Book Reviews

BOOK REVIEWS

Greguš, M.: THIRD ORDER LINEAR DIFFERENTIAL EQUATIONS. Veda, Bratislava — D. Reidel Publishing Company, Dordrecht/Boston/Lancaster/Tokyo 1987, xv + 270 pages.

The book gives a complete survey of the third order linear homogeneous differential equation theory for the last three decades. It marks the culminating point in the author's many years lasting research concerning linear differential equations of the third order. While C. A. Swanson's monograph *Comparison and Oscillation Theory of Linear Differential Equations* contains only some results about the oscillatoricity of third order differential equations, in the book under review the author presents a more self-contained theory of third order differential equations and also includes a wide variety of problems. The book is written for a large spectrum of readers.

The theory of third order differential equations is systematically treated in four chapters.

The first chapter deals with the linear differential equation of the third order in the so-called normal form and with the adjoint equation. The topics treated in this chapter include the basic properties of solutions of such equations, mutual relations between the solutions, and the influence of the Laguerre invariant on the properties of solutions. The properties of the conjugate points of solutions are also studied. Further, criteria for third order linear differential equations in the normal form to be oscilatory, non-oscillatory or disconjugate are derived, based on the behaviour of their non-oscillatory solutions and also as an application of the conjugate points theory. Of special interest are comparison theorems, yielding concrete sufficient conditions for the oscillatoricity of third order differential equations. Also, the asymptotic behaviour of solutions of the linear differential equations in the normal form in a neighbourhood of infinity is examined. To conclude the first chapter, the author formulates and proves the latest results concerning several-point boundary-value problems for third order differential equations.

Chapter 2 presents a survey of the latest results about third order differential equations in the general form. The questions studied here are mostly similar to those treated in the preceding chapter.

The third chapter mentions various forms of differential equations of the third order that the general third order differential equation can be reduced to. There is also a remark concerning the theory of transformations of third order linear differential equations with respect to possible further research.

The last of the four chapters presents applications of the third order linear differential equation theory to some boundary-value problems for non-linear differential equations of the third order and also deals with properties of solutions of a special type of non-linear differential equations of order 3 which in a particular case includes the third order linear differential equations in the normal form. At the end of this chapter, some applications of third order linear differential equations to physics and engineering can be found.

The monograph contains the sum of the author's own research as well as results of other mathematicians published in various journals. The author has succeeded in presenting a good, self-contained and up-to-date theory of third order linear differential equations.

Several papers have been published in recent years, dealing with linear non-homogeneous and non-linear differential equations of the third order. The methods of research applied in them are mostly the same as those used for third order linear differential equations.

The book is certainly a great contribution to a further development of the theory of third order differential equations, both linear and non-linear.

Milan Gera, Bratislava

Rényi, A.: A DIARY ON INFORMATION THEORY, Akadémiai Kiadó, Budapest, 1984, 192 pages.

The last beautiful book written by the late outstanding Hungarian mathematician Alfréd Rényi has been published. (Let us recall his Dialogues on Mathematics and Letters on Probability.)

As it is noted on the last page of the cover: "This book may be of interest not only to mathematicians, but to laymen as well." The book is not only an approach to some parts of mathematics, but it shows how mathematics can be the tool of solutions to many problems and even a source of pleasure and joy.

The book consists of several parts. The first, the main, is entiteld "On the mathematical notion of information." In the form of a diary of a university student basic notions of the information theory are presented. In records from lectures notions like information, the measuring of the quantity of information, entropy, conditional entropy, mutual information, optimal discrete source coding and channel capacity are explained.

The following two parts are devoted to the probability theory — notes of teaching and strategies of card games. The book is concluded by variations on a theme by Fibonacci, the mathematical theory of trees and its applications to other fields.

The whole book is written in a very simple, understandable style. Great mathematical skill is not expected. As Pál Révész point out in the foreword "The book is not written with the aim of teaching a particular field of mathematics. Its intent is to explain what mathematics is, what it can contribute to our everyday lives, how it can further the development of the way we think and how we can enjoy its beauty." I warmly recommend this book for all interested in mathematics.

Karol Nemoga, Bratislava

Krajňáková, D. et al.: MATHEMATICAL EXERCISE BOOK (Slovak), ALFA, Bratislava — SNTL, Praha, 1988, 528 pages.

A supplement to the textbook of mathematics for students of chemistry at technical universities in Czechoslovakia containing exercises from the calculus of one and more variables, linear algebra, differential equations, probability and mathematical statistics. In every chapter some typical problems are given with a complete solution, to others the book contains the results on hints how to solve them.

Štefan Porubský, Bratislava

Vajteršic, M.: MODERN ALGORITHMS FOR SOLVING SOME ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS (Slovak). Veda, Bratislava 1988, 198 pages.

The numerical solution of boundary value problems is indispensable in almost all fields of physics and engineering sciences. The recent development, e.g. the study of three-dimensional problems, leads to large systems of linear algebraic equations, the matrices of which have special qualities (thin, diagonal dominant, positive definite). On that account very fast algorithms can be used for their solving.

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After reading the book through one can obtain a good view of modern and effective algorithms for solving special systems of linear algebraic equations. The monograph is not a text-book of individual methods but rather a short analysis and a survey of their implementation on certain computers. The author evidently assumes that the reader issufficiently acquainted with the gist of these methods.

The book consists of five chapters. The first two are devoted to algorithms for serial and the rest for parallel computers.

Chapter 1. Some direct and iterative methods for solving the Poisson equation on different domains (rectangle, circle, ...) are presented.

Chapter 2. Fast serial algorithms for solving the biharmonic equation.

Chapter 3. Some parallel algorithms for solving selected elliptic problems for the model SIMD and MIMD parallel computer are described.

Chapter 4. A few modes of implementation of fast algorithms on special computers (CDC STAR 100, CRAY-1, EGPA, ...) are given.

Chapter 5. Multigrid methods represent the latest trend of solving linear algebraic systems today. Some ways of their parallelization can be found in this part.

The core of the book undoubtedly consists of chapters 3—5, devoted to one of the most dynamical parts of computer science — parallel computers. Their main advantages are rate and reliability of calculations. Though the book presents some new effective numerical methods, one can say that it has mostly an informative character for most of the readers in Czechoslovakia, since parallel computers are still very rare in our coutry.

The title of book is not quite exact, since only a small part is dedicated to elliptic partial differential equations. A large part of the book discusses specific systems of linear algebraic equations.

M. Slodička, Bratislava