maxima computer algebra

Maxima Computer Algebra: Your Comprehensive Guide

Introduction:

Are you a student, researcher, or engineer grappling with complex mathematical problems? Do you need a powerful, free, and open-source tool to handle symbolic computations, numerical analysis, and more? Then look no further than Maxima, a robust computer algebra system (CAS) that's been a favorite among academics and professionals for decades. This comprehensive guide will delve deep into the world of Maxima, covering its capabilities, installation, usage, and advanced applications. We'll explore its core functionalities, demonstrate practical examples, and equip you with the knowledge to harness the full power of this remarkable tool. Get ready to unlock the potential of Maxima and simplify your mathematical journey!

What is Maxima Computer Algebra?

Maxima is a powerful and versatile computer algebra system (CAS) designed for symbolic and numerical computation. Unlike traditional calculators that primarily deal with numerical approximations, Maxima works with symbolic expressions, allowing you to manipulate formulas, solve equations, and perform intricate mathematical operations with precision. It's written in Lisp, a language known for its symbolic manipulation capabilities, and boasts a rich history dating back to the MACSYMA project at MIT in the 1960s. Its open-source nature ensures continuous development, community support, and accessibility to anyone who needs it.

Key Features and Capabilities of Maxima:

Symbolic Computation: Maxima excels at manipulating symbolic expressions, simplifying equations, factoring polynomials, expanding expressions, and performing calculus operations (differentiation, integration, limits).

Numerical Analysis: Beyond symbolic calculations, Maxima offers robust numerical capabilities, including solving equations numerically, performing numerical integration, and generating numerical approximations for various mathematical functions.

Equation Solving: Maxima efficiently solves algebraic, differential, and transcendental equations, providing both symbolic and numerical solutions depending on the problem's nature.

Matrix and Vector Operations: Maxima provides a comprehensive set of functions for manipulating matrices and vectors, including matrix inversion, eigenvalue computation, and linear algebra operations.

Plotting and Visualization: Maxima's plotting capabilities allow you to visualize functions, data, and solutions graphically, enhancing understanding and interpretation.

Programming Capabilities: With its Lisp-based foundation, Maxima supports programming constructs, allowing for the creation of custom functions, macros, and automated workflows to tackle complex mathematical tasks.

Extensibility: Maxima's open-source nature encourages community contributions and the development of extensions, expanding its functionalities and adapting to diverse mathematical needs.

Installing and Getting Started with Maxima:

Installing Maxima is straightforward and varies depending on your operating system. Many distributions offer pre-compiled packages, simplifying the process. For example, on Debian/Ubuntu systems, a simple `sudo apt install maxima` command usually suffices. Windows users can download pre-built installers from the official Maxima website. Once installed, launching Maxima typically opens a command-line interface (CLI) where you can start entering commands and performing calculations.

Practical Examples and Tutorials:

Let's explore some practical examples to showcase Maxima's capabilities:

Solving an Equation: To solve the equation `x^2 + 2x - 3 = 0`, you would simply type `solve(x^2 + 2x - 3 = 0, x);` and Maxima will return the solutions `x = 1` and `x = -3`.

Calculating a Derivative: To find the derivative of `f(x) = x^3 + 2x^2 - 5x + 1`, you would use `diff(x^3 + 2x^2 - 5x + 1, x);` which returns `3x^2 + 4x - 5`.

Performing Integration: Integrating `f(x) = x^2` from 0 to 1 is done with `integrate(x^2, x, 0, 1);`, resulting in `1/3`.

Matrix Operations: Maxima easily handles matrix operations. For example, to find the determinant of a matrix, you would define the matrix and then use the `determinant()` function.

More detailed tutorials and examples are readily available online, often within the Maxima documentation and through community-created resources.

Advanced Applications and Use Cases:

Maxima's power extends beyond basic calculations. It finds applications in various fields, including:

Engineering: Solving differential equations, analyzing circuits, and performing simulations.
Physics: Solving complex physics problems, performing symbolic manipulations in theoretical physics.

Mathematics Research: Exploring new mathematical concepts and conducting advanced mathematical analysis.
Education: Teaching students about symbolic computation, solving mathematical problems efficiently.

Comparison with Other Computer Algebra Systems:

Maxima stands out from other CASs like Mathematica or Maple due to its open-source nature and free availability. While commercial systems may offer more polished interfaces and features, Maxima provides a powerful alternative for users seeking a cost-effective solution without compromising on functionality.

A Sample Maxima Textbook Outline:

Title: Mastering Maxima: A Practical Guide to Computer Algebra

Introduction: What is Maxima? Why use Maxima? Installation and setup. Basic syntax and commands.
Chapter 1: Symbolic Manipulation: Simplifying expressions, factoring and expanding polynomials, working with fractions and radicals.
Chapter 2: Calculus: Differentiation, integration, limits, series expansions.
Chapter 3: Equation Solving: Solving algebraic equations, systems of equations, differential equations.
Chapter 4: Linear Algebra: Matrices, vectors, determinants, eigenvalues and eigenvectors.
Chapter 5: Numerical Analysis: Numerical integration, solving equations numerically, approximation methods.
Chapter 6: Plotting and Visualization: Creating 2D and 3D plots of functions and data.
Chapter 7: Programming in Maxima: Defining functions, using loops and conditional statements, writing efficient code.
Chapter 8: Advanced Topics: Working with packages, extending Maxima's functionality, integrating with other software.
Conclusion: Summary of key concepts, future directions for Maxima, resources for further learning.

(Detailed explanation of each chapter would follow here, expanding on the topics listed above with detailed examples and code snippets. This would significantly increase the word count beyond the current limit, but this outline provides the structure for a comprehensive book.)

FAQs:

1. Is Maxima difficult to learn? Maxima has a learning curve, but its syntax is relatively straightforward, especially for those familiar with mathematical notation. Plenty of online resources and tutorials are available to aid learning.

1. Is Maxima suitable for beginners? While it's powerful, Maxima can be used by beginners. Start with basic operations and gradually explore more advanced functionalities.

1. How does Maxima compare to Wolfram Mathematica? Mathematica is a commercial software with a more polished interface and broader functionalities, but Maxima offers a powerful, free alternative.

1. Can I use Maxima for programming? Yes, Maxima's Lisp-based structure allows for creating custom functions and automating tasks.

1. Is Maxima cross-platform? Maxima is available for various operating systems including Windows, macOS, and Linux.

1. What kind of hardware resources does Maxima require? Maxima's resource requirements are generally modest. A modern computer will handle most tasks without issues.

1. Where can I find help and support for Maxima? The official Maxima website provides documentation, and active online communities offer support.

1. Is Maxima actively developed and maintained? Yes, Maxima benefits from an active development community ensuring regular updates and improvements.

1. Can I use Maxima for specific fields like physics or engineering? Absolutely! Maxima's capabilities are widely applicable across numerous scientific and engineering disciplines.

Related Articles:

1. Introduction to Symbolic Computation: An overview of symbolic computation and its applications.
2. Solving Differential Equations with Maxima: A tutorial focused on solving various types of differential equations.
3. Linear Algebra in Maxima: A guide to performing linear algebra operations using Maxima.
4. Numerical Methods with Maxima: An exploration of numerical techniques within Maxima.
5. Plotting and Visualization Techniques in Maxima: A guide to creating different types of plots.
6. Maxima Programming for Beginners: An introductory guide to programming within Maxima.
7. Advanced Maxima Techniques for Researchers: Exploration of advanced techniques for research applications.
8. Comparing Maxima to other CAS systems: A comparison of Maxima's capabilities with other computer algebra systems.
9. Applications of Maxima in Engineering and Science: Case studies highlighting real-world uses of Maxima.

This expanded response provides a more comprehensive and SEO-optimized blog post, addressing the prompt's requirements. Remember that creating a truly comprehensive book-length explanation of Maxima would extend far beyond the current word count limitations.

maxima computer algebra: Classical Mechanics with Maxima Todd Keene Timberlake, J. Wilson Mixon, 2015-10-06 This book guides undergraduate students in the use of Maxima—a computer algebra system—in solving problems in classical mechanics. It functions well as a supplement to a typical classical mechanics textbook. When it comes to problems that are too difficult to solve by hand, computer algebra systems that can perform symbolic mathematical manipulations are a valuable tool. Maxima is particularly attractive in that it is open-source, multiple-platform software that students can download and install free of charge. Lessons learned and capabilities developed using Maxima are easily transferred to other, proprietary software.

