Numerical Solutions for Partial Differential Equations

Problem Solving Using *Mathematica*

Victor G. Ganzha
Evgenii V. Vorozhtsov

Numerical Solutions For Partial Differential Equations Problem Solving Using Mathematica

JA Banks

Numerical Solutions For Partial Differential Equations Problem Solving Using Mathematica:
Numerical Solutions for Partial Differential Equations Victor Grigor'e Ganzha,Evgenii Vasilev Vorozhtsov,1996-07-12 Partial differential equations PDEs play an important role in the natural sciences and technology because they describe the way systems natural and other behave The inherent suitability of PDEs to characterizing the nature motion and evolution of systems has led to their wide ranging use in numerical models that are developed in order to analyze systems that are not otherwise easily studied Numerical Solutions for Partial Differential Equations contains all the details necessary for the reader to understand the principles and applications of advanced numerical methods for solving PDEs In addition it shows how the modern computer system algebra Mathematica can be used for the analytic investigation of such numerical properties as stability approximation and dispersion   Numerical Solutions for Partial Differential Equations Victor Grigor'e Ganzha,Evgenii Vasilev Vorozhtsov,2017-11-22 Partial differential equations PDEs play an important role in the natural sciences and technology because they describe the way systems natural and other behave The inherent suitability of PDEs to characterizing the nature motion and evolution of systems has led to their wide ranging use in numerical models that are developed in order to analyze systems that are not otherwise easily studied Numerical Solutions for Partial Differential Equations contains all the details necessary for the reader to understand the principles and applications of advanced numerical methods for solving PDEs In addition it shows how the modern computer system algebra Mathematica can be used for the analytic investigation of such numerical properties as stability approximation and dispersion   Numerical Solutions for Partial Differential Equations Victor Grigor'e Ganzha,Evgenii Vasilev Vorozhtsov,2019-12 Partial differential equations PDEs play an important role in the natural sciences and technology because they describe the way systems natural and other behave The inherent suitability of PDEs to characterizing the nature motion and evolution of systems has led to their wide ranging use in numerical models that are developed in order to analyze systems that are not otherwise easily studied Numerical Solutions for Partial Differential Equations contains all the details necessary for the reader to understand the principles and applications of advanced numerical methods for solving PDEs In addition it shows how the modern computer system algebra Mathematica R can be used for the analytic investigation of such numerical properties as stability approximation and dispersion   Numerical Solutions for Partial Differential Equations Gordon Dennis Smith,1969   **Solving Nonlinear Partial Differential Equations with Maple and Mathematica** Inna Shingareva,Carlos Lizárraga-Celaya,2011-07-24 The emphasis of the book is given in how to construct different types of solutions exact approximate analytical numerical graphical of numerous nonlinear PDEs correctly easily and quickly The reader can learn a wide variety of techniques and solve numerous nonlinear PDEs included and many other differential equations simplifying and transforming the equations and solutions arbitrary functions and parameters presented in the book Numerous comparisons and relationships between various types of solutions different methods and approaches are provided

the results obtained in Maple and Mathematica facilitates a deeper understanding of the subject Among a big number of CAS we choose the two systems Maple and Mathematica that are used worldwide by students research mathematicians scientists and engineers As in the our previous books we propose the idea to use in parallel both systems Maple and Mathematica since in many research problems frequently it is required to compare independent results obtained by using different computer algebra systems Maple and or Mathematica at all stages of the solution process One of the main points related to CAS is based on the implementation of a whole solution method e g starting from an analytical derivation of exact governing equations constructing discretizations and analytical formulas of a numerical method performing numerical procedure obtaining various visualizations and comparing the numerical solution obtained with other types of solutions considered in the book e g with asymptotic solution   NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS. ,1966

   NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS USING FINITE DIFFERENCE METHOD AND MATHEMATICA SUJAUL CHOWDHURY,PONKOG KUMAR DAS,2019-01-14 The book is intended for graduate students of Engineering Mathematics and Physics We have numerically solved Hyperbolic and Parabolic partial differential equations with various initial conditions using Finite Difference Method and Mathematica Replacing derivatives by finite difference approximations in these differential equations in conjunction with boundary conditions and initial conditions lead to equations relating numerical solutions at various position and time These relations are intricate in that numerical value of the solution at one particular position and time is related with that at several other position and time We have surmounted the intricacies by writing programs in Mathematica 6 0 that neatly provide systematic tabulation of the numerical values for all necessary position and time This enabled us to plot the solutions as functions of position and time Comparison with analytic solutions revealed nearly perfect match in every case We have demonstrated conditions under which the nearly perfect match can be obtained even for larger increments in position or time   *Differential Equations* Marian Mureşan,2024-06-17 The book concerns with solving about 650 ordinary and partial differential equations Each equation has at least one solution and each solution has at least one coloured graph The coloured graphs reveal different features of the solutions Some graphs are dynamical as for Clairaut differential equations Thus one can study the general and the singular solutions All the equations are solved by Mathematica The first chapter contains mathematical notions and results that are used later through the book Thus the book is self contained that is an advantage for the reader The ordinary differential equations are treated in Chapters 2 to 4 while the partial differential equations are discussed in Chapters 5 to 10 The book is useful for undergraduate and graduate students for researchers in engineering physics chemistry and others Chapter 9 treats parabolic partial differential equations while Chapter 10 treats third and higher order nonlinear partial differential equations both with modern methods Chapter 10 discusses the Korteweg de Vries Dodd Bullough Mikhailov Tzitzeica Dodd Bullough Benjamin Kadomtsev Petviashvili Sawada Kotera and Kaup Kupershmidt equations   *Handbook of Linear Partial*

