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Book reviews

J. D. Lambert, **Computational Methods in Ordinary Differential Equations,** John Wiley and Sons Ltd., 1973, 278 pp., price £5.50.

This is an extremely well-written book on numerical methods available for solving ordinary differential equations. Its primary purpose is to serve as a textbook for which it is very well suited. On the other hand it contains much more than what will be dealt with in an average course since it is very complete with regard to practical numerical methods. For proofs of some theorems the reader is referred to the book of Henrici, "Discrete variable methods in ordinary differential equations", but the reviewer did not feel this to be any objection at all.

After an introductory chapter the book begins with linear multistep methods. Definitions of order, error constant, local and global truncation error, convergence, consistency and zero-stability are given. Weak stability theory is considered and, with regard to the choice of the steplength, intervals of absolute and relative stability are defined and calculated for many of the methods.

Ch. 4 deals with Runge–Kutta methods. It is mentioned that Runge–Kutta methods of order R need more than R function evaluations if $R>4$. For $R\leqslant 4$ all Runge–Kutta methods of order R which use R function evaluations have the same interval of absolute stability. A detailed comparison between the advantages of linear multistep and Runge–Kutta methods is given.

In Ch. 5 hybrid methods are considered. These are linear-multistep methods which incorporate a function evaluation at an off-step point. Hybrid methods share with Runge–Kutta methods the property of utilizing data at points other than the step points. A hybrid formula has, compared to the multistep method, the advantage that the order is increased while retaining zero-stability.

In Ch. 6 the accuracy is increased by applying Richardson extrapolation (deferred approach to the limit).

In Ch. 8 the problem of stiffness for first-order systems is considered. A definition of stiffness and various definitions of stability for stiff systems are given. Methods for solving moderately stiff systems are described and suggestions are forwarded for dealing with the difficult problem of very stiff systems.

Chs. 7 and 9 deal with particular problems (a.o. second-order differential equations).

The book can be warmly recommended.

A. I. van de Vooren

L. Kosten, **Stochastic Theory of Service Systems,** International Series of Monographs in Pure and Applied Mathematics, 103. Pergamon Press, 1973. xii+165 pp. Price £3.80.

In 165 pages this book gives a good introduction to the ideas of queueing theory and methods of solving problems arising in this theory. The author's viewpoint is an engineer's. Service systems with stochastic input and operation are realities and the reader is introduced into building mathematical models of concrete examples and solving the problems they present by the most practical methods. These may be analytical methods or numerical methods (the importance of which is stressed though no example is worked out) or simulation.

The preface states that knowledge of elementary probability theory and an engineer's course in calculus are assumed. This restriction to elementary probability has a drawback. Avoiding rigorous probability techniques sometimes leads to relying on more intuitive arguments (as e.g. in chapter 3.2), but these may require more probabilistic "feeling" than may be expected from a reader knowing only the elements of probability.

The book starts with a very useful introductory chapter describing the operation of service systems and explaining terminology. Chapters 2 and 3 contain the "standard cases" admitting complete analytical solutions: the stationary state of the $M/M/c$ delay and blocking queues. Chapter 4 is on general holding times and in chapters 5–8 we find non-stationary behaviour, different priority systems, restricted availability and arrival and service in batches. The final chapter is on simulation: principles, implementation and accuracy. There is an appendix on generating functions and a reference list of three pages.

Emphasis is on simple methods (wherever possible) e.g. the "combinatorial method" – computing moments as long time averages in the stationary situation by considering what actually happens in the process.

A useful, clearly written introduction containing much information with a fair balance between generalities, special cases and techniques.

A. J. Stam

Stanley A. Berger, **Laminar Wakes**. American Elsevier Publ. Co., 294 pages, 1971, price Dfl. 65.00, $19.00.

This book presents a comprehensive survey of the present state of knowledge of laminar wake theory.

Ch. 1 begins with a qualitative picture of the development of the wake behind finite bodies for the whole range of Reynolds numbers. Next, the general equations for steady compressible flow of a viscous, heat conducting fluid are given.

In Ch. 2 the classical Goldstein solution of the near wake behind a finite flat plate under zero angle of incidence is presented, while in Ch. 10 the far wake of this same configuration is considered.

Ch. 3 deals with the Chapman model which is used for separated supersonic flow. This model leads to a solution for the base region. The pressure is assumed to be constant in the laminar mixing part, while near the rear stagnation point (reattachment) the pressure follows from the assumption of isentropic recompression. This recompression process is inviscid and occurs over a small distance. In the model of Crocco und Lees (Ch. 5) the recompression is treated as a gradual interaction between the inner viscous wake and the outer inviscid flow. This model yields a dependence of the base pressure on the Reynolds number.

In Ch. 6 Batchelor's model for the determination of the steady, incompressible, laminar separated flow behind blunt bodies at very high Reynolds number is treated. Ch. 7 deals with the separation and rapid expansion of a supersonic boundary layer at a sharp corner as described by the inviscid model of Weinbaum and Weiss. If the velocity is decreased, viscous forces no longer can be neglected while, finally, for low Reynolds number the inertia forces can be neglected with regard to the viscous forces. Then, solutions can be obtained by aid of the Oseen and Stokes approximations.

In conclusion, this book is an extremely valuable source of information summarizing the work which has been described in a large number of publications. It will be clear that the book is intended primarily for research workers.

A. I. van de Vooren