

progress of computer techniques for orthogonal transformations, including the Fourier transform. Their expertise is a guarantee of first-hand accounts of the latest developments in these techniques.

The subject is treated with practical applications and implementation in mind. This makes the book valuable for both scientists and engineers dealing with transmission or compression of large quantities of data.

The presentation is concise (about 180 pages) but includes discussion and theoretical development when appropriate. Special tribute must be paid to the author's excellent choice of highly informative illustrations.

The topics covered are chiefly concerned with the processing of two-dimension pictures in the transformed domain, either through purely optical techniques or through various computed orthogonal transformations (discrete Fourier, Hadamard and so on). Possible applications to pattern recognition and economical coding of signals are suggested. Sampling techniques in the transformed domain and their effect on the reconstructed image are considered in some detail. The generous bibliography gives the reader a good introduction to further study of specialized applications.

The examples chosen reflect the experiments of the authors with photographs from space probes. Their conclusions, however, can easily be extended to any field where photographs or graphical patterns are processed (characters or pattern recognition, aerial photographs, biological and medical research, geological and sociological surveys and complex multivariate statistics among others) and wherever optical Fourier transform techniques can be enhanced or simulated on binary computers.

J. A. G. HALÉ

Nonlinear Problems

Iterative Solution of Nonlinear Equations in Several Variables. By J. M. Ortega and W. C. Rheinboldt. (Computer Science and Applied Mathematics: a Series of Monographs and Textbooks.) Pp. xx+572. (Academic: New York and London, August 1970.) £11.20.

THIS book is a result of five years' work by the authors and several PhD students at the University of Maryland with the intention of producing a text for postgraduate courses and a reference source for research workers.

The system under consideration is a set of n real nonlinear equations in n variables with isolated real solutions, which occurs in many fields of research such as nonlinear partial difference

equations and nonlinear multivariate regression analysis.

Approximately 90 pages are devoted to basic mathematical requirements in algebra and analysis, 90 pages to theorems on the existence of solutions, 100 pages to the description of major iterative methods, and 240 pages to the analysis of convergence. Considerable reference is made to the methods of Newton and successive over-relaxation, which have been treated in books by Ostrowski (1966) and Varga (1962).

Although this is indeed a comprehensive textbook, its scope is necessarily limited in several respects. There is no discussion of iterative methods which require the evaluation of second or higher derivatives; infinite dimensional spaces are not considered; no numerical examples are given; and there is no treatment of computational error. All these omissions are justified by the authors, who give references to other works which deal with these topics. Ill-conditioned equations, however, do not appear to merit comment. Partly as a result of these limitations, it is likely that this book will prove to be of greater use to postgraduate mathematics students, and their lecturers and supervisors, than to physicists and engineers engaged in the solution of specific problems.

The above remarks are not intended to detract from the value of this book. The presentation is admirably lucid, and the publishers are to be commended for an excellent standard of production. The book contains useful exercises, numerous informative notes and remarks, a very extensive bibliography, and author and subject indices.

A. FONDA

Guide to Examiners

The Principles of Objective Testing in Physics. By J. G. Houston. (The Principles of Objective Testing Series.) Pp. vii+102. (Heinemann: Educational: London and Edinburgh, August 1970.) £1.25.

THE author of this book has clearly had in mind that his readers will be more or less skilled already as examiners, and receptive in varying degrees to the suggestion that improvement in their present practice is possible. He accordingly assumes little constructive thought about the aims of examining, and so inevitably includes a great deal which many of those who use the book will regard as inapplicable to themselves. In fact, few of them will not gain by following through his clearly developed thesis, which is prepared to emphasize as strongly what objective testing, even at its best, is not fitted to do as what it can do well. It quickly becomes apparent that an effective introduction

to objective testing gains very much by being linked to the problems of a particular subject. But equally, even within that subject, although this book is directly aimed towards those teaching in the schools, it will undoubtedly provide helpful guidance to people also who have to examine and test at other levels. The book bears much evidence of care in its preparation, and this has certainly been rewarding.

J. G. WILSON

Crystal Structures

Crystals and X-rays. By H. S. Lipson. (The Wykeham Science Series, 13.) Pp. xiv+198. (Wykeham: London and Winchester, October 1970.) £1.75.

THE avowed aim of the Wykeham Science Series is "To introduce the present state of science as a university subject to students approaching or starting their university careers . . .". The problem is how, on the one hand, to avoid an erudite exposition while, on the other hand, not producing too sketchy an outline. Crystal structure, and the mechanics of its determination, is not an easy subject.

The book starts from the optical microscope and leads on to the wave theory, Abbé theory and the limit of resolution. From this, consideration is given to X-rays, their discovery, production, properties and uses in the determination of crystal structure. The treatment of this is in historical order, includes examples of the determination of actual structures and covers all the principal techniques in use today. Of necessity, in a volume of this size, the development of the subject proceeds very fast. I wonder if the uninitiated can be expected to cope with the rate at which ideas and terminology are introduced without recourse to a lot of outside references or to the help of a sixth form master well versed in the subject of crystallography (and how many are?). The subject matter is treated more than superficially, Miller indices being introduced perforce and reciprocal lattices and Fourier methods being just two of the topics that students could find difficult.

The later chapters deal in an interesting manner with discoveries made by X-ray diffraction methods and the technological uses of X-rays. It seems a pity that many sixth form readers will not read these chapters, through having become bogged down in some of the rather heavy work earlier on.

The book is lavishly illustrated with X-ray photographs, diagrams and the like, is well cross referenced and has a good index. It deserves a place on the shelves of any sixth form library but the student may need some encouragement with the middle chapters.

D. A. TURNER