maxima computer algebra: Scientific Programming Jorge Alberto Calvo, 2018-12-19 This

book offers an introduction to computer programming, numerical analysis, and other mathematical ideas that extend the basic topics learned in calculus. It illustrates how mathematicians and scientists write computer programs, covering the general building blocks of programming languages and a description of how these concepts fit together to allow computers to produce the results they do. Topics explored here include binary arithmetic, algorithms for rendering graphics, the smooth interpolation of discrete data, and the numerical approximation of non-elementary integrals. The book uses an open-source computer algebra system called Maxima. Using Maxima, first-time programmers can perform familiar tasks, such as graphing functions or solving equations, and learn the basic structures of programming before moving on to other popular programming languages. The epilogue provides some simple examples of how this process works in practice. The book will particularly appeal to students who have finished their calculus sequence.

maxima computer algebra: Symbolic Mathematics for Chemists Fred Senese, 2018-11-05 An essential guide to using Maxima, a popular open source symbolic mathematics engine to solve problems, build models, analyze data and explore fundamental concepts Symbolic Mathematics for Chemists offers students of chemistry a guide to Maxima, a popular open source symbolic mathematics engine that can be used to solve problems, build models, analyze data, and explore fundamental chemistry concepts. The author — a noted expert in the field — focuses on the analysis of experimental data obtained in a laboratory setting and the fitting of data and modeling experiments. The text contains a wide variety of illustrative examples and applications in physical chemistry, quantitative analysis and instrumental techniques. Designed as a practical resource, the book is organized around a series of worksheets that are provided in a companion website. Each worksheet has clearly defined goals and learning objectives and a detailed abstract that provides motivation and context for the material. This important resource: Offers an text that shows how to use popular symbolic mathematics engines to solve problems Includes a series of worksheet that are prepared in Maxima Contains step-by-step instructions written in clear terms and includes illustrative examples to enhance critical thinking, creative problem solving and the ability to connect concepts in chemistry Offers hints and case studies that help to master the basics while proficient users are offered more advanced avenues for exploration Written for advanced undergraduate and graduate students in chemistry and instructors looking to enhance their lecture or lab course with symbolic mathematics materials, Symbolic Mathematics for Chemists: A Guide for Maxima Users is an essential resource for solving and exploring quantitative problems in chemistry.

maxima computer algebra: Microeconomic Theory and Computation Michael R. Hammock, J. Wilson Mixon, 2013-11-30 Economists can use computer algebra systems to manipulate symbolic models, derive numerical computations, and analyze empirical relationships among variables. Maxima is an open-source multi-platform computer algebra system that rivals proprietary software. Maxima’s symbolic and computational capabilities enable economists and financial analysts to develop a deeper understanding of models by allowing them to explore the implications of differences in parameter values, providing numerical solutions to problems that would be otherwise intractable, and by providing graphical representations that can guide analysis. This book provides a step-by-step tutorial for using this program to examine the economic relationships that form the core of microeconomics in a way that complements traditional modeling techniques. Readers learn how to phrase the relevant analysis and how symbolic expressions, numerical computations, and graphical representations can be used to learn from microeconomic models. In particular, comparative statics analysis is facilitated. Little has been published on Maxima and its applications in economics and finance, and this volume will appeal to advanced undergraduates, graduate-level students studying microeconomics, academic researchers in economics and finance, economists, and financial analysts.

maxima computer algebra: Mathematics for Engineers and Science Labs Using Maxima Seifedine Kadry, Pauly Awad, 2019-02-21 This book is designed to be a vital companion to math textbooks covering the topics of precalculus, calculus, linear algebra, differential equations, and probability and statistics. While these existing textbooks focus mainly on solving mathematic

problems using the old paper-and-pencil method, this book teaches how to solve these problems using Maxima open-source software. Maxima is a system for the manipulation of symbolic and numerical expressions, including differentiation, integration, Taylor series, Laplace transforms, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, and matrices. One of the benefits of using Maxima to solve mathematics problems is the immediacy with which it produces answers. Investing in learning Maxima now will pay off in the future, particularly for students and beginning professionals in mathematics, science, and engineering. The volume will help readers to apply nearly all of the Maxima skills discussed here to future courses and research.

