **Numerical Algorithms: Origins and Applications** Bruce W. Arden,Kenneth N. Astill,1970 *Practical Numerical Algorithms for Chaotic Systems* Thomas S. Parker,Leon Chua,2012-12-06 One of the basic tenets of science is that deterministic systems are completely predictable given the initial condition and the equations describing a system the behavior of the system can be predicted 1 for all time The discovery of chaotic systems has eliminated this viewpoint Simply put a chaotic system is a deterministic system that exhibits random behavior Though identified as a robust phenomenon only twenty years ago chaos has almost certainly been encountered by scientists and engi neers many times during the last century only to be dismissed as physical noise Chaos is such a wide spread phenomenon that it has now been reported in virtually every scientific discipline astronomy biology biophysics chemistry engineering

geology mathematics medicine meteorology plasmas physics and even the social sci ences It is no coincidence that during the same two decades in which chaos has grown into an independent field of research computers have permeated society It is in fact the wide availability of inex pensive computing power that has spurred much of the research in chaotic dynamics The reason is simple the computer can calculate a solution of a nonlinear system This is no small feat Unlike lin ear systems where closed form solutions can be written in terms of the system s eigenvalues and eigenvectors few nonlinear systems and virtually no chaotic systems possess closed form solutions   Control Perspectives on Numerical Algorithms and Matrix Problems Amit Bhaya,Eugenius Kaszkurewicz,2006-01-01 Control Perspectives on Numerical Algorithms and Matrix Problems organizes the analysis and design of iterative numerical methods from a control perspective The authors discuss a variety of applications including iterative methods for linear and nonlinear systems of equations neural networks for linear and quadratic programming problems support vector machines integration and shooting methods for ordinary differential equations matrix preconditioning matrix stability and polynomial zero finding This book opens up a new field of interdisciplinary research that should lead to insights in the areas of both control and numerical analysis and shows that a wide range of applications can be approached from and benefit from a control perspective   **Accurate Numerical Algorithms** Christian Ullrich,Jürgen Wolff Gudenberg,1989 Mathematics of Computing Numerical Analysis   *Numerical Algorithms for Number Theory: Using Pari/GP* Karim Belabas,Henri Cohen,2021-06-23 This book presents multiprecision algorithms used in number theory and elsewhere such as extrapolation numerical integration numerical summation including multiple zeta values and the Riemann Siegel formula evaluation and speed of convergence of continued fractions Euler products and Euler sums inverse Mellin transforms and complex L L functions For each task many algorithms are presented such as Gaussian and doubly exponential integration Euler MacLaurin Abel Plana Lagrange and Monien summation Each algorithm is given in detail together with a complete implementation in the free Pari GP system These implementations serve both to make even more precise the inner workings of the algorithms and to gently introduce advanced features of the Pari GP language This book will be appreciated by anyone interested in number theory specifically in practical implementations computer experiments and numerical algorithms that can be scaled to produce thousands of digits of accuracy

   Variational Methods: Open Problems, Recent Progress, and Numerical Algorithms John Neuberger,John M. Neuberger,2004 This volume contains the proceedings of the conference on Variational Methods Open Problems Recent Progress and Numerical Algorithms It presents current research in variational methods as applied to nonlinear elliptic PDE although several articles concern nonlinear PDE that are nonvariational and or nonelliptic The book contains both survey and research papers discussing important open questions and offering suggestions on analytical and numerical techniques for solving those open problems It is suitable for graduate students and research mathematicians interested in elliptic partial differential equations

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