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Numerical Toolbox For Verified Computing I Basic Numerical Problems Theory Algorithms And Pasca ***2023-01-04***

GROSS GRANT

4th International Conference, LSSC 2003, Sozopol, Bulgaria, June 4-8, 2003, Revised Papers

C++ Toolbox for Verified Computing IBasic Numerical Problems Theory, Algorithms, and Programs

An update on the author's previous books, this introduction to interval analysis provides an introduction to INTLAB, a high-quality, comprehensive MATLAB toolbox for interval computations, making this the first interval analysis book that does with INTLAB what general numerical analysis texts do with MATLAB.

Developments in Global Optimization

Springer Nature

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.

Large-Scale Scientific Computing Springer Science & Business Media

The two volume set LNCS 7133 and LNCS 7134 constitutes the thoroughly refereed post-conference proceedings of the 10th International Conference on Applied Parallel and Scientific Computing, PARA 2010, held in Reykjavík, Iceland, in June 2010. These volumes contain three keynote lectures, 29 revised papers and 45 minisymposia presentations arranged on the following topics: cloud computing, HPC algorithms, HPC programming tools, HPC in meteorology, parallel numerical algorithms, parallel computing in physics, scientific computing tools, HPC software engineering, simulations of atomic scale systems, tools and environments for accelerator based computational biomedicine, GPU computing, high performance

computing interval methods, real-time access and processing of large data sets, linear algebra algorithms and software for multicore and hybrid architectures in honor of Fred Gustavson on his 75th birthday, memory and multicore issues in scientific computing - theory and praxis, multicore algorithms and implementations for application problems, fast PDE solvers and a posteriori error estimates, and scalable tools for high performance computing.

International Dagstuhl Seminar, Dagstuhl Castle, Germany, January 6-11, 2008, Revised Papers

Springer Science & Business Media

This book constitutes the thoroughly refereed post-proceedings of the 5th International Conference on Parallel Processing and Applied Mathematics, PPAM 2003, held in Czestochowa, Poland, in September 2003. The 149 papers presented were carefully selected and improved during two rounds of reviewing and revision. The papers are organized in topical sections on parallel and distributed architectures, scheduling and load balancing, performance analysis and prediction, parallel and distributed non-numerical algorithms, parallel and distributed programming, tools and environments, applications, evolutionary computing, soft

computing data and knowledge management, numerical methods and their applications, multi-dimensional systems, grid computing, heterogeneous platforms, high performance numerical computation, large-scale scientific computation, and bioinformatics applications.

Convection-Diffusion and Flow Problems

Springer Science & Business Media

Scan 2000, the GAMM - IMACS International Symposium on Scientific Computing, Computer Arithmetic, and Validated Numerics and Interval 2000, the International Conference on Interval Methods in Science and Engineering were jointly held in Karlsruhe, September 19-22, 2000. The joint conference continued the series of 7 previous Scan-symposia under the joint sponsorship of GAMM and IMACS. These conferences have traditionally covered the numerical and algorithmic aspects of scientific computing, with a strong emphasis on validation and verification of computed results as well as on arithmetic, programming, and algorithmic tools for this purpose. The conference further continued the series of 4 former Interval conferences focusing on interval methods and their application in science and engineering. The objectives are to propagate current applications and

research as well as to promote a greater understanding and increased awareness of the subject matters. The symposium was held in Karlsruhe the European cradle of interval arithmetic and self-validating numerics and attracted 193 researchers from 33 countries. 12 invited and 153 contributed talks were given. But not only the quantity was overwhelming we were deeply impressed by the emerging maturity of our discipline. There were many talks discussing a wide variety of serious applications stretching all parts of mathematical modelling. New efficient, publicly available or even commercial tools were proposed or presented, and also foundations of the theory of intervals and reliable computations were considerably strengthened.