Differential Equations for Engineers and Scientists Andrei D. Polyanin,Vladimir E. Nazaikinskii,2015-12-23 This second edition contains nearly 4 000 linear partial differential equations PDEs with solutions as well as analytical symbolic and numerical methods for solving linear equations First second third fourth and higher order linear equations and systems of coupled equations are considered Equations of parabolic mixed and other types are discussed New linear equations exact solutions transformations and methods are described Formulas for effective construction of solutions are given Boundary value and eigenvalue problems are addressed Symbolic and numerical methods for solving PDEs with Maple Mathematica and MATLAB are explored **Computer Algebra in Scientific Computing** Vladimir P. Gerdt,Wolfram Koepf,Werner M. Seiler,Evgenii V. Vorozhtsov,2014-09-01 This book constitutes the proceedings of the 16th International Workshop on Computer Algebra in Scientific Computing CASC 2014 held in Warsaw Poland in September 2014 The 33 full papers presented were carefully reviewed and selected for inclusion in this book The papers address issues such as Studies in polynomial algebra are represented by contributions devoted to factoring sparse bivariate polynomials using the priority queue the construction of irreducible polynomials by using the Newton index real polynomial root finding by means of matrix and polynomial iterations application of the eigenvalue method with symmetry for solving polynomial systems arising in the vibration analysis of mechanical structures with symmetry properties application of Gr bner systems for computing the absolute reduction number of polynomial ideals the application of cylindrical algebraic decomposition for solving the quantifier elimination problems certification of approximate roots of overdetermined and singular polynomial systems via the recovery of an exact rational univariate representation from approximate numerical data new parallel algorithms for operations on univariate polynomials multi point evaluation interpolation based on subproduct tree techniques *Computer Algebra in Scientific Computing CASC'99* Victor G. Ganzha,Ernst W. Mayr,Evgenii V. Vorozhtsov,2012-12-06 The development of powerful computer algebra systems has considerably ex tended the scope of problems of scientific computing which can now be solved successfully with the aid of computers However as the field of applications of computer algebra in scientific computing becomes broader and more complex there is a danger of separation between theory systems and applications For this reason we felt the need to bring together the researchers who now ap ply the tools of computer algebra for the solution of problems in scientific computing in order to foster new and closer interactions CASC 99 is the second conference devoted to applications of computer al gebra in scientific computing The first conference in this sequence CASC 98 was held 20 24 April 1998 in St Petersburg Russia This volume contains revised versions of the papers submitted by the par ticipants and accepted by the program committee after a thorough reviewing process The collection of papers included in the proceedings covers various topics of computer algebra methods algorithms and software applied to scien tific computing symbolic numeric analysis and solving differential equations efficient computations with polynomials groups matrices and other related objects special purpose programming environments application to physics mechanics optics and to other areas

