

Reliable Numerical Computation

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Reliable Numerical Computation

Bo Einarsson



Reliable Numerical Computation:

Reliable Numerical Computation M. G. Cox, S. J. Hammarling, 1990 Published to honor the late Jim Wilkinson the respected pioneer in numerical analysis this book includes contributions from his colleagues and collaborators leading experts in their own right The breadth of Wilkinson's research is reflected in the topics covered which include linear algebra error analysis and computer arithmetic algorithms and mathematical software An invaluable reference the book is completely up to date with the latest developments on the Lanczos algorithm QR factorizations error propagation models parameter estimation problems sparse systems and shape preserving splines Reflecting the current growth and vitality of this field the volume is an essential reference for all numerical analysts

Reliable Numerical Computation Sven Hammarling, James Hardy Wilkinson, 2023 A collection of research papers based on talks given in honour of Jim Wilkinson a pioneer of numerical analysis These papers provide information on new techniques in numerical analysis written by his colleagues and collaborators

Reliable Engineering Computing , Accuracy and Reliability in Scientific Computing Bo Einarsson, 2005-01-01 Numerical software is used to test scientific theories design airplanes and bridges operate manufacturing lines control power plants and refineries analyze financial derivatives identify genomes and provide the understanding necessary to derive and analyze cancer treatments Because of the high stakes involved it is essential that results computed using software be accurate reliable and robust Unfortunately developing accurate and reliable scientific software is notoriously difficult This book investigates some of the difficulties related to scientific computing and provides insight into how to overcome them and obtain dependable results The tools to assess existing scientific applications are described and a variety of techniques that can improve the accuracy and reliability of newly developed applications is discussed Accuracy and Reliability in Scientific Computing can be considered a handbook for improving the quality of scientific computing It will help computer scientists address the problems that affect software in general as well as the particular challenges of numerical computation approximations occurring at all levels continuous functions replaced by discretized versions infinite processes replaced by finite ones and real numbers replaced by finite precision numbers Divided into three parts it starts by illustrating some of the difficulties in producing robust and reliable scientific software Well known cases of failure are reviewed and the what and why of numerical computations are considered The second section describes diagnostic tools that can be used to assess the accuracy and reliability of existing scientific applications In the last section the authors describe a variety of techniques that can be employed to improve the accuracy and reliability of newly developed scientific applications The authors of the individual chapters are international experts many of them members of the IFIP Working Group on Numerical Software

Reliability in Computing Ramon E. Moore, 2014-05-10 Perspectives in Computing Vol 19 Reliability in Computing The Role of Interval Methods in Scientific Computing presents a survey of the role of interval methods in reliable scientific computing including vector arithmetic language description convergence and

algorithms The selection takes a look at arithmetic for vector processors FORTRAN SC and reliable expression evaluation in PASCAL SC Discussions focus on interval arithmetic optimal scalar product matrix and vector arithmetic transformation of arithmetic expressions development of FORTRAN SC and language description with examples The text then examines floating point standards algorithms for verified inclusions applications of differentiation arithmetic and interval acceleration of convergence The book ponders on solving systems of linear interval equations interval least squares existence of solutions and iterations for nonlinear equations and interval methods for algebraic equations Topics include interval methods for single equations diagnosing collinearity interval linear equations effects of nonlinearity and bounding the solutions The publication is a valuable source of data for computer science experts and researchers interested in the role of interval methods in reliable scientific computing

The Paramount Role of Joints into the Reliable Response of Structures C. C. Baniotopoulos, F. Wald, 2000 A detailed presentation of the major role played by correctly designed and fabricated joints in the safe and reliable response of steel composite and timber structures The typology morphology of connections is discussed for both conventional pinned and rigid joints and semi rigid types All relevant topics are comprehensively surveyed definitions classification and influence of joint behaviour on overall structural response Also presented are the application of the component method the notion of rotational capacity the local ductility of different types of earthquake resistant structural joints as determined in cyclic experiments numerical techniques for the realistic simulation of joint response simple and moment resistant structural connections

