

maxima computer algebra system

Maxima Computer Algebra System: A Comprehensive Guide

Introduction:

Are you a student, researcher, or professional grappling with complex mathematical computations? Tired of tedious manual calculations and prone-to-error spreadsheets? Then prepare to meet Maxima, a powerful and versatile computer algebra system (CAS) that can revolutionize your workflow. This comprehensive guide will delve into the intricacies of the Maxima CAS, exploring its functionalities, advantages, and how to effectively utilize it for a wide range of applications. We'll cover everything from basic operations to advanced techniques, ensuring you're well-equipped to harness the full potential of this remarkable tool. Get ready to unlock a world of effortless mathematical problem-solving with Maxima!

1. Understanding the Maxima Computer Algebra System

Maxima is a free and open-source computer algebra system, meaning its source code is publicly available and can be modified and distributed freely. Unlike numerical software that provides approximate solutions, Maxima performs symbolic calculations, yielding exact results or symbolic expressions. This makes it incredibly useful for tasks requiring precise mathematical manipulations, such as solving equations, simplifying expressions, performing calculus operations, and much more. Its origins trace back to the pioneering Macsyma project at MIT in the 1960s, and it boasts a rich history and a dedicated community of users and developers constantly refining and expanding its capabilities. This legacy contributes to Maxima's robustness and reliability, making it a trusted choice for both academic and professional applications.

2. Key Features and Capabilities of Maxima

Maxima's versatility is truly impressive. Here are some of its key features:

Symbolic Manipulation: Maxima excels at manipulating algebraic expressions. It can simplify, expand, factor, and perform other algebraic operations with ease. This includes handling polynomials, rational functions, and even more complex structures.

Calculus: Maxima is a powerful tool for calculus operations. It can compute derivatives, integrals (definite and indefinite), limits, and series expansions. It handles both single and multi-variable calculus problems with remarkable efficiency.

Differential Equations: Solving differential equations, often a daunting task, becomes significantly simpler with Maxima. It can solve various types of differential equations, including ordinary differential equations (ODEs) and some partial differential equations (PDEs).

Linear Algebra: Maxima provides comprehensive support for linear algebra operations. This includes

matrix manipulation (addition, multiplication, inversion), eigenvalue and eigenvector calculations, and solving systems of linear equations.

Graphics and Plotting: Maxima can generate various types of plots, including 2D and 3D graphs, allowing for visual representation of mathematical functions and data. This visual feedback can be invaluable in understanding complex mathematical concepts.

Programming Capabilities: Maxima has its own programming language, allowing users to write custom functions and extend its functionality. This extensibility makes it highly adaptable to specific needs and research domains.

Extensive Documentation and Community Support: A wealth of documentation and a supportive online community make learning and using Maxima significantly easier. Numerous tutorials, manuals, and forums are available to assist users at all levels of expertise.

3. Getting Started with Maxima: A Practical Tutorial

Installing Maxima is typically straightforward, with readily available packages for various operating systems (Windows, macOS, Linux). Once installed, the interface is relatively intuitive, primarily command-line based. Beginners can start by entering simple arithmetic expressions and observing Maxima's responses. For instance, typing ``2 + 2;`` will promptly return ``4``. More complex operations can be performed by utilizing Maxima's built-in functions. For example, to calculate the derivative of x^2 with respect to x , you would use the command ``diff(x^2, x);``, yielding ``2x``. Learning the syntax is crucial, and the extensive online documentation provides ample examples and explanations. The learning curve is manageable, and the rewards of mastering this powerful tool are substantial.

4. Advanced Applications of the Maxima CAS

Beyond basic computations, Maxima finds applications in numerous advanced fields:

Physics and Engineering: Modeling physical systems, solving complex equations in fluid dynamics, electromagnetism, and mechanics.

Mathematics Research: Exploring abstract mathematical concepts, conducting symbolic computations in algebra, number theory, and topology.

Economics and Finance: Developing and analyzing mathematical models in econometrics, financial modeling, and optimization.

Computer Science: Algorithm analysis, symbolic computation in artificial intelligence, and formal verification.

5. Comparing Maxima to Other Computer Algebra Systems

Maxima stands out due to its open-source nature, affordability (being free), and its extensive capabilities. While commercial CAS like Mathematica and Maple offer more polished interfaces and sometimes broader functionalities, Maxima provides a powerful alternative that's accessible to everyone. The choice between Maxima and other systems often depends on individual needs and

budget constraints. Maxima's open-source nature also fosters a strong community contribution and ensures its continued development and improvement.

6. Troubleshooting and Common Issues

While generally robust, users may encounter occasional difficulties. Common issues include syntax errors, memory limitations with extremely complex calculations, and occasional bugs within the software. The active community provides invaluable support through online forums and documentation. Understanding Maxima's syntax and error messages is crucial for effective troubleshooting.

