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Book reviews

G. B. Whitham, **Linear and nonlinear waves,** Wiley-Interscience, New York, London, 1974, xvi + 636 pages, price £12.15.

This outstanding book gives a fairly complete account of the theory of wave propagation. Although the title might suggest that linear and nonlinear waves are equally dealt with, the emphasis is really on nonlinear phenomena. Nevertheless, since the latter cannot be understood completely without the corresponding linearised theory, linear waves receive due attention.

The book is divided into two parts, the first part dealing with hyperbolic waves (that is, waves governed by hyperbolic equations), the second with dispersive waves. Both types of waves have been (and still are) the subject of the author's own research, and he has made important contributions to the theory of both of them, mainly in relation to fluid mechanics. Therefore, it is no wonder that, although a large number of different wave phenomena are discussed in the book, most attention is paid to waves in fluids.

After the introductory Chapter 1, the treatment of hyperbolic waves starts with Chapter 2, in which nonlinear first-order kinematical wave equations are studied. The chapter is mainly concerned with shock wave formation and shock fitting for that type of equations. Chapter 3 presents specific applications like traffic flow (very amusing) and flood waves. Burgers' equation is dealt with in Chapter 4, and Chapter 5 presents some general theory of hyperbolic systems of equations needed in the sequel. Chapter 6 is an extensive one, being a self-contained account of the fundamentals of gas dynamics with an emphasis on shock waves. The (linear) wave equation is dealt with in Chapter 7, with applications to supersonic slender body theory and with an introduction to geometrical optics. The three final chapters of Part I are on shock dynamics, propagation of weak shocks, and wave hierarchies.

The second part of the book, devoted to dispersive waves, starts with a chapter on linear dispersive waves (Chapter 11), introducing well-known concepts such as dispersion relation and group velocity. Chapter 12 deals with wave patterns (mainly for waves in fluids) which can be studied using only the dispersion relation. An extensive treatment of water waves (including nonlinear ones like Stokes', cnoidal and solitary waves) is presented in Chapter 13. The core of Part II of the book is Chapter 14 on nonlinear dispersion, in which the variational method involving the averaged Lagrangian principle (developed by the author himself) is presented. Chapter 15 is concerned with some general consequences of the preceding chapter, and Chapter 16 gives a number of applications to nonlinear optics, water waves and the Korteweg-de Vries equation. The last chapter deals with important recent developments on exact solutions and interacting solitons.

The book is written in a very attractive and clear style with a nice belance between mathematics and physical intuition. At a few places there is some inaccuracy in the presentation. The work is quite self-contained, since only some knowledge of a few well-known

methods of mathematical physics is required. It is beyond doubt that this book will be the standard reference text in the field for many years to come.

H. W. Hoogstraten

P. Henrici, **Applied and computational complex analysis, Volume I.** Wiley-Interscience, New York, London, 1974, xi + 682 pages, price £13.50.

This book is the first volume of a projected three-volume series that will present applications as well as the basic theory of analytic functions of one or several complex variables. Applications are presented to other branches of mathematics, to science and engineering, and to computation. The author's philosophy is an algorithmic one: a problem is not considered solved unless an algorithm for constructing the solution has been found. In line with this philosophy, the complex variable theory is presented according to the approach of Weierstrass, based on power series. After laying the necessary foundations in the theory of power series and of complex integration, the applications and basic theory of conformal mapping (without the Riemann mapping theorem) and the solution of algebraic and transcendental equations are dealt with in this first volume. The seven chapters are entitled: Formal power series, Functions analytic at a point, Analytic continuation, Complex integration, Conformal mapping, Polynomials, and Partial fractions. Throughout the book, many excercises are given. The second and third volume will cover subjects connected with, respectively, ordinary and partial differential equations.

Textbooks like this, in which a self-contained, rigourous and detailed presentation of the theory is given together with many interesting applications to other fields, are very rare. It is an extremely well-written book, which is very suitable for self-study. A fascinating, modern course of complex analysis.

H. W. Hoogstraten