Advanced Numerical Problems Springer Science & Business Media

As suggested by the title of this book Numerical Toolbox for Verified Computing, we present an extensive set of sophisticated tools to solve basic numerical problems with a verification of the results. We use the features of the scientific computer language PASCAL-XSC to offer modules that can be combined by the reader to his/her individual needs. Our overriding concern is reliability - the automatic verification of the result a computer returns for a given problem. All

algorithms we present are influenced by this central concern. We must point out that there is no relationship between our methods of numerical result verification and the methods of program verification to prove the correctness of an imple~entation for a given algorithm. This book is the first to offer a general discussion on • arithmetic and computational reliability, • analytical mathematics and verification techniques, • algorithms, and • (most importantly) actual implementations in the form of working computer routines. Our task has been to find the right balance among these ingredients for each topic. For some topics, we have placed a little more emphasis on the algorithms. For other topics, where the mathematical prerequisites are universally held, we have tended towards more in-depth discussion of the nature of the computational algorithms, or towards practical questions of implementation. For all topics, we present exam ples, exercises, and numerical results demonstrating the application of the routines presented.

International Seminar Dagstuhl Castle, Germany, January 8-13, 2006, Revised Papers

Walter de Gruyter

Reliable computing techniques are essential if the validity of the output of a - merical algorithm is to be guaranteed to be correct. Our society

relies more and more on computer systems. Usually, our systems appear to work successfully, but there are sometimes serious, and often minor, errors. Validated computing is one essential technology to achieve increased software reliability. Formal - gor in the de?nition of data types, the computer arithmetic, in algorithm design, and in program execution allows us to guarantee that the stated problem has (or does not have) a solution in an enclosing interval we compute. If the enclosure is narrow, we are certain that the result can be used. Otherwise, we have a clear warning that the uncertainty of input values might be large and the algorithm and the model have to be improved. The use of interval data types and al- rithms with controlled rounding and result veri?cation capture uncertainty in modeling and problem formulation, in model parameter estimation, in algorithm truncation, in operation round-o?, and in model interpretation. The techniques of validated computing have proven their merits in many scienti?c and engineering applications. They are based on solid and interesting theoretical studies in mathematics and computer science. Contributions from ?elds including real, complex and functional analysis, semigroups, probability, statistics,fuzzyintervalanalysis,fuzzylogic,automaticdi?erentiation,computer hardware,

operating systems, compiler construction, programming languages, object-oriented modeling, parallel processing, and software engineering are all essential.

Applied Parallel Computing Walter de Gruyter GmbH & Co KG

This book constitutes the thoroughly refereed post-proceedings of the 5th International Conference on Large-Scale Scientific Computations, LSSC 2005, held in Sozopol, Bulgaria in June 2005. The 75 revised full papers presented together with five invited papers were carefully reviewed and selected for inclusion in the book. The papers are organized in topical sections.

Introduction to Interval Analysis Springer Science & Business Media

In recent years global optimization has found applications in many interesting areas of science and technology including molecular biology, chemical equilibrium problems, medical imaging and networks. The collection of papers in this book indicates the diverse applicability of global optimization. Furthermore, various algorithmic, theoretical developments and computational studies are presented. Audience: All researchers and students working in mathematical programming.

Beyond Traditional Probabilistic Data Processing Techniques: Interval, Fuzzy etc. Methods and Their

Applications Springer
C++ Toolbox for Verified Computing IBasic Numerical Problems Theory, Algorithms, and ProgramsSpringer Science & Business Media
Basic Numerical Problems SIAM
This book constitutes the refereed proceedings of the 7th International Conference on Applied Parallel Computing, PARA 2004, held in June 2004. The 118 revised full papers presented together with five invited lectures and 15 contributed talks were carefully reviewed and selected for inclusion in the proceedings. The papers are organized in topical sections.
Applied Parallel Computing Springer Science & Business Media
As suggested by the title of this book Numerical Toolbox for Verified Computing, we present an extensive set of sophisticated tools to solve basic numerical problems with a verification of the results. We use the features of the scientific computer language PASCAL-XSC to offer modules that can be combined by the reader to his/her individual needs. Our overriding concern is reliability - the automatic verification of the result a computer returns for a given problem. All algorithms we present are influenced by this central concern. We must point out that there is no relationship between our methods of numerical result verification and the

methods of program verification to prove the correctness of an imple~entation for a given algorithm. This book is the first to offer a general discussion on • arithmetic and computational reliability, • analytical mathematics and verification techniques, • algorithms, and • (most importantly) actual implementations in the form of working computer routines. Our task has been to find the right balance among these ingredients for each topic. For some topics, we have placed a little more emphasis on the algorithms. For other topics, where the mathematical prerequisites are universally held, we have tended towards more in-depth discussion of the nature of the computational algorithms, or towards practical questions of implementation. For all topics, we present exam ples, exercises, and numerical results demonstrating the application of the routines presented.