7. The Future of Maxima

Maxima's future looks bright, driven by the active community dedicated to its development and improvement. Ongoing efforts focus on enhancing its interface, expanding its capabilities, and improving its performance. The open-source nature guarantees its continued availability and adaptability to the evolving needs of users. The integration of new algorithms and features promises to make Maxima an even more powerful and versatile tool in the coming years.

8. Book Outline: Mastering Maxima: A Practical Guide

Title: Mastering Maxima: A Practical Guide to Symbolic Computation

Outline:

Introduction: What is Maxima? Why use it? Installation and setup.

Chapter 1: Basic Operations: Arithmetic, variables, functions, and basic syntax.

Chapter 2: Algebraic Manipulation: Simplification, expansion, factoring, and equation solving.

Chapter 3: Calculus: Differentiation, integration, limits, and series expansions.

Chapter 4: Linear Algebra: Matrices, vectors, eigenvalues, and linear equation systems.

Chapter 5: Differential Equations: Solving ODEs and some PDEs.

Chapter 6: Plotting and Visualization: Creating 2D and 3D graphs.

Chapter 7: Programming in Maxima: Defining functions, loops, and conditional statements.

Chapter 8: Advanced Applications: Examples in physics, engineering, and other fields.

Conclusion: Summary and resources for further learning.

9. Frequently Asked Questions (FAQs)

1. Is Maxima free to use? Yes, Maxima is a free and open-source computer algebra system.

1. What operating systems does Maxima support? Maxima supports Windows, macOS, Linux, and other Unix-like systems.

1. Is Maxima difficult to learn? The learning curve is manageable, especially with the available documentation and online resources.

1. How does Maxima compare to Mathematica or Maple? While commercial systems like Mathematica and Maple offer more polished interfaces, Maxima provides a powerful and free alternative.

1. Can Maxima handle complex mathematical problems? Yes, Maxima is capable of handling complex symbolic and numerical calculations.

1. What kind of plotting capabilities does Maxima offer? Maxima can generate various 2D and 3D plots, useful for visualizing mathematical functions and data.

1. Does Maxima have a programming language? Yes, Maxima has its own programming language, allowing users to extend its functionalities.

1. Where can I find help and support for Maxima? The Maxima website, online forums, and documentation provide excellent resources for assistance.

1. What are some advanced applications of Maxima? Maxima finds applications in various fields, including physics, engineering, mathematics research, and economics.

10. Related Articles:

1. "A Beginner's Guide to Maxima": A gentle introduction to the basics of Maxima, suitable for novices.

1. "Maxima for Calculus Students": A tutorial focusing on Maxima's applications in calculus.

1. "Solving Differential Equations with Maxima": A detailed guide on using Maxima for solving various types of differential equations.
1. "Linear Algebra in Maxima": A comprehensive tutorial on performing linear algebra operations using Maxima.
1. "Maxima Programming Techniques": An advanced guide on writing custom functions and programs in Maxima.
1. "Visualizing Mathematical Functions with Maxima": A guide to plotting and visualizing functions using Maxima's plotting capabilities.
1. "Maxima in Physics and Engineering Applications": A review of Maxima's use in solving problems in various physics and engineering domains.
1. "Comparing Maxima to Other CAS Software": A comparative analysis of Maxima with other computer algebra systems.
1. "Troubleshooting Common Maxima Errors": A guide to resolving common issues and errors encountered while using Maxima.

maxima computer algebra system: 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 system: 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 system: 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 system: 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 system: 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 system: 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 sciences. 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 Symphony 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.

maxima computer algebra system: 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 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 system: 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 engineering 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 calculations 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 science and engineering, remaining competitive in the global economy will require hiring employees having had a traditionally rigorous mathematical education.

maxima computer algebra system: 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. Thiéry, 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 system: 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 system: 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 system: 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 system: 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 system: 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 system: Mathematics for Machine Learning Marc Peter

Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020-04-23 The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

maxima computer algebra system: Street-Fighting Mathematics Sanjoy Mahajan,

2010-03-05 An antidote to mathematical rigor mortis, teaching how to guess answers without

needing a proof or an exact calculation. In problem solving, as in street fighting, rules are for fools: do whatever works—don't just stand there! Yet we often fear an unjustified leap even though it may land us on a correct result. Traditional mathematics teaching is largely about solving exactly stated problems exactly, yet life often hands us partly defined problems needing only moderately accurate solutions. This engaging book is an antidote to the rigor mortis brought on by too much mathematical rigor, teaching us how to guess answers without needing a proof or an exact calculation. In *Street-Fighting Mathematics*, Sanjoy Mahajan builds, sharpens, and demonstrates tools for educated guessing and down-and-dirty, opportunistic problem solving across diverse fields of knowledge—from mathematics to management. Mahajan describes six tools: dimensional analysis, easy cases, lumping, picture proofs, successive approximation, and reasoning by analogy. Illustrating each tool with numerous examples, he carefully separates the tool—the general principle—from the particular application so that the reader can most easily grasp the tool itself to use on problems of particular interest. *Street-Fighting Mathematics* grew out of a short course taught by the author at MIT for students ranging from first-year undergraduates to graduate students ready for careers in physics, mathematics, management, electrical engineering, computer science, and biology. They benefited from an approach that avoided rigor and taught them how to use mathematics to solve real problems. *Street-Fighting Mathematics* will appear in print and online under a Creative Commons Noncommercial Share Alike license.

