

EFFECTIVE POLYNOMIAL COMPUTATION

Richard Zippel

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Effective Polynomial Computation

Franz Winkler



Effective Polynomial Computation:

Effective Polynomial Computation Richard Zippel, 2012-12-06 Effective Polynomial Computation is an introduction to the algorithms of computer algebra. It discusses the basic algorithms for manipulating polynomials including factoring polynomials. These algorithms are discussed from both a theoretical and practical perspective. Those cases where theoretically optimal algorithms are inappropriate are discussed and the practical alternatives are explained. Effective Polynomial Computation provides much of the mathematical motivation of the algorithms discussed to help the reader appreciate the mathematical mechanisms underlying the algorithms and so that the algorithms will not appear to be constructed out of whole cloth. Preparatory to the discussion of algorithms for polynomials, the first third of this book discusses related issues in elementary number theory. These results are either used in later algorithms, e.g., the discussion of lattices and Diophantine approximation, or analogs of the number theoretic algorithms are used for polynomial problems, e.g., Euclidean algorithm and p -adic numbers. Among the unique features of Effective Polynomial Computation is the detailed material on greatest common divisor and factoring algorithms for sparse multivariate polynomials. In addition, both deterministic and probabilistic algorithms for irreducibility testing of polynomials are discussed.

Polynomial and Matrix Computations Dario Bini, Victor Y. Pan, 2012-12-06 Our Subjects and Objectives This book is about algebraic and symbolic computation and numerical computing with matrices and polynomials. It greatly extends the study of these topics presented in the celebrated books of the seventies, AHU and BM; these topics have been underrepresented in CLR, which is a highly successful extension and updating of AHU. Otherwise, compared to AHU and BM, our volume adds extensive material on parallel computations with general matrices and polynomials, on the bit complexity of arithmetic computations including some recent techniques of data compression, and the study of numerical approximation properties of polynomial and matrix algorithms, and on computations with Toeplitz matrices and other dense structured matrices. The latter subject should attract people working in numerous areas of application, in particular coding, signal processing, control, algebraic computing, and partial differential equations. The authors' teaching experience at the Graduate Center of the City University of New York and at the University of Pisa suggests that the book may serve as a text for advanced graduate students in mathematics and computer science who have some knowledge of algorithm design and wish to enter the exciting area of algebraic and numerical computing. The potential readership may also include algorithm and software designers and researchers specializing in the design and analysis of algorithms, computational complexity, algebraic and symbolic computing, and numerical computation.

Polynomial Algorithms in Computer Algebra Franz Winkler, 2012-12-06 For several years now I have been teaching courses in computer algebra at the Universität Linz, the University of Delaware, and the Universidad de Alcalá de Henares. In the summers of 1990 and 1992 I have organized and taught summer schools in computer algebra at the Universität Linz. Gradually, a set of course notes has emerged from these activities. People have asked

me for copies of the course notes and different versions of them have been circulating for a few years Finally I decided that I should really take the time to write the material up in a coherent way and make a book out of it Here now is the result of this work Over the years many students have been helpful in improving the quality of the notes and also several colleagues at Linz and elsewhere have contributed to it I want to thank them all for their effort in particular I want to thank B Buchberger who taught me the theory of Gröbner bases nearly two decades ago B F Caviness and B D Saunders who first stimulated my interest in various problems in computer algebra G E Collins who showed me how to compute in algebraic domains and J R Sendra with whom I started to apply computer algebra methods to problems in algebraic geometry Several colleagues have suggested improvements in earlier versions of this book However I want to make it clear that I am responsible for all remaining mistakes

Parallel Symbolic Computation Pasco '94 - Proceedings Of The First International Symposium Hoon Hong, 1994-09-17 These proceedings are devoted to communicating significant developments in all areas pertinent to Parallel Symbolic Computation The scope includes algorithms languages software systems and application in any area of parallel symbolic computation where parallelism is interpreted broadly to include concurrent distributive cooperative schemes and so forth

Intelligent Computation in Big Data Era Hongzhi Wang, Haoliang Qi, Wanxiang Che, Zhaowen Qiu, Leilei Kong, Zhongyuan Han, Junyu Lin, Zeguang Lu, 2014-12-29 This book constitutes the refereed proceedings of the International Conference of Young Computer Scientists Engineers and Educators ICYCSEE 2015 held in Harbin China in January 2015 The 61 revised full papers presented were carefully reviewed and selected from 200 submissions The papers cover a wide range of topics related to intelligent computation in Big Data era such as artificial intelligence machine learning algorithms natural language processing image processing MapReduce social network

Geospatial Algebraic Computations Joseph Awange, Béla Paláncz, 2016-01-29 Improved geospatial instrumentation and technology such as in laser scanning has now resulted in millions of data being collected e g point clouds It is in realization that such huge amount of data requires efficient and robust mathematical solutions that this third edition of the book extends the second edition by introducing three new chapters Robust parameter estimation Multiobjective optimization and Symbolic regression Furthermore the linear homotopy chapter is expanded to include nonlinear homotopy These disciplines are discussed first in the theoretical part of the book before illustrating their geospatial applications in the applications chapters where numerous numerical examples are presented The renewed electronic supplement contains these new theoretical and practical topics with the corresponding Mathematica statements and functions supporting their computations introduced and applied This third edition is renamed in light of these technological advancements

