

<<微分方程与数学物理问题>>

图书基本信息

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前言

Modern mathematics has over 300 years of history. From the very beginning, it was focused on differential equations as a major tool for mathematical modelling. Most of mathematical models in physics, engineering sciences, biomathematics, etc. lead to nonlinear differential equations. Today's engineering and science students and researchers routinely confront problems in mathematical modelling involving solution techniques for differential equations. Sometimes these solutions can be obtained analytically by numerous traditional ad hoc methods appropriate for integrating particular types of equations. More often, however, the solutions cannot be obtained by these methods, in spite of the fact that, e.g. over 400 types of integrable second-order ordinary differential equations were accumulated due to ad hoc approaches and summarized in voluminous catalogues. On the other hand, the fundamental natural laws and technological problems formulated in terms of differential equations can be successfully treated and solved by Lie group methods. For example, Lie group analysis reduces the classical 400 types of equations to 4 types only !

Development of group analysis furnished ample evidence that the theory provides a universal tool for tackling considerable numbers of differential equations even when other means of integration fail. In fact, group analysis is the only universal and effective method for solving nonlinear differential equations analytically. The old integration methods rely essentially on linearity as well as on constant coefficients. Group analysis deals equally easily with linear and nonlinear equations, as well as with constant and variable coefficients. For example, from the traditional point of view, the linear equation

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内容概要

A Practical Course in Differential Equations and Mathematical Modelling is a unique blend of the traditional methods of ordinary and partial differential equations with Lie group analysis enriched by the author's own theoretical developments. The book -- which aims to present new mathematical curricula based on symmetry and invariance principles -- is tailored to develop analytic skills and "working knowledge" in both classical and Lie's methods for solving linear and nonlinear equations. This approach helps to make courses in differential equations, mathematical modelling, distributions and fundamental solution, etc. easy to follow and interesting for students. The book is based on the author's extensive teaching experience at Novosibirsk and Moscow universities in Russia, College de France, Georgia Tech and Stanford University in the United States, universities in South Africa, Cyprus, Turkey, and Blekinge Institute of Technology (BTH) in Sweden. The new curriculum prepares students for solving modern nonlinear problems and will essentially be more appealing to students compared to the traditional way of teaching mathematics. The book can be used as a main textbook by undergraduate and graduate students and university lecturers in applied mathematics, physics and engineering.

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