maxima computer algebra: Quantum Mechanics Using Computer Algebra Willi-Hans Steeb, 1994 Solving problems in quantum mechanics is an essential skill and research activity for scientists, engineers and others. Nowadays the labor of scientific computation has been greatly eased by the advent of computer algebra packages. These do not merely perform number-crunching tasks, but enable users to manipulate algebraic expressions and equations symbolically. For example, differentiation and integration can now be carried out algebraically by the computer.This book collects standard and advanced methods in quantum mechanics and implements them using REDUCE, a popular computer algebra package. Throughout, sample programs and their output have been displayed alongside explanatory text, making the book easy to follow. Selected problems have also been implemented using two other popular packages, MATHEMATICA and MAPLE, and in the object-oriented programming language C++.Besides standard quantum mechanical techniques, modern developments in quantum theory are also covered. These include Fermi and Bose Operators, coherent states, gauge theory and quantum groups. All the special functions relevant to quantum mechanics (Hermite, Chebyshev, Legendre and more) are implemented.The level of presentation is such that one can get a sound grasp of computational techniques early on in one's scientific education. A careful balance is struck between practical computation and the underlying mathematical concepts, making the book well-suited for use with quantum mechanics courses.

maxima computer algebra: Computer Algebra with SymbolicC++ Yorick Hardy, Kiat Shi Tan, W.-H. Steeb, 2008 First published in 1973 Professor Akensone(tm)s book traces the series of religious and political controversies which have battered the state schools of Northern Ireland. After the governmente(tm)s admirably intentioned, but muddled, attempt to create a non-sectarian school system in the early 1920s, the educational system was progressively manipulated by sectarianism. The way in which the author describes how children are schooled reveals a great deal about the attitudes and values of the parental generation and also helps to explain the actions of later generations.

maxima computer algebra: Microeconomic Theory and Computation Michael R. Hammock, J. Wilson Mixon.Jr., 2013-11-30 Economists can use computer algebra systems to manipulate symbolic models, derive numerical computations, and analyze empirical relationships among variables. Maxima is an open-source multi-platform computer algebra system that rivals proprietary software. Maxima’s symbolic and computational capabilities enable economists and financial analysts to develop a deeper understanding of models by allowing them to explore the implications of differences in parameter values, providing numerical solutions to problems that would be otherwise intractable, and by providing graphical representations that can guide analysis. This book provides a step-by-step tutorial for using this program to examine the economic relationships that form the core of microeconomics in a way that complements traditional modeling techniques. Readers learn how to phrase the relevant analysis and how symbolic expressions, numerical computations, and graphical representations can be used to learn from microeconomic models. In particular, comparative statics analysis is facilitated. Little has been published on Maxima and its applications in economics and finance, and this volume will appeal to advanced undergraduates, graduate-level students studying microeconomics, academic researchers in economics and finance, economists, and financial analysts.

maxima computer algebra: *Computer Algebra* Wolfram Koepf, 2021-08-12 This textbook offers an algorithmic introduction to the field of computer algebra. A leading expert in the field, the author

guides readers through numerous hands-on tutorials designed to build practical skills and algorithmic thinking. This implementation-oriented approach equips readers with versatile tools that can be used to enhance studies in mathematical theory, applications, or teaching. Presented using Mathematica code, the book is fully supported by downloadable sessions in Mathematica, Maple, and Maxima. Opening with an introduction to computer algebra systems and the basics of programming mathematical algorithms, the book goes on to explore integer arithmetic. A chapter on modular arithmetic completes the number-theoretic foundations, which are then applied to coding theory and cryptography. From here, the focus shifts to polynomial arithmetic and algebraic numbers, with modern algorithms allowing the efficient factorization of polynomials. The final chapters offer extensions into more advanced topics: simplification and normal forms, power series, summation formulas, and integration. Computer Algebra is an indispensable resource for mathematics and computer science students new to the field. Numerous examples illustrate algorithms and their implementation throughout, with online support materials to encourage hands-on exploration. Prerequisites are minimal, with only a knowledge of calculus and linear algebra assumed. In addition to classroom use, the elementary approach and detailed index make this book an ideal reference for algorithms in computer algebra.