Innovative Approaches in Computational Structural Engineering George C. Tsiatas, Vagelis Plevris, 2020-04-22 Nowadays numerical computation has become one of the most vigorous tools for scientists researchers and professional engineers following the enormous progress made during the last decades in computing technology in terms of both computer hardware and software development Although this has led to tremendous achievements in computer based structural engineering the increasing necessity of solving complex problems in engineering requires the development of new ideas and innovative methods for providing accurate numerical solutions in affordable computing times This collection aims at providing a forum for the presentation and discussion of state of the art innovative developments concepts methodologies and approaches in scientific computation applied to structural engineering It involves a wide coverage of timely issues on computational structural engineering with a broad range of both research and advanced practical applications This Research Topic encompasses but is not restricted to the following scientific areas modeling in structural engineering finite element methods boundary element methods static and dynamic analysis of structures structural stability structural mechanics meshless methods smart structures and systems fire engineering blast engineering structural reliability structural health monitoring and control optimization and composite materials with application to engineering structures

Developments in Reliable Computing Tibor Csendes, 2013-04-17 The SCAN conference the International Symposium on Scientific Computing Computer Arithmetic and Validated Numerics takes place biannually under the joint

auspices of GAMM Gesellschaft für Angewandte Mathematik und Mechanik and IMACS International Association for Mathematics and Computers in Simulation SCAN 98 attracted more than 100 participants from 21 countries all over the world During the four days from September 22 to 25 nine highlighted plenary lectures and over 70 contributed talks were given These figures indicate a large participation which was partly caused by the attraction of the organizing country Hungary but also the effective support system have contributed to the success The conference was substantially supported by the Hungarian Research Fund OTKA GAMM the National Technology Development Board OMFB and by the József Attila University Due to this funding it was possible to subsidize the participation of over 20 scientists mainly from Eastern European countries It is important that the possibly first participation of 6 young researchers was made possible due to the obtained support The number of East European participants was relatively high These results are especially valuable since in contrast to the usual 2 years period the present meeting was organized just one year after the last SCAN xx conference

Mathematical and Computational Modeling Roderick Melnik, 2015-05-18 Mathematical and Computational Modeling Illustrates the application of mathematical and computational modeling in a variety of disciplines With an emphasis on the interdisciplinary nature of mathematical and computational modeling Mathematical and Computational Modeling With Applications in the Natural and Social Sciences Engineering and the Arts features chapters written by well known international experts in these fields and presents readers with a host of state of the art achievements in the development of mathematical modeling and computational experiment methodology The book is a valuable guide to the methods ideas and tools of applied and computational mathematics as they apply to other disciplines such as the natural and social sciences engineering and technology The book also features Rigorous mathematical procedures and applications as the driving force behind mathematical innovation and discovery Numerous examples from a wide range of disciplines to emphasize the multidisciplinary application and universality of applied mathematics and mathematical modeling Original results on both fundamental theoretical and applied developments in diverse areas of human knowledge Discussions that promote interdisciplinary interactions between mathematicians scientists and engineers Mathematical and Computational Modeling With Applications in the Natural and Social Sciences Engineering and the Arts is an ideal resource for professionals in various areas of mathematical and statistical sciences modeling and simulation physics computer science engineering biology and chemistry and industrial and computational engineering The book also serves as an excellent textbook for graduate courses in mathematical modeling applied mathematics numerical methods operations research and optimization

Scientific and Technical Aerospace Reports, 1995 **Computational Science and Its Applications - ICCSA 2008**
Osvaldo Gervasi, Beniamino Murgante, Antonio Laganà, Youngsong Mun, David Taniar, 2008-06-24 The two volume set LNCS 5072 and 5073 constitutes the refereed proceedings of the International Conference on Computational Science and Its Applications ICCSA 2008 held in Perugia Italy in June July 2008 The two volumes contain papers presenting a wealth of

original research results in the field of computational science from foundational issues in computer science and mathematics to advanced applications in virtually all sciences making use of computational techniques The topics of the fully refereed papers are structured according to the five major conference themes computational methods algorithms and scientific applications high performance technical computing and networks advanced and emerging applications geometric modelling graphics and visualization as well as information systems and information technologies Moreover submissions from more than 20 workshops and technical sessions in the areas such as embedded systems geographical analysis computational geometry computational geomatics computer graphics virtual reality computer modeling computer algebra mobile communications wireless networks computational forensics data storage information security web learning software engineering computational intelligence digital security biometrics molecular structures material design ubiquitous computing symbolic computations web systems and intelligence and e education contribute to this publication