Algorithms and Theory of Computation Handbook Mikhail J. Atallah, 1998-11-23 *Algorithms and Theory of Computation Handbook* is a comprehensive collection of algorithms and data structures that also covers many theoretical issues It offers a balanced perspective that reflects the needs of practitioners including emphasis on applications within discussions on theoretical issues Chapters include information on

finite precision issues as well as discussion of specific algorithms where algorithmic techniques are of special importance including graph drawing robotics forming a VLSI chip vision and image processing data compression and cryptography The book also presents some advanced topics in combinatorial optimization and parallel distributed computing applications areas where algorithms and data structuring techniques are of special importance graph drawing robot algorithms VLSI layout vision and image processing algorithms scheduling electronic cash data compression dynamic graph algorithms on line algorithms multidimensional data structures cryptography advanced topics in combinatorial optimization and parallel distributed computing

The Nature of Computation Cristopher Moore, Stephan Mertens, 2011-08-11 Computational complexity is one of the most beautiful fields of modern mathematics and it is increasingly relevant to other sciences ranging from physics to biology But this beauty is often buried underneath layers of unnecessary formalism and exciting recent results like interactive proofs phase transitions and quantum computing are usually considered too advanced for the typical student This book bridges these gaps by explaining the deep ideas of theoretical computer science in a clear and enjoyable fashion making them accessible to non computer scientists and to computer scientists who finally want to appreciate their field from a new point of view The authors start with a lucid and playful explanation of the P vs NP problem explaining why it is so fundamental and so hard to resolve They then lead the reader through the complexity of mazes and games optimization in theory and practice randomized algorithms interactive proofs and pseudorandomness Markov chains and phase transitions and the outer reaches of quantum computing At every turn they use a minimum of formalism providing explanations that are both deep and accessible The book is intended for graduate and undergraduate students scientists from other areas who have long wanted to understand this subject and experts who want to fall in love with this field all over again

Logic and Computation Wilfried Sieg, 1990 This volume contains the proceedings of the Workshop on Logic and Computation held in July 1987 at Carnegie Mellon University The focus of the workshop was the refined interaction between mathematics and computation theory one of the most fascinating and potentially fruitful developments in logic The importance of this interaction lies not only in the emergence of the computer as a powerful tool in mathematics research but also in the various attempts to carry out significant parts of mathematics in computationally informative ways The proceedings pursue three complementary aims to develop parts of mathematics under minimal set theoretic assumptions to provide formal frameworks suitable for computer implementation and to extract from formal proofs mathematical and computational information Aimed at logicians mathematicians and computer scientists this volume is rich in results and replete with mathematical logical and computational problems

Solving Polynomial Equations Alicia Dickenstein, 2005-04-27 This book provides a general introduction to modern mathematical aspects in computing with multivariate polynomials and in solving algebraic systems It presents the state of the art in several symbolic numeric and symbolic numeric techniques including effective and algorithmic methods in algebraic geometry and computational algebra complexity issues and applications ranging from

statistics and geometric modelling to robotics and vision Graduate students as well as researchers in related areas will find an excellent introduction to currently interesting topics These cover Groebner and border bases multivariate resultants residues primary decomposition multivariate polynomial factorization homotopy continuation complexity issues and their applications

Art of Computer Programming, Volume 2 Donald E. Knuth, 2014-05-06 The bible of all fundamental algorithms and the work that taught many of today's software developers most of what they know about computer programming Byte September 1995 I can't begin to tell you how many pleasurable hours of study and recreation they have afforded me I have pored over them in cars restaurants at work at home and even at a Little League game when my son wasn't in the line up Charles Long If you think you're a really good programmer read Knuth's Art of Computer Programming You should definitely send me a resume if you can read the whole thing Bill Gates It's always a pleasure when a problem is hard enough that you have to get the Knuths off the shelf I find that merely opening one has a very useful terrorizing effect on computers Jonathan Laventhol The second volume offers a complete introduction to the field of seminumerical algorithms with separate chapters on random numbers and arithmetic The book summarizes the major paradigms and basic theory of such algorithms thereby providing a comprehensive interface between computer programming and numerical analysis Particularly noteworthy in this third edition is Knuth's new treatment of random number generators and his discussion of calculations with formal power series Ebook PDF version produced by Mathematical Sciences Publishers MSP <http://msp.org>

Computer Algebra in Scientific Computing François Boulrier, Matthew England, Ilias Kotsireas, Timur M. Sadykov, Evgenii V. Vorozhtsov, 2023-08-23 This book constitutes the refereed proceedings of the 25th International Workshop on Computer Algebra in Scientific Computing CASC 2023 which took place in Havana Cuba during August 28 September 1 2023 The 22 full papers included in this book were carefully reviewed and selected from 29 submissions They focus on the theory of symbolic computation and its implementation in computer algebra systems as well as all other areas of scientific computing with regard to their benefit from or use of computer algebra methods and software