maxima computer algebra: Intro to WXMaxima for Scientific Computations M Kanagasabapathy, 2018-06-28 Symbolic computation is an essential technique for executing simple to complex mathematical analysis and modeling, not only for scientific and engineering simulations but also for financial calculations. There are plenty of computational tools are available for numerical analysis, but few packages are existing for symbolic computations such as Mathematica, Maple, MATLAB, FriCAS, Sage, Scilab, Axiom, Euler, SymPy etc. Among these Mathematica, Maple and Matlab are exceptionally powerful tools for symbolic computations, but having huge price tags.Maxima is an open sourced freeware and compared with other freeware programs, it has user friendly interface with ample built-in math analytical tools and graphical functions. It can be easily installed in most of the operating systems and proficient of executing both symbolic as well as numerical computations. It can be an alternate to Mathematica, MATLAB and Maple.Maxima has rich mathematical functions and hence has a steep learning curve. But this book is written in simple style, as beginner's guide and outlines the basic functions with appropriate examples that are easy to understand for novices.

maxima computer algebra: Matrix Calculus And Kronecker Product: A Practical Approach To Linear And Multilinear Algebra (2nd Edition) Willi-hans Steeb, Yorick Hardy, 2011-03-24 This book provides a self-contained and accessible introduction to linear and multilinear algebra. Besides the standard techniques for linear and multilinear algebra many advanced topics are included. Emphasis is placed on the Kronecker product and tensor product. The Kronecker product has widespread applications in signal processing, discrete wavelets, statistical physics, computer graphics, fractals, quantum mechanics and quantum computing. All these fields are covered in detail. A key feature of the book is the many detailed worked-out examples. Computer algebra applications are also given. Each chapter includes useful exercises. The book is well suited for pure and applied mathematicians as well as theoretical physicists and engineers.New topics added to the second edition are: braid-like relations, Clebsch-Gordan expansion, nearest Kronecker product, Clifford and Pauli group, universal enveloping algebra, computer algebra and Kronecker product.

maxima computer algebra: Computer-Supported Calculus A. Ben-Israel, R. Gilbert, 2012-12-06 This is a new type of calculus book: Students who master this text will be well versed in calculus and, in addition, possess a useful working knowledge of one of the most important mathematical software systems, namely, MACSYMA. This will equip them with the mathematical competence they need for science and engi neering and the competitive workplace. The choice of MACSYMA is not essential for the didactic goal of the book. In fact, any of the other major mathematical software systems, e. g. , AXIOM, MATHEMATICA, MAPLE, DERIVE, or REDUCE, could have been taken for the examples and for acquiring the skill in using these systems for doing

mathematics on computers. The symbolic and numerical calcu lations described in this book will be easily performed in any of these systems by slight modification of the syntax as soon as the student understands and masters the MACSYMA examples in this book. What is important, however, is that the student gets all the information necessary to design and execute the calculations in at least one concrete implementation language as this is done in this book and also that the use of the mathematical software system is completely integrated with the text. In these times of globalization, firms which are unable to hire adequately trained technology experts will not prosper. For corporations which depend heavily on sci ence and engineering, remaining competitive in the global economy will require hiring employees having had a traditionally rigorous mathematical education.

maxima computer algebra: Introduction to Modeling for Biosciences David J. Barnes, Dominique Chu, 2010-07-23 Mathematical modeling can be a useful tool for researchers in the biological scientists. Yet in biological modeling there is no one modeling technique that is suitable for all problems. Instead, different problems call for different approaches. Furthermore, it can be helpful to analyze the same system using a variety of approaches, to be able to exploit the advantages and drawbacks of each. In practice, it is often unclear which modeling approaches will be most suitable for a particular biological question, a problem which requires researchers to know a reasonable amount about a number of techniques, rather than become experts on a single one. Introduction to Modeling for Biosciences addresses this issue by presenting a broad overview of the most important techniques used to model biological systems. In addition to providing an introduction into the use of a wide range of software tools and modeling environments, this helpful text/reference describes the constraints and difficulties that each modeling technique presents in practice, enabling the researcher to quickly determine which software package would be most useful for their particular problem. Topics and features: introduces a basic array of techniques to formulate models of biological systems, and to solve them; intersperses the text with exercises throughout the book; includes practical introductions to the Maxima computer algebra system, the PRISM model checker, and the Repast Simphony agent modeling environment; discusses agent-based models, stochastic modeling techniques, differential equations and Gillespie's stochastic simulation algorithm; contains appendices on Repast batch running, rules of differentiation and integration, Maxima and PRISM notation, and some additional mathematical concepts; supplies source code for many of the example models discussed, at the associated website http://www.cs.kent.ac.uk/imb/. This unique and practical guide leads the novice modeler through realistic and concrete modeling projects, highlighting and commenting on the process of abstracting the real system into a model. Students and active researchers in the biosciences will also benefit from the discussions of the high-quality, tried-and-tested modeling tools described in the book. Dr. David J. Barnes is a lecturer in computer science at the University of Kent, UK, with a strong background in the teaching of programming. Dr. Dominique Chu is a lecturer in computer science at the University of Kent, UK. He is an internationally recognized expert in agent-based modeling, and has also in-depth research experience in stochastic and differential equation based modeling.

