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Book reviews

I. Stakgold, **Green's functions and boundary value problems**, John Wiley & Sons, Ltd., Chichester/New York, 1979. xvi + 638 pp., price £ 18,–.

This book is a revision of the author's earlier two-volume book 'Boundary value problems of mathematical physics', Vols. I and II, MacMillan, New York, 1967, and its purpose is to give a systematic analysis of boundary value problems. It is aimed at graduate students in the physical sciences, engineering and applied mathematics, who have already taken 'methods' courses in vector analysis, elementary complex variables, Fourier series and elementary boundary value problems. Examples are chosen from a wide variety of applications in engineering and physical sciences.

There are 10 chapters: 0. Preliminaries, 1. Green's functions (intuitive ideas), 2. The theory of distributions, 3. One-dimensional boundary value problems, 4. Metric spaces and Hilbert spaces, 5. Operator theory, 6. Spectral theory of second-order differential operators, 8. Partial differential equations, 9. Nonlinear problems.

This book is an excellent introduction to the wide field of boundary value problems. One of its attractions is that every result of a more abstract character is illuminated by well-chosen examples. There is an extensive collection of excercises. The style is easy-going, and all theorems, except for some in Chapter 9, are proved in detail. The inclusion of short introductions to Lebesgue integration, to distribution theory and to Hilbert spaces makes this book very useful for the public at which it is aimed.

H. S. V. de Snoo.

Annual Review of Fluid Mechanics, Vol. 12, 1980, edited by M. Van Dyke, J. V. Wehausen and J. L. Lumley. Annual Reviews Inc., Palo Alto, California, USA, 490 pp., price $ 17.50.

This volume contains the following contributions:
Some notes on the relation between fluid mechanics and statistical physics, by G. E. Uhlenbeck,
Solitary waves, by J. W. Miles,
Topographically trapped waves, by L. A. Mysak,
Water transport in soils, by J. -Y. Parlange,
Analysis of two-dimensional interactions between shock waves and boundary layers, by T. C. Adamson, Jr. and A. F. Messiter,
Fluid mechanics of the duodenum, by E. O. Macagno and J. Christensen,
Dynamic materials testing: biological and clinical applications of network-forming systems, by L. V. McIntyre,
Transonic flow past oscillating airfoils, by H. Tijdeman and R. Seebass,
Scientific progress on fire, by H. W. Emmons,
Toward a statistical theory of suspension, by R. Herczyński and I. Pieńkowska,
Coastal circulation and wind-induced currents, by C. D. Winant,

Instabilities of waves on deep water, by H. C. Yuen and B. M. Lake,
Stokeslets and eddies in creeping flow, by H. Hasimoto and O. Sano,
Continuous drawing of liquids to form fibers, by M. M. Denn,
Models of wind-driven currents on the continental shelf, by J. S. Allen,
Particle motions in a viscous fluid, by L. G. Leal.

Solution methods for integral equations, theory and applications, edited by Michael A. Golberg. Plenum Press, New York and London, 1979, 350 pp., price $ 35.00.

This book consists of 13 chapters, written by various authors. The aim of the book is to present numerical methods for integral equations, but this is done with a thorough treatment of the underlying theory. Chapter 1, written by the editor, gives a valuable survey of numerical methods for integral equations, many of them being discussed in more detail in the succeeding chapters. Chapter 2 by R. C. Allen and G. M. Wing deals with the so-called synthetic method for accelerating the iterative solution of Fredholm equations with displacement kernel. The algorithm is a special case of the splitting method applied to the integral operator. Conditions for convergence are derived. In Chapter 3 D. Elliott treats numerical methods for solving Cauchy singular equations on both open and closed arcs in the plane. In particular, attention is drawn to the method of regularization. In Chapters 4 and 5 J. A. Fromme and M. A. Golberg consider the problem of an oscillating airfoil in a windtunnel and that of an oscillating airfoil with flap in a free stream. For the first problem Bland's method for solving the integral equation is followed and extended. For the second problem various methods are being compared. A. Goldman and W. Visscher discuss in Chapter 6 applications of integral equations in particle-size statistics. The problem here is to draw conclusions for the three-dimensional distribution if only measurements in two-dimensional sections are available. Chapter 7 by G. Wahba is on smoothing and ill-posed problems with the emphasis on the method of weighted cross-validation. Then, in Chapter 8, H. Kagiwada and R. Kalaba describe the current status of imbedding methods for integral equations. They include new developments for application in various fields as control and filtering, multiple scattering, wave propagation, solid and fluid mechanics. In Chapter 9 J. M. Bownds deals with an initial-value method for quickly solving Volterra integral equations, while in Chapter 10 M. A. Golberg shows that if in the method of Bownds, a variable-step integrator is used instead of a fixed-step integrator, the accuracy can be raised significantly. Chapter 11 by L. B. Rall is mainly on the construction of resolvent kernels for Fredholm equations of the second kind with symmetric separable kernels. Such kernels occur frequently as Green's functions for two-point boundary-value problems for ordinary differential operators. J. Casti gives in Chapter 12 an algebraic classification of Fredholm integral operators. Finally, in Chapter 13, the editor shows that linear and non-linear Fredholm equations with semidegenerate kernels are equivalent to two-point boundary-value problems for a system of ordinary differential equations and a new class of numerical algorithms is developed for the original integral equations.

Reviewer recommends book to those interested in the numerical solution of integral equations.

A. I. van de Vooren.

K. B. Wolf, **Integral transforms in science and engineering**, Mathematical Concepts and Methods in Science and Engineering, Vol. 11, Plenum Press, New York and London, 1979, xiv + 489 pp., price $ 32.50.

This is a book that describes transform techniques with many illustrations from various fields. It is divided into four parts: (i) Finite dimensional vector spaces and the Fourier transform, (ii) Fourier and Bessel series, (iii) Fourier and related integral transforms, (iv) Canonical transforms. The first three parts contain material that can also be found elsewhere (see, for instance, the book on Fourier series and integrals by Dym and McKean), but it is presented here with emphasis on the point of view of a physicist. The material in the last part describes more recent work about a continuum of transforms which includes Fourier transforms but also Bargmann transforms. As the author says: the pace and the tone of the text have been set by the balance of intuition and rigor as practiced in applied mathematics.

H. S. V. de Snoo.

Forthcoming papers

The following papers have been accepted for publication:

1. The flow and heat transfer between a torsionally oscillating and a stationary disk, by N. Dōhara.
2. High Reynolds number flows with closed streamlines, by N. Riley.
3. A boundary integral equation method for a Neumann boundary problem for force-free fields, by R. Kress.
4. Effect of stratification on hydrodynamic pressures on dams, by A. T. Chwang.
5. On the departure of a sphere from contact with a permeable membrane, by A. Nir.
6. The fluid-filled cylindrical membrane container, by C. Y. Wang.
7. Steady flow and static stability of airfoils in extreme ground effect, by E. O. Tuck.