Partial Differential Equation

A partial differential equation (PDE) is an equation involving functions and their partial derivatives; for example, the wave equation

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} = \frac{1}{v^2}\frac{\partial^2 \psi}{\partial t^2}. \tag{1}$$

Some partial differential equations can be solved exactly in the Wolfram Language using DSolve[eqn, y, {x1, x2}], and numerically using NDSolve[eqns, y, {x, xmin, xmax}, {t, tmin, tmax}].

In general, partial differential equations are much more difficult to solve analytically than are ordinary differential equations. They may sometimes be solved using a Bäcklund transformation, characteristics, Green's function, integral transform, Lax pair, separation of variables, or--when all else fails (which it frequently does)--numerical methods such as finite differences.

Partial Differential Equations And Mathematica

Dimitri Dimitrievich Vvedensky

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presentation of the material in the book is based on Mathematica 3 0 note books The entire printed version of this book is available on the accompanying CD The text is presented in such a way that the reader can interact with the calculations and experiment with the models and methods Also contained on the CD is a package called MathLie in honor of Sophus Lie carrying out the calculations automatically The application of symmetry analysis to problems from physics mathematics and en gineering is demonstrated by many examples The study of symmetries of differential equations is an old subject Thanks to Sophus Lie we today have available to us important information on the behavior of differential equations Symmetries can be used to find exact solutions Symmetries can be applied to verify and to develop numerical schemes They can provide conservation laws for differential equations The theory presented here is based on Lie containing improve ments and generalizations made by later mathematicians who rediscovered and used Lie s work The presentation of Lie s theory in connection with Mathematica is novel and vitalizes an old theory The extensive symbolic calculations necessary under Lie s theory are supported by MathLie a package written in 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 **Differential Equations with Mathematica** Martha L. Abell,James P. Braselton,1997 The second edition of this groundbreaking book integrates new applications from a variety of fields especially biology physics and engineering The new handbook is also completely compatible with Mathematica version 3 0 and is a perfect introduction for Mathematica beginners The CD ROM contains built in commands that let the users solve problems directly using graphical solutions Introduction to Partial Differential Equations for Scientists and Engineers Using Mathematica Kuzman Adzievski,Abul Hasan Siddiqi,2013-10-23 With a special emphasis on engineering and science applications this textbook provides a mathematical introduction to PDEs at the undergraduate level It takes a new approach to PDEs by presenting computation as an integral part of the study of differential equations The authors use Mathematica along with graphics to improve understanding and interpretation of concepts They also present exercises in each chapter and solutions to selected examples Topics discussed include Laplace and Fourier transforms as well as Sturm Liouville boundary value problems 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

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