Theory, Algorithms, and Programs. Basic numerical problems. 1

Springer Science & Business Media

The number one requirement for computer arithmetic has always been speed. It is the main force that drives the technology. With increased speed larger problems can be attempted. To gain speed, advanced processors and pro gramming languages offer, for instance, compound arithmetic operations like matmul

and dotproduct. But there is another side to the computational coin - the accuracy and reliability of the computed result. Progress on this side is very important, if not essential. Compound arithmetic operations, for instance, should always deliver a correct result. The user should not be obliged to perform an error analysis every time a compound arithmetic operation, implemented by the hardware manufacturer or in the programming language, is employed. This treatise deals with computer arithmetic in a more general sense than usual. Advanced computer arithmetic extends the accuracy of the elementary floating-point operations, for instance, as defined by the IEEE arithmetic standard, to all operations in the usual product spaces of computation: the complex numbers, the real and complex intervals, and the real and complex vectors and matrices and their interval counterparts. The implementation of advanced computer arithmetic by fast hardware is examined in this book. Arithmetic units for its elementary components are described. It is shown that the requirements for speed and for reliability do not conflict with each other. Advanced computer arithmetic is superior to other arithmetic with respect to accuracy, costs, and speed.

Computer Arithmetic and Validity Springer

Nature
Enclosure methods and their applications have been developed to a high standard during the last decades. These methods guarantee the validity of the computed results. This means they are of the same standard as the rest of mathematics. The book deals with a wide variety of aspects of enclosure methods. All contributions follow the common goal to push the limits of enclosure methods forward. Topics that are treated include basic questions of arithmetic, proving conjectures, bounds for Krylow type linear system solvers, bounds for eigenvalues, the wrapping effect, algorithmic differencing, differential equations, finite element methods, application in robotics, and nonsmooth global optimization.
5th International Conference, PPAM 2003, Czestochowa, Poland, September 7-10, 2003. Revised Papers Springer Verlag
In the last decades, various mathematical problems have been solved by computer-assisted proofs, among them the Kepler conjecture, the existence of chaos, the existence of the Lorenz attractor, the famous four-color problem, and more. In many cases, computer-assisted proofs have the remarkable advantage (compared with a “theoretical” proof) of additionally providing accurate quantitative information. The authors have been working more than a

quarter century to establish methods for the verified computation of solutions for partial differential equations, mainly for nonlinear elliptic problems of the form -Δu=f(x,u,∇u) with Dirichlet boundary conditions. Here, by “verified computation” is meant a computer-assisted numerical approach for proving the existence of a solution in a close and explicit neighborhood of an approximate solution. The quantitative information provided by these techniques is also significant from the viewpoint of a posteriori error estimates for approximate solutions of the concerned partial differential equations in a mathematically rigorous sense. In this monograph, the authors give a detailed description of the verified computations and computer-assisted proofs for partial differential equations that they developed. In Part I, the methods mainly studied by the authors Nakao and Watanabe are presented. These methods are based on a finite dimensional projection and constructive a priori error estimates for finite element approximations of the Poisson equation. In Part II, the computer-assisted approaches via eigenvalue bounds developed by the author Plum are explained in detail. The main task of this method consists of establishing eigenvalue bounds for the

linearization of the corresponding nonlinear problem at the computed approximate solution. Some brief remarks on other approaches are also given in Part III. Each method in Parts I and II is accompanied by appropriate numerical examples that confirm the actual usefulness of the authors' methods. Also in some examples practical computer algorithms are supplied so that readers can easily implement the verification programs by themselves.

Numerical Validation in Current Hardware Architectures BoD – Books on Demand

This book constitutes the thoroughly refereed post-proceedings of the 8th International Workshop on Applied Parallel Computing, PARA 2006. It covers partial differential equations, parallel scientific computing algorithms, linear algebra, simulation environments, algorithms and applications for blue gene/L, scientific computing tools and applications, parallel search algorithms, peer-to-peer computing, mobility and security, algorithms for single-chip multiprocessors.