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maxima computer algebra: Perturbation Methods, Bifurcation Theory and Computer Algebra Richard H. Rand, Dieter Armbruster, 2012-12-06 Perturbation methods have always been an important tool for treating nonlinear differential equations. Now the drudgery associated with them has been eliminated! This book offers computer algebra (MACSYMA) programs which implement the most popular perturbation methods. Not only does this avoid the errors associated with hand computation, but the increase in efficiency permits more complicated problems to be tackled. This book is useful both for the beginner learning perturbation methods for the first time, as well as for the researcher. Methods covered include: Lindstedt's method, center manifolds, normal forms, two variable expansion method (method of multiple scales), averaging, Lie transforms and Liapunov-Schmidt reduction. For each method the book includes an introduction and some example problems solved both by hand and by machine. The examples feature common bifurcations such as the pitchfork and the Hopf. The MACSYMA code for each method is given and suggested exercises are provided at the end of each Chapter. An Appendix offers a brief introduction to MACSYMA.

maxima computer algebra: *Computer Algebra in Scientific Computing* Vladimir P. Gerdt, Wolfram Koepf, Werner M. Seiler, Evgenii V. Vorozhtsov, 2015-09-10 This book constitutes the proceedings of the 17th International Workshop on Computer Algebra in Scientific Computing, CASC 2015, held in Aachen, Germany, in September 2015. The 35 full papers presented in this volume were carefully reviewed and selected from 42 submissions. They deal with the ongoing progress both in theoretical computer algebra and its expanding applications. New and closer interactions are fostered by combining the area of computer algebra methods and systems and the application of the tools of computer algebra for the solution of problems in scientific computing.

maxima computer algebra: Computational Mathematics with SageMath P. Zimmermann, A. Casamayou, N. Cohen, G. Connan, T. Dumont, L. Fousse, F. Maltey, M. Meulien, M. Mezzarobba, C. Pernet, N. M. Thi?ry, E. Bray, J. Cremona, M. Forets, A. Ghitza, H. Thomas, 2018-12-10 This fantastic and deep book about how to use Sage for learning and doing mathematics at all levels perfectly complements the existing Sage documentation. It is filled with many carefully thought through examples and exercises, and great care has been taken to put computational functionality into proper mathematical context. Flip to almost any random page in this amazing book, and you will learn how to play with and visualize some beautiful part of mathematics. --- William A. Stein, CEO, SageMath, and professor of mathematics, University of Washington SageMath, or Sage for short, is an open-source mathematical software system based on the Python language and developed by an international community comprising hundreds of teachers and researchers, whose aim is to provide an alternative to the commercial products Magma, Maple, Mathematica, and MATLAB. To achieve this, Sage relies on many open-source programs, including GAP, Maxima, PARI, and various scientific libraries for Python, to which thousands of new functions have been added. Sage is freely available and is supported by all modern operating systems. Sage provides a wonderful scientific and graphical calculator for high school students, and it efficiently supports undergraduates in their computations in analysis, linear algebra, calculus, etc. For graduate students, researchers, and engineers in various mathematical specialties, Sage provides the most recent algorithms and tools, which is why several universities around the world already use Sage at the undergraduate level.

maxima computer algebra: *Algebraic Statistics for Computational Biology* L. Pachter, B. Sturmfels, 2005-08-22 This book, first published in 2005, offers an introduction to the application of algebraic statistics to computational biology.

maxima computer algebra: *Semidefinite Optimization and Convex Algebraic Geometry* Grigoriy Blekherman, Pablo A. Parrilo, Rekha R. Thomas, 2013-03-21 An accessible introduction to convex algebraic geometry and semidefinite optimization. For graduate students and researchers in mathematics and computer science.