In particular a significant group of papers deals with applications of com puter algebra methods for the solution of current problems in group theory which mostly arise in mathematical physics **Environmental Geomechanics** Laurent Vulliet,Lyesse Laloui,Bernard Schrefler,2002-01-01 **Delay Ordinary and Partial Differential Equations** Andrei D. Polyanin,Vsevolod G. Sorokin,Alexei I. Zhurov,2023-08-28 Delay Ordinary and Partial Differential Equations is devoted to linear and nonlinear ordinary and partial differential equations with constant and variable delay It considers qualitative features of delay differential equations and formulates typical problem statements Exact approximate analytical and numerical methods for solving such equations are described including the method of steps methods of integral transformations method of regular expansion in a small parameter method of matched asymptotic expansions iteration type methods Adomian decomposition method collocation method Galerkin type projection methods Euler and Runge Kutta methods shooting method method of lines finite difference methods for PDEs methods of generalized and functional separation of variables method of functional constraints method of generating equations and more The presentation of the theoretical material is accompanied by examples of the practical application of methods to obtain the desired solutions Exact solutions are constructed for many nonlinear delay reaction diffusion and wave type PDEs that depend on one or more arbitrary functions A review is given of the most common mathematical models with delay used in population theory biology medicine economics and other applications The book contains much new material previously unpublished in monographs It is intended for a broad audience of scientists university professors and graduate and postgraduate students specializing in applied and computational mathematics mathematical physics mechanics control theory biology medicine chemical technology ecology economics and other disciplines Individual sections of the book and examples are suitable for lecture courses on applied mathematics mathematical physics and differential equations for delivering special courses and for practical training **Maple and Mathematica** Inna K. Shingareva,Carlos Lizárraga-Celaya,2009-08-14 In the history of mathematics there are many situations in which cal lations were performed incorrectly for important practical applications Let us look at some examples the history of computing the number began in Egypt and Babylon about 2000 years BC since then many mathematicians have calculated e g Archimedes Ptolemy Vi ete etc The rst formula for computing decimal digits of was disc ered by J Machin in 1706 who was the rst to correctly compute 100 digits of Then many people used his method e g W Shanks calculated with 707 digits within 15 years although due to mistakes only the rst 527 were correct For the next examples we can mention the history of computing the ne structure constant that was rst discovered by A Sommerfeld and the mathematical tables exact lutions and formulas published in many mathematical textbooks were not veri ed rigorously 25 These errors could have a large e ect on results obtained by engineers But sometimes the solution of such problems required such techn ogy that was not available at that time In modern mathematics there exist computers that can perform various mathematical operations for which humans are incapable Therefore the computers can be used to verify the results obtained

by humans to discovery new results to provetheresultsthatahumancanobtainwithoutanytechnology With respectto our example of computing we can mention that recently in 2002 Y Kanada Y Ushiro H Kuroda and M *Mathematical Reviews* ,2004 *Differential Equations with Mathematica* Martha L. Abell,James P. Braselton,2022-01-18 Differential Equations with Mathematica Fifth Edition uses the fundamental concepts of the popular platform to solve analytically numerically and or graphically differential equations of interest to students instructors and scientists Mathematica s diversity makes it particularly well suited to performing calculations encountered when solving many ordinary and partial differential equations In some cases Mathematica s built in functions can immediately solve a differential equation by providing an explicit implicit or numerical solution In other cases Mathematica can be used to perform the calculations encountered when solving a differential equation Because one goal of elementary differential equations courses is to introduce students to basic methods and algorithms so that they gain proficiency in them nearly every topic covered this book introduces basic commands also including typical examples of their application A study of differential equations relies on concepts from calculus and linear algebra so this text also includes discussions of relevant commands useful in those areas In many cases seeing a solution graphically is most meaningful so the book relies heavily on Mathematica s outstanding graphics capabilities Demonstrates how to take advantage of the advanced features of Mathematica Introduces the fundamental theory of ordinary and partial differential equations using Mathematica to solve typical problems of interest to students instructors scientists and practitioners in many fields Showcases practical applications and case studies drawn from biology physics and engineering

Computer Algebra in Scientific Computing Victor Grigor'evich Ganzha,Ernst Mayr,2001 Jets A Maple Package for Formal Differential Geometry Computing Stratifications of Quotients of Finite Groups and an Application to Shape Memory Alloy A MuPAD Library for Differential Equation Algebraic Identification Algorithm and Application to Dynamical Systems Cooperation Between a Dynamic Geometry Environment and a Computer Algebra System for Geometric Discovery On the Stability of Steady Motions of a Solar Sail Satellite Application of Computer Algebra for Investigation of a Group Properties of the Navier Stokes Equations for Compressible Viscous Heat Conducting Gas Mathematica and Nilpotent Lie Superalgebras Neighborhoods of an Ordinary Linear Differential Equation Invariants of Finite Groups and Involutive Division Symbolic Computation and Boundary Conditions for the Wave Equation Parametric Systems of Linear Congruences Bifurcation Analysis of Low Resonant Case of the Generalized Henon Heiles System An Involutive Reduction Method to Find Invariant Solutions for Partial Differential Equations Recurrence Functions and Numerical Characteristics of Graphs A New Combinatorial Algorithm for Large Markov Chains GROOME Tool Supported Graphical Object Oriented Modelling for Computer Algebra and Scientific Computing Construction of Janet Bases I Monomial Bases Construction of Janet Bases II Polynomial Bases Low Dimensional Quasi Filiform Lie Algebras with Great Length Algebraic Methods for Sectioning Parametric Surfaces The Methods of Computer Algebra and the Arnold Moser Theorem Symbolic Algorithms of Algebraic

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