Lectures on Finite Precision Computations Francoise Chaitin-Chatelin, Val[rie Frayss], 1996-01-01 Finite precision computations are at the heart of the daily activities of many engineers and researchers in all branches of applied mathematics Written in an informal style the book combines techniques from engineering and mathematics to describe the rigorous and novel theory of computability in finite precision In the challenging cases of nonlinear problems theoretical analysis is supplemented by software tools to explore the stability on the computer

Recent Developments in Optimization Theory and Nonlinear Analysis Yair Censor, Simeon Reich, 1997 This volume contains the refereed proceedings of the special session on Optimization and Nonlinear Analysis held at the Joint American Mathematical Society Israel Mathematical Union Meeting which took place at the Hebrew University of Jerusalem in May 1995 Most of the papers in this book originated from the lectures delivered at this special session In addition some participants who didn t present lectures and invited speakers who were unable to attend contributed their work The fields of optimization theory and nonlinear analysis continue to be very active This book presents not only the wide spectrum and diversity of the results but also their manifold connections to other areas such as differential equations functional analysis operator theory calculus of variations numerical analysis and mathematical programming In reading this book one encounters papers that deal for example with convex quasiconvex and generalized convex functions fixed and periodic points fractional linear transformations moduli of convexity monotone operators Morse lemmas Navier Stokes equations nonexpansive maps nonsmooth analysis numerical stability products of projections steepest descent the Leray Schauder degree the turnpike property and variational inequalities

Artificial Neural Nets and Genetic Algorithms Rudolf F. Albrecht, Colin R. Reeves, Nigel C. Steele, 2012-12-06 Artificial neural networks and genetic algorithms both are areas of research which have their origins in mathematical models constructed in order to gain understanding of important natural processes By focussing on the process models rather than the processes themselves significant new computational techniques have evolved which have found application in a large number of diverse fields This

diversity is reflected in the topics which are the subjects of contributions to this volume. There are contributions reporting theoretical developments in the design of neural networks and in the management of their learning. In a number of contributions applications to speech recognition tasks, control of industrial processes as well as to credit scoring and so on are reflected. Regarding genetic algorithms, several methodological papers consider how genetic algorithms can be improved using an experimental approach as well as by hybridizing with other useful techniques such as tabu search. The closely related area of classifier systems also receives a significant amount of coverage aiming at better ways for their implementation. Further, while there are many contributions which explore ways in which genetic algorithms can be applied to real problems, nearly all involve some understanding of the context in order to apply the genetic algorithm paradigm more successfully. That this can indeed be done is evidenced by the range of applications covered in this volume.

Reliable Plan Selection By Intelligent Machines John E. McInroy, Joseph C. Musto, George N. Saridis, 1996-02-29. This book derives techniques which allow reliable plans to be automatically selected by Intelligent Machines. It concentrates on the uncertainty analysis of candidate plans so that a highly reliable candidate may be identified and used. For robotic components such as a particular vision algorithm for pose estimation or a joint controller, methods are explained for directly calculating the reliability. However, these methods become excessively complex when several components are used together to complete a plan. Consequently, entropy minimization techniques are used to estimate which complex tasks will perform reliably. The book first develops tools for directly calculating the reliability of sub systems and methods of using entropy minimization to greatly facilitate the analysis are explained. Since these sub systems are used together to accomplish complex tasks, the book then explains how complex tasks can be efficiently evaluated.

Ab initio Calculation Tutorial Ryo Maezono, 2023-05-16. This textbook covers the framework of first principles analysis applied to materials using density functional theory (DFT). It provides a set of hands-on tutorials using the Quantum ESPRESSO package, an open source software for DFT. The tutorials are well chosen, designed for maximum effectiveness while requiring a minimum of the reader's time, and the book describes how the essential components are combined to create the practical applications based on the idea of modeling practical problems of materials. The book carefully explains how to prepare the platform to run the tutorials assisted by free software. This textbook is useful for students in experimental laboratories, for industrial researchers, and for those not majoring in theoretical studies but learning individually.