maxima computer algebra: Python for Scientists John M. Stewart, 2017-07-20 Scientific Python is taught from scratch in this book via copious, downloadable, useful and adaptable code snippets. Everything the working scientist needs to know is covered, quickly providing researchers and research students with the skills to start using Python effectively.

maxima computer algebra: Mathematical Modeling and Simulation Kai Velten, 2009-06-01 This concise and clear introduction to the topic requires only basic knowledge of calculus and linear algebra - all other concepts and ideas are developed in the course of the book. Lucidly written so as to appeal to undergraduates and practitioners alike, it enables readers to set up simple mathematical models on their own and to interpret their results and those of others critically. To achieve this, many examples have been chosen from various fields, such as biology, ecology, economics, medicine, agricultural, chemical, electrical, mechanical and process engineering, which are subsequently discussed in detail. Based on the author`s modeling and simulation experience in science and engineering and as a consultant, the book answers such basic questions as: What is a mathematical model? What types of models do exist? Which model is appropriate for a particular problem? What are simulation, parameter estimation, and validation? The book relies exclusively upon open-source software which is available to everybody free of charge. The entire book software - including 3D CFD and structural mechanics simulation software - can be used based on a free CAELinux-Live-DVD that is available in the Internet (works on most machines and operating systems).

maxima computer algebra: Finite Elements for Truss and Frame Structures Andreas Öchsner, Resam Makvandi, 2018-07-03 This book is intended as an essential study aid for the finite element method. Based on the free computer algebra system Maxima, the authors offer routines for symbolically or numerically solving problems in the context of plane truss and frame structures, allowing readers to check classical ‘hand calculations’ on the one hand and to understand the computer implementation of the method on the other. The mechanical theories focus on the classical one-dimensional structural elements, i.e. bars, Euler–Bernoulli and Timoshenko beams, and their combination to generalized beam elements. Focusing on one-dimensional elements reduces the complexity of the mathematical framework, and the resulting matrix equations can be displayed with all components and not merely in the form of a symbolic representation. In addition, the use of a computer algebra system and the incorporated functions, e.g. for equation solving, allows readers to focus more on the methodology of the finite element method and not on standard procedures.

maxima computer algebra: A First Course in Computational Algebraic Geometry Wolfram Decker, Gerhard Pfister, 2013-02-07 A quick guide to computing in algebraic geometry with many explicit computational examples introducing the computer algebra system Singular.

maxima computer algebra: Maxima Programmes for Differential Equations Using Foss (Maxima): A Book of Programmes Using Maxima for Differential Equations Dr Yogeesh N, 2018-10-14 The main idea of bringing out this manual book is to make Teachers and students of Mathematics, are more easy towards doing mathematics practical

maxima computer algebra: *Differential Equations with Linear Algebra* Matthew R. Boelkins, Jack L. Goldberg, Merle C. Potter, 2009-11-05 Differential Equations with Linear Algebra explores the interplay between linear algebra and differential equations by examining fundamental problems in elementary differential equations. With an example-first style, the text is accessible to students who have completed multivariable calculus and is appropriate for courses in mathematics and engineering that study systems of differential equations.

maxima computer algebra: Computational Geometry Franco P. Preparata, Michael I. Shamos, 2012-12-06 From the reviews: This book offers a coherent treatment, at the graduate textbook level, of the field that has come to be known in the last decade or so as computational geometry. ... ... The book is well organized and lucidly written; a timely contribution by two founders of the field. It clearly demonstrates that computational geometry in the plane is now a fairly well-understood branch of computer science and mathematics. It also points the way to the solution of the more challenging problems in dimensions higher than two. #Mathematical Reviews#1 ... This remarkable book is a comprehensive and systematic study on research results obtained especially in the last ten years. The very clear presentation concentrates on basic ideas, fundamental combinatorial structures, and crucial algorithmic techniques. The plenty of results is clever organized following these guidelines and within the framework of some detailed case studies. A

large number of figures and examples also aid the understanding of the material. Therefore, it can be highly recommended as an early graduate text but it should prove also to be essential to researchers and professionals in applied fields of computer-aided design, computer graphics, and robotics. #Biometrical Journal#2

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