Public-Key Cryptography Daniel Lieman, 2005 This collection of articles grew out of an expository and tutorial conference on public key cryptography held at the Joint Mathematics Meetings Baltimore The book provides an introduction and survey on public key cryptography for those with considerable mathematical maturity and general mathematical knowledge Its goal is to bring visibility to the cryptographic issues that fall outside the scope of standard mathematics These mathematical expositions are intended for experienced mathematicians who are not well acquainted with the subject The book is suitable for graduate students researchers and engineers interested in mathematical aspects and applications of public key cryptography

Modern Computer Algebra Joachim von zur Gathen, Jürgen Gerhard, 2003-07-03 Computer algebra systems are gaining importance in all areas of science and engineering This textbook gives a thorough introduction to the algorithmic basis of the mathematical engine in computer algebra systems It is designed to accompany one or two semester courses for advanced

undergraduate or graduate students in computer science or mathematics Its comprehensiveness and authority also make it an essential reference for professionals in the area Special features include detailed study of algorithms including time analysis implementation reports on several topics complete proofs of the mathematical underpinnings a wide variety of applications among others in chemistry coding theory cryptography computational logic and the design of calendars and musical scales Some of this material has never appeared before in book form For the new edition errors have been corrected the text has been smoothed and updated and new sections on greatest common divisors and symbolic integration have been added

Symbolic-Numeric Computation Dongming Wang,Li-Hong Zhi,2007-06-25 The growing demand of speed accuracy and reliability in scientific and engineering computing has been accelerating the merging of symbolic and numeric computations These two types of computation coexist in mathematics yet are separated in traditional research of mathematical computation This book presents 27 research articles on the integration and interaction of symbolic and numeric computation

Automata, Languages and Programming Pierpaolo Degano,1997-06-18 This book constitutes the refereed proceedings of the 24th International Colloquium on Automata Languages and Programming ICALP 97 held in Bologna Italy in July 1997 ICALP 97 celebrated the 25th anniversary of the European Association for Theoretical Computer Science EATCS which has sponsored the ICALP meetings since 1972 The volume presents 73 revised full papers selected from a total of 197 submissions Also included are six invited contributions ICALP is one of the few flagship conferences in the area The book addresses all current topics in theoretical computer science

Algorithmic Number Theory Wieb Bosma,2006-12-30 This book constitutes the refereed proceedings of the 4th International Algorithmic Number Theory Symposium ANTS IV held in Leiden The Netherlands in July 2000 The book presents 36 contributed papers which have gone through a thorough round of reviewing selection and revision Also included are 4 invited survey papers Among the topics addressed are gcd algorithms primality factoring sieve methods cryptography linear algebra lattices algebraic number fields class groups and fields elliptic curves polynomials function fields and power sums

Computer Algebra Methods for Equivariant Dynamical Systems Karin Gatermann,2007-05-06 This book starts with an overview of the research of Gr bner bases which have many applications in various areas of mathematics since they are a general tool for the investigation of polynomial systems The next chapter describes algorithms in invariant theory including many examples and time tables These techniques are applied in the chapters on symmetric bifurcation theory and equivariant dynamics This combination of different areas of mathematics will be interesting to researchers in computational algebra and or dynamics

Algorithms and Theory of Computation Handbook, Volume 1 Mikhail J. Atallah,Marina Blanton,2009-11-20 Algorithms and Theory of Computation Handbook Second Edition General Concepts and Techniques provides an up to date compendium of fundamental computer science topics and techniques It also illustrates how the topics and techniques come together to deliver efficient solutions to important practical problems Along with updating and revising many

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of Computation Handbook - 2 Volume Set Mikhail J. Atallah, Marina Blanton, 2022-05-29 Algorithms and Theory of Computation Handbook Second Edition in a two volume set provides an up to date compendium of fundamental computer science topics and techniques It also illustrates how the topics and techniques come together to deliver efficient solutions to important practical problems New to the Second Edition Along with updating and revising many of the existing chapters this second edition contains more than 20 new chapters This edition now covers external memory parameterized self stabilizing and pricing algorithms as well as the theories of algorithmic coding privacy and anonymity databases computational games and communication networks It also discusses computational topology computational number theory natural language processing and grid computing and explores applications in intensity modulated radiation therapy voting DNA research systems biology and financial derivatives This best selling handbook continues to help computer professionals and engineers find significant information on various algorithmic topics The expert contributors clearly define the terminology present basic results and techniques and offer a number of current references to the in depth literature They also provide a glimpse of the major research issues concerning the relevant topics

Unveiling the Magic of Words: A Report on "**Effective Polynomial Computation**"

In a global defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their ability to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Effective Polynomial Computation**," a mesmerizing literary masterpiece penned by a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve in to the book is central themes, examine its distinctive writing style, and assess its profound affect the souls of its readers.

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