Festschrift for Klaus Ritter Springer Science & Business Media

This work grew out of several years of research, graduate seminars and talks on the subject. It was motivated by a desire to make the technology accessible to those who most needed it or could

most use it. It is meant to be a self-contained introduction, a reference for the techniques, and a guide to the literature for the underlying theory. It contains pointers to fertile areas for future research. It also serves as introductory documentation for a Fortran 90 software package for nonlinear systems and global optimization. The subject of the monograph is deterministic, automatically verified or r- orous methods. In such methods, directed rounding and computational fix-point theory are combined with exhaustive search (branch and bound) te-niques. Completion of such an algorithm with a list of solutions constitutes a rigorous mathematical proof that all of the solutions within the original search region are within the output list. The monograph is appropriate as an introduction to research and technology in the area, as a desk reference, or as a graduate-level course reference. Kno-edge of calculus, linear algebra, and elementary numerical analysis is assumed.

Numerical Toolbox for Verified Computing Springer Science & Business Media

The authors of this Festschrift prepared these papers to honour and express their friendship to Klaus Ritter on the occasion of his sixtieth birthday. Be cause of Ritter's many friends and his

international reputation among math ematicians, finding contributors was easy. In fact, constraints on the size of the book required us to limit the number of papers. Klaus Ritter has done important work in a variety of areas, especially in var ious applications of linear and nonlinear optimization and also in connection with statistics and parallel computing. For the latter we have to mention Rit ter's development of transputer workstation hardware. The wide scope of his research is reflected by the breadth of the contributions in this Festschrift. After several years of scientific research in the U.S., Klaus Ritter was ap pointed as full professor at the University of Stuttgart. Since then, his name has become inextricably connected with the regularly scheduled conferences on optimization in Oberwolfach. In 1981 he became full professor of Applied Mathematics and Mathematical Statistics at the Technical University of Mu nich. In addition to his university teaching duties, he has made the activity of applying mathematical methods to problems of industry to be centrally important.

Parallel Processing and Applied Mathematics Springer Our aim in writing this book was to provide an extensive set of C++ programs for solving basic numerical problems with

verification of the results. This C++ Toolbox for Verified Computing I is the C++ edition of the Numerical Toolbox for Verified Computing I. The programs of the original edition were written in PASCAL-XSC, a PASCAL eXtension for Scientific Computation. Since we published the first edition we have received many requests from readers and users of our tools for a version in C++. We take the view that C++ is growing in importance in the field of numeri cal computing. C++ includes C, but as a typed language and due to its modern concepts, it is superior to C. To obtain the degree of efficiency that PASCAL-XSC provides, we used the C-XSC library. C-XSC is a C++ class library for eXtended Scientific Computing. C++ and the C-XSC library are an adequate alternative to special XSC-languages such as PASCAL-XSC or ACRITH-XSC. A shareware version of the C-XSC library and the sources of the toolbox programs are freely available via anonymous ftp or can be ordered against reimbursement of expenses. The programs of this book do not require a great deal of insight into the features of C++. Particularly, object oriented programming techniques are not required.

C+[plus]+[plus] Toolbox for Verified Computing Springer

Revised and updated, this second edition of Walter Gautschi's

successful Numerical Analysis explores computational methods for problems arising in the areas of classical analysis, approximation theory, and ordinary differential equations, among others. Topics included in the book are presented with a view toward stressing basic principles and maintaining simplicity and teachability as far as possible, while subjects requiring a higher level of technicality are referenced in detailed bibliographic notes at the end of each chapter. Readers are thus given the guidance and opportunity to pursue advanced modern topics in more depth. Along with updated references, new biographical notes, and enhanced notational clarity, this second edition includes the expansion of an already large collection of exercises and assignments, both the kind that deal with theoretical and practical aspects of the subject and those requiring machine computation and the use of mathematical software. Perhaps most notably, the edition also comes with a complete solutions manual, carefully developed and polished by the author, which will serve as an exceptionally valuable resource for instructors.