maxima computer algebra system: *Computer Algebra with SymbolicC++* Yorick Hardy, Kiat Shi Tan, W.-H. Steeb, 2008 First published in 1973 Professor Akenzone's book traces the series of religious and political controversies which have battered the state schools of Northern Ireland. After the government'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 system: *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 system: *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 system: *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 system: From Computing to Computational Thinking Paul S. Wang, 2017-07-20 Computational Thinking (CT) involves fundamental concepts and reasoning, distilled from computer science and other computational sciences, which become powerful general mental tools for solving problems, increasing efficiency, reducing complexity, designing procedures, or interacting with humans and machines. An easy-to-understand guidebook, *From Computing to Computational Thinking* gives you the tools for understanding and using CT. It does not assume experience or knowledge of programming or of a programming language, but explains concepts and methods for CT with clarity and depth. Successful applications in diverse disciplines have shown the power of CT in problem solving. The book uses puzzles, games, and everyday examples as starting points for discussion and for connecting abstract thinking patterns to real-life situations. It provides an interesting and thought-provoking way to gain general knowledge about modern computing and the concepts and thinking processes underlying modern digital technologies.

maxima computer algebra system: 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 system: 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 system: Max-linear Systems: Theory and Algorithms Peter Butkovič, 2010-08-05 Recent years have seen a significant rise of interest in max-linear theory and techniques. Specialised international conferences and seminars or special sessions devoted to max-algebra have been organised. This book aims to provide a first detailed and self-contained account of linear-algebraic aspects of max-algebra for general (that is both irreducible and reducible) matrices. Among the main features of the book is the presentation of the fundamental max-algebraic theory (Chapters 1-4), often scattered in research articles, reports and theses, in one place in a comprehensive and unified form. This presentation is made with all proofs and in full generality (that is for both irreducible and reducible matrices). Another feature is the presence of advanced material (Chapters 5-10), most of which has not appeared in a book before and in many cases has not been published at all. Intended for a wide-ranging readership, this book will be useful for anyone with basic mathematical knowledge (including undergraduate students) who wish to learn fundamental max-algebraic ideas and techniques. It will also be useful for researchers working in tropical geometry or idempotent analysis.

maxima computer algebra system: Sage for Undergraduates Gregory V. Bard, 2015-02-16 As the open-source and free competitor to expensive software like MapleTM, Mathematica®, Magma, and MATLAB®, Sage offers anyone with access to a web browser the ability to use

cutting-edge mathematical software and display his or her results for others, often with stunning graphics. This book is a gentle introduction to Sage for undergraduate students toward the end of Calculus II (single-variable integral calculus) or higher-level course work such as Multivariate Calculus, Differential Equations, Linear Algebra, or Math Modeling. The book assumes no background in computer science, but the reader who finishes the book will have learned about half of a first semester Computer Science I course, including large parts of the Python programming language. The audience of the book is not only math majors, but also physics, engineering, finance, statistics, chemistry, and computer science majors.

maxima computer algebra system: Algorithms for Computer Algebra Keith O. Geddes, Stephen R. Czapor, George Labahn, 2007-06-30 Algorithms for Computer Algebra is the first comprehensive textbook to be published on the topic of computational symbolic mathematics. The book first develops the foundational material from modern algebra that is required for subsequent topics. It then presents a thorough development of modern computational algorithms for such problems as multivariate polynomial arithmetic and greatest common divisor calculations, factorization of multivariate polynomials, symbolic solution of linear and polynomial systems of equations, and analytic integration of elementary functions. Numerous examples are integrated into the text as an aid to understanding the mathematical development. The algorithms developed for each topic are presented in a Pascal-like computer language. An extensive set of exercises is presented at the end of each chapter. Algorithms for Computer Algebra is suitable for use as a textbook for a course on algebraic algorithms at the third-year, fourth-year, or graduate level. Although the mathematical development uses concepts from modern algebra, the book is self-contained in the sense that a one-term undergraduate course introducing students to rings and fields is the only prerequisite assumed. The book also serves well as a supplementary textbook for a traditional modern algebra course, by presenting concrete applications to motivate the understanding of the theory of rings and fields.

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