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**Symbolic Algebraic Methods
and Verification Methods**

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Symbolic Algebraic Methods And Verification Methods

Günter Mayer



Symbolic Algebraic Methods And Verification Methods:

Symbolic Algebraic Methods and Verification Methods Götz Alefeld, Jiri Rohn, Siegfried M. Rump, Tetsuro Yamamoto, 2001-02-12 The usual implementation of real numbers as floating point numbers on existing computers has the well known disadvantage that most of the real numbers are not exactly representable in floating point Also the four basic arithmetic operations can usually not be performed exactly During the last years research in different areas has been intensified in order to overcome these problems LEDA Library by K Mehlhorn et al Exact arithmetic with real numbers by A Edalat et al Symbolic algebraic methods verification methods The latest development is the combination of symbolic algebraic methods and verification methods to so called hybrid methods This book contains a collection of worked out talks on these subjects given during a Dagstuhl seminar at the Forschungszentrum für Informatik Schlo Dagstuhl Germany presenting the state of the art *Symbolic-algebraic Methods and Verification Methods* Götz Alefeld, Jiri Rohn, Siegfried M. Rump, Tetsuro Yamamoto, 1999 Using Algebraic Geometry David A Cox, John Little, Donal O'Shea, 2005-03-17 The discovery of new algorithms for dealing with polynomial equations and their implementation on fast inexpensive computers has revolutionized algebraic geometry and led to exciting new applications in the field This book details many uses of algebraic geometry and highlights recent applications of Grobner bases and resultants This edition contains two new sections a new chapter updated references and many minor improvements throughout *Numerical Verification Methods and Computer-Assisted Proofs for Partial Differential Equations* Mitsuhiro T. Nakao, Michael Plum, Yoshitaka Watanabe, 2019-11-11 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 $u = f(x, u, u_x)$ 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

Computer Algebra in Scientific Computing François Boulrier, Matthew England, Timur M. Sadykov, Evgenii V. Vorozhtsov, 2020-10-17 This book constitutes the refereed proceedings of the 22nd International Workshop on Computer Algebra in Scientific Computing CASC 2020 held in Linz Austria in September 2020 The conference was held virtually due to the COVID 19 pandemic The 34 full papers presented together with 2 invited talks were carefully reviewed and selected from 41 submissions They deal with cutting edge research in all major disciplines of computer algebra The papers cover topics such as polynomial algebra symbolic and symbolic numerical computation applications of symbolic computation for investigating and solving ordinary differential equations applications of CAS in the investigation and solution of celestial mechanics problems and in mechanics physics and robotics

Advanced Computational Methods for Knowledge Engineering Tien Do, Hoai An Le Thi, Ngoc Thanh Nguyen, 2014-04-11 The proceedings consists of 30 papers which have been selected and invited from the submissions to the 2nd International Conference on Computer Science Applied Mathematics and Applications ICCSAMA 2014 held on 8 9 May 2014 in Budapest Hungary The conference is organized into 7 sessions Advanced Optimization Methods and Their Applications Queueing Models and Performance Evaluation Software Development and Testing Computational Methods for Mobile and Wireless Networks Computational Methods for Knowledge Engineering Logic Based Methods for Decision Making and Data Mining and Nonlinear Systems and Applications respectively All chapters in the book discuss theoretical and practical issues connected with computational methods and optimization methods for knowledge engineering The editors hope that this volume can be useful for graduate and Ph D students and researchers in Computer Science and Applied Mathematics It is the hope of the editors that readers of this volume can find many inspiring ideas and use them to their research Many such challenges are suggested by particular approaches and models presented in individual chapters of this book

Algorithmic Aspects of Analysis, Prediction, and Control in Science and Engineering Jaime Nava, Vladik Kreinovich, 2014-10-18 This book demonstrates how to describe and analyze a system s behavior and extract the desired prediction and control algorithms from this analysis A typical prediction is based on observing similar situations in the past knowing the outcomes of these past situations and expecting that the future outcome of the current situation will be similar to these past observed outcomes In mathematical terms similarity corresponds to symmetry and similarity of outcomes to invariance This book shows how symmetries can be used in all classes of algorithmic problems of sciences and engineering from analysis to prediction to control Applications cover chemistry geosciences intelligent control neural networks quantum physics and thermal physics Specifically it is shown how the approach based on symmetry and similarity can be used in the

analysis of real life systems in the algorithms of prediction and in the algorithms of control *Inclusion Methods for Nonlinear Problems* Jürgen Herzberger, 2012-12-06 This workshop was organized with the support of GAMM the International Association of Applied Mathematics and Mechanics on the occasion of J Herzberger's 60th birthday GAMM is thankful to him for all the time and work he spent in the preparation and holding of the meeting The talks presented during the workshop and the papers published in this volume are part of the field of Verification Numerics The important subject is fostered by GAMM already since a number of years especially also by the GAMM Fachausschuß special interest group Rechnerarithmetik und Wissenschaftliches Rechnen GiHz Alefeld Karlsruhe Dezember 2001 President of GAMM Preface At the end of the year 2000 about 23 scientists from many countries gathered in the beautiful city of Munich on the occasion of the International GAMM Workshop on Inclusion Methods for Nonlinear Problems with Applications in Engineering Economics and Physics from December 15 to 18 The purpose of this meeting was to bring together representatives of research groups from Austria Bulgaria China Croatia Germany Japan Russia Ukraine and Yugoslavia who in a wider sense work in the field of calculating numerical solutions with error bounds Most of those participants have already known each other from earlier occasions or closely cooperated in the past Representatives from three Academies of Sciences were among the speakers of this conference from the Bulgarian Academy the Russian Academy and the Ukrainian Academy of Sciences

Algorithms - ESA 2001 Friedhelm Meyer auf der Heide, 2003-05-15 This book constitutes the refereed proceedings of the 9th Annual European Symposium on Algorithms ESA 2001 held in Aarhus Denmark in August 2001 The 41 revised full papers presented together with three invited contributions were carefully reviewed and selected from 102 submissions The papers are organized in topical sections on caching and prefetching online algorithms data structures optimization and approximation sequences scheduling shortest paths geometry distributed algorithms graph algorithms pricing broadcasting and multicasting graph labeling and graph drawing and graphs *Interval Analysis* Günter Mayer, 2017-04-10 This self contained text is a step by step introduction and a complete overview of interval computation and result verification a subject whose importance has steadily increased over the past many years The author an expert in the field gently presents the theory of interval analysis through many examples and exercises and guides the reader from the basics of the theory to current research topics in the mathematics of computation Contents Preliminaries Real intervals Interval vectors interval matrices Expressions P contraction inflation Linear systems of equations Nonlinear systems of equations Eigenvalue problems Automatic differentiation Complex intervals *Computer Arithmetic and Validity* Ulrich Kulisch, 2013-04-30 This is the revised and extended second edition of the successful basic book on computer arithmetic It is consistent with the newest recent standard developments in the field The book shows how the arithmetic and mathematical capability of the digital computer can be enhanced in a quite natural way The work is motivated by the desire and the need to improve the accuracy of numerical computing and to control the quality of the computed results validity The accuracy requirements for the

elementary floating point operations are extended to the customary product spaces of computations including interval spaces The mathematical properties of these models are extracted into an axiomatic approach which leads to a general theory of computer arithmetic Detailed methods and circuits for the implementation of this advanced computer arithmetic on digital computers are developed in part two of the book Part three then illustrates by a number of sample applications how this extended computer arithmetic can be used to compute highly accurate and mathematically verified results The book can be used as a high level undergraduate textbook but also as reference work for research in computer arithmetic and applied mathematics Mathematical Software - ICMS 2010 Komei Fukuda,Joris van der Hoeven,Michael Joswig,Nobuki

Takayama,2010-09-10 This book constitutes the refereed proceedings of the Third International Congress on Mathematical Software ICMS 2010 held in Kobe Japan in September 2010 The 49 revised full papers presented were carefully reviewed and selected for presentation The papers are organized in topical sections on computational group theory computation of special functions computer algebra and reliable computing computer tools for mathematical editing and scientific visualization exact numeric computation for algebraic and geometric computation formal proof geometry and visualization Groebner bases and applications number theoretical software as well as software for optimization and polyhedral computation **Applied Parallel and Scientific Computing** Kristján Jónasson,2012-02-04 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 Reykjav k 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 **PROCEEDINGS OF THE 22ND CONFERENCE ON FORMAL METHODS IN**

