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Book Reviews

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BOOK REVIEWS

D. Wang, Z. Zheng, Eds.: DIFFERENTIAL EQUATIONS WITH SYMBOLIC COMPUTATION. Trends in Mathematics. Birkhäuser-Verlag, Basel, 2005. ISBN 3-7643-7368-7, hardcover, viii+374 pages, price EUR 78.00.

To briefly characterize this volume of Trends in Mathematics, let us quote its Preface: "This book provides a picture of what can be done in differential equations with advanced methods and software tools of symbolic computation. It focuses on the symbolic-computational aspect of three kinds of fundamental problems in differential equations: transforming the equations, solving the equations, and studying the structure and properties of their solutions."

The book comprises 20 paper-like chapters written by different authors. Although the contributions are mutually independent, they form three groups, each one focusing on a different subject: qualitative study of differential systems, tools assisting in the search for solutions of differential equations, and the transformations of differential equations to forms manageable more easily than the original problem.

It is necessary to emphasize that this collection is not a textbook for readers who wish to learn from scratch how to use symbolic computation for analyzing and solving differential equations. Indeed, familiarity with advanced topics in ordinary and, to some extent, partial differential equations is assumed. A code for solving particular problems is given rarely because the focus lies in mathematics not in programming. That is, the mathematical treatment of the problems studied is presented and, where necessary, the results obtained by symbolic computation are used.

Since the presented topics are well covered by the contributions and since the information content of each chapter is further enhanced by a rich reference section, researchers and students pursuing the relevant subjects should not miss this book.

The following list of contributions and their authors gives a good idea about the material that the reader can find in the book: Symbolic Computation of Lyapunov Quantities and the Second Part of Hilbert's Sixteenth Problem (*S. Lynch*); Estimating Limit Cycle Bifurcations from Centers (*C. Christopher*); Conditions of Infinity to be an Isochronous Center for a Class of Differential Systems (*W. Huang, Y. Liu*); Darboux Integrability and Limit Cycles for a Class of Polynomial Differential Systems (*J. Giné, J. Llibre*); Time-Reversibility in Two-Dimensional Polynomial Systems (*V. G. Romanovski, D. S. Shafer*); On Symbolic Computation of the LCE[2] of N-Dimensional Dynamical Systems (*S. Ning, Z. Zheng*); Symbolic Computation for Equilibria of Two Dynamic Models (*W. Zhang, R. Yan*); Attractive Regions in Power Systems by Singular Perturbation Analysis (*Z. Jing* et al.); Algebraic Multiplicity and the Poincaré Problem (*J. Lei, L. Yang*); Formalizing a Reasoning Strategy in Symbolic Approach to Differential Equations (*S. Ma*); Looking for Periodic Solutions of ODE Systems by the Normal Form Method (*V. F. Edneral*); Algorithmic Reduction and Rational General Solutions of First Order Algebraic Differential Equations (*G. Chen, Y. Ma*); Factoring Partial Differential Systems in Positive Characteristic (*M. A. Barkatou* et al.); On the Factorization of Differential Modules (*M. Wu*); Continuous and Discrete Homotopy Operators and the Computation of Conservative Laws (*W. Hereman* et al.); Partial and Complete Linearization of PDEs Based on Conservation Laws (*T. Wolf*); CONSLAW:

[2] Lyapunov characteristic exponents

A Maple Package to Construct the Conservation Laws for Nonlinear Evolution Equations (*R.-X. Yao, Z.-B. Li*); Generalized Differential Resultant Systems of Algebraic ODEs and Differential Elimination Theory (*G. C. Ferro*); On "Good" Bases of Algebraico-Differential Ideals (*W. Wu*); On the Construction of Groebner Basis of a Polynomial Ideal Based on Riquier-Janet Theory (*W. Wu*).

Jan Chleboun

Y. Sone: MOLECULAR GAS DYNAMICS: THEORY, TECHNIQUES, AND APPLICATIONS. Modeling and Simulation in Science, Engineering and Technology. Birkhäuser-Verlag, Boston, 2007. ISBN 0-8176-4645-1, xiii+658 pages, price EUR 98.00.

The monograph provides a comprehensive and self-contained overview of gas dynamics based on the kinetic theory.

After developing the basic theory and various simple flows, more advanced topics are discussed such as temperature-induced flows, evaporation, condensation, and bifurcation of flows.

The presentation is supplemented with illustrations and tables demonstrating the numerical methods suitable for the respective problems.

An up-to-date survey of the current status of research in the various areas is given together with an extensive bibliography.

The book can serve as a self-study reference or as a textbook.

Jan Stebel