Computational Optimal Control Roland Bulirsch, Dieter Kraft, 2012-12-06. Resources should be used sparingly, both from a point of view of economy and ecology. Thus, in controlling industrial, economical, and social processes, optimization is the tool of choice. In this area of applied numerical analysis, the INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL (IFAC) acts as a link between research groups in universities, national research laboratories, and industry. For this purpose, the technical committee Mathematics of Control of IFAC organizes biennial conferences with the objective of bringing together experts to exchange ideas, experiences, and future developments in control applications of

optimization There should be a genuine feedback loop between mathematicians computer scientists engineers and software developers This loop should include the design application and implementation of algorithms The contributions of industrial practitioners are especially important These proceedings contain selected papers from a workshop on CONTROL APPLICATIONS OF OPTIMIZATION which took place at the Fachhochschule Munchen in September 1992 The workshop was the ninth in a series of very successful biennial meetings starting with the Joint Automatic Control Conference in Denver in 1978 and followed by conferences in London Oberpfaffenhofen San Francisco Capri Tbilisi and Paris The workshop was attended by ninety researchers from four continents This volume represents the state of the art in the field with emphasis on progress made since the publication of the proceedings of the Capri meeting edited by G di Pillo under the title Control Applications of Optimization and Nonlinear Programming

Advances in Reliable Numerical Computation M. G. Cox, National Physical Laboratory (Great Britain). Division of Information Technology and Computing, 1987

Solving Fault Diagnosis Problems Andreas Varga, 2017-02-14 This book addresses fault detection and isolation topics from a computational perspective Unlike most existing literature it bridges the gap between the existing well developed theoretical results and the realm of reliable computational synthesis procedures The model based approach to fault detection and diagnosis has been the subject of ongoing research for the past few decades While the theoretical aspects of fault diagnosis on the basis of linear models are well understood most of the computational methods proposed for the synthesis of fault detection and isolation filters are not satisfactory from a numerical standpoint Several features make this book unique in the fault detection literature Solution of standard synthesis problems in the most general setting for both continuous and discrete time systems regardless of whether they are proper or not consequently the proposed synthesis procedures can solve a specific problem whenever a solution exists Emphasis on the best numerical algorithms to solve the synthesis problems for linear systems in generalized state space form also known as descriptor systems Development of general synthesis procedures relying on new computational paradigms such as factorization based design based on filter updating techniques and nullspace based synthesis Availability of a comprehensive set of free accompanying software tools for descriptor systems which allows readers to easily implement all synthesis procedures presented in the book and ensures that all results are reproducible This book is primarily intended for researchers and advanced graduate students in the areas of fault diagnosis and fault tolerant control It will also appeal to mathematicians with an interest in control oriented numerics

Proficient Ada Programming: An In-Depth Guide Adam Jones, 2025-01-03 Proficient Ada Programming An In Depth Guide serves as the essential resource for those eager to gain expertise in the Ada programming language celebrated for its robust typing reliability and suitability for high integrity and real time systems Whether you're a newcomer to programming or an experienced developer looking to enhance your skill set this book offers a comprehensive journey through Ada's foundational syntax and program architecture extending to sophisticated concepts like object oriented programming generics and

concurrency Designed to promote a seamless learning experience Proficient Ada Programming meticulously covers vital topics across key chapters such as the Ada ecosystem data types variables expressions control structures procedures functions package design tasking and synchronization and language interfacing It culminates in an exploration of Ada s advanced functionalities maximizing the potential of attributes pragmas and specialized annexes Emphasizing practical application this guide is rich with examples best practices and in depth explanations that clarify Ada programming and equip you with the knowledge to tackle complex coding challenges confidently Whether your projects involve aerospace defense transportation or you aim to implement robust software engineering principles Proficient Ada Programming is your indispensable resource on the journey to excel in this powerful and reliable language

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