COMPUTER-AIDED DESIGN - FMCAD 2022 Alberto Griggio,Neha Rungta,Georg Weissenbacher,Warren A. Hunt, Jr.,2022-10-12 The Conference on Formal Methods in Computer Aided Design FMCAD is an annual conference on the theory and applications of formal methods in hardware and system in academia and industry for presenting and discussing groundbreaking methods technologies theoretical results and tools for reasoning formally about computing systems FMCAD covers formal aspects of computer aided system testing *Modelling, Computation and Optimization in Information Systems and Management Sciences* Hoai An Le Thi,Tao Pham Dinh,Ngoc Thanh Nguyen,2015-05-04 This proceedings set contains 85

selected full papers presented at the 3rd International Conference on Modelling Computation and Optimization in Information Systems and Management Sciences MCO 2015 held on May 11-13 2015 at Lorraine University France The present part I of the 2 volume set includes articles devoted to Combinatorial optimization and applications DC programming and DCA thirty years of Developments Dynamic Optimization Modelling and Optimization in financial engineering Multiobjective programming Numerical Optimization Spline Approximation and Optimization as well as Variational Principles and Applications **Computer Vision - ECCV 2006** Aleš Leonardis, Aleš Leonardis, Axel Pinz, Horst Bischof, Axel Pinz, 2006

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 intended 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 Validation in Current Hardware Architectures** Annie A.M. Cuyt, Walter Krämer, Wolfram Luther, Peter Markstein, 2009-04-24 The major emphasis of the Dagstuhl Seminar on Numerical Validation in Current Hardware Architectures lay on numerical validation in current hardware architectures and software environments The general idea was to bring together experts who are concerned with computer arithmetic in systems with actual processor architectures and scientists who develop use and need techniques from verified computation in their applications Topics of the seminar therefore included The ongoing revision of the IEEE 754-854 standard for floating point arithmetic Feasible ways to implement multiple precision multiword arithmetic and to compute the actual precision at run time according to the needs of input data The achievement of a similar behavior of fixed point floating point and interval arithmetic across language compliant implementations The design of robust and efficient numerical programs portable from diverse computers to those that adhere to the IEEE standard The development and propagation of validated special purpose software in different application areas Error analysis in several contexts Certification of numerical programs verification and validation assessment Computer arithmetic plays an important role at the hardware and software level when microprocessors embedded systems or grids are designed The reliability of numerical software strongly depends on the compliance with the corresponding floating point norms Standard CISC processors follow the 1985 IEEE norm 754 which is currently under revision but the new highly performing CELL processor is not fully IEEE compliant *Algorithms - ESA 2005* Gerth S.

Brodal, Stefano Leonardi, 2005-09-19 This book constitutes the refereed proceedings of the 13th Annual European Symposium on Algorithms ESA 2005 held in Palma de Mallorca Spain in September 2005 in the context of the combined conference ALGO 2005 The 75 revised full papers presented together with abstracts of 3 invited lectures were carefully reviewed and selected from 244 submissions The papers address all current issues in algorithmics reaching from design and mathematical

issues over real world applications in various fields up to engineering and analysis of algorithms *PROCEEDINGS OF THE 24TH CONFERENCE ON FORMAL METHODS IN COMPUTER-AIDED DESIGN - FMCAD 2024* Nina Narodytska, Philipp Rümmer, 2024-10-01 Die Proceedings zur Konferenz Formal Methods in Computer Aided Design 2024 geben aktuelle Einblicke in ein spannendes Forschungsfeld Zum fünften Mal erscheinen die Beiträge der Konferenzreihe Formal Methods in Computer Aided Design FMCAD als Konferenzband bei TU Wien Academic Press Der aktuelle Band der seit 2006 jährlich veranstalteten Konferenzreihe präsentiert in 35 Beiträgen neueste wissenschaftliche Erkenntnisse aus dem Bereich des computergestützten Entwerfens Die Beiträge behandeln formale Aspekte des computergestützten Systemdesigns einschließlich Verifikation Spezifikation Synthese und Test Die FMCAD Konferenz findet im Oktober 2024 in Prag Tschechische Republik statt Sie gilt als führendes Forum im Bereich des computer aided design und bietet seit ihrer Gründung Forschenden sowohl aus dem akademischen als auch dem industriellen Umfeld die Möglichkeit sich auszutauschen und zu vernetzen

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