Book Reviews

Advances in Computers. vol. 1. Franz L. Alt, Ed. Academic Press, New York, 1960. x + 316 pp. Illus. $10.

Mathematical Methods for Digital Computers. Anthony Ralston and Herbert S. Wilf, Eds. Wiley, New York, 1960. xi + 293 pp. Illus. $9.

Progress in Automation. vol. 1. Andrew D. Booth, Ed. Academic Press, New York; Butterworths, London, 1960. viii + 231 pp. Illus. $8.50.

Automatic Data-Processing Systems. Principles and procedures. Robert H. Gregory and Richard L. Van Horn. Wadsworth, San Francisco, Calif., 1960. xii + 705 pp. Illus.

Management Organization and the Computer. George P. Shultz and Thomas L. Whisler, Eds. Free Press, Glencoe, Ill., 1960. xvii + 257 pp. $7.50.

The literature on computers has many facets which reflect the manifold applications of these instruments in our everyday life. A glance at volume 1 of *Advances in Computers,* the first of a new series, is sufficient to demonstrate that the role of the computer is not confined to the scientific and engineering calculations for which the early computers were developed. Side by side with the articles "Numerical weather prediction" and "Binary arithmetic" appear the papers "General-purpose programming for business applications," "The present status of automatic translation of languages," "Programming computers to play games," and "Machine recognition of spoken words." Each of these survey articles is written by an authority in the field and is accompanied by a comprehensive bibliography. Almost all indicate the progress made in the field to date, as well as the work still to be done before the problems involved can be considered solved, if, indeed, they ever can be. Thus Bar-Hillel makes a strong case for the impossibility of ever achieving fully automatic high quality translation by computers. On the other hand, there is reasonable expectation that weather can eventually be predicted with great accuracy by machines.

The use of a computer as a calculating instrument is most fully realized when it solves scientific and engineering problems. For this purpose, the branch of mathematics called numerical analysis provides the tools with which these problems, once they have been well formulated in mathematical terms, can be tackled to yield numerical results. Because automatic digital computers operate much faster than hand computers and have different logical characteristics, numerical analysis has undergone a tremendous upheaval with their appearance. The greater speed and capacity of these machines have made possible the use of techniques which were not feasible previously and have stimulated the search for new algorithms as more difficult problems are posed for solution. *Mathematical Methods for Digital Computers* is the first book which deals solely with computer-oriented numerical analysis.

The book consists of an introduction, which explains the general layout of each chapter, and 26 chapters, which are divided into six sections, on the generation of elementary functions, matrices and linear equations, ordinary differential equations, statistics, and miscellaneous methods. The last-mentioned category includes solutions of polynomial equations, quadrature, Fourier analysis, linear programming, and network analysis. The layout of each chapter except the first, which is of a special nature, is uniform and follows this outline: function of method, mathematical discussion, summary of the calculation procedure, flow chart with description, subroutines needed, sample problem, memory requirements, estimation of running time, and references. The individual chapters are written by experts in the different fields, and hence the treatment is uneven. Some authors treat the problem in its full generality, from beginning to end, while others deal adequately with the theory but treat only a simplified version in the flow chart. In addition, several fairly widespread methods are omitted, while others of limited application are included. However, this is a good first effort to fill a gap in the rapidly growing literature on computers.

Among the many users of computers, the large industrial concerns are best able to exploit their diverse capabilities to the utmost. Thus, in addition to performing the scientific calculations associated with research and development and with mathematical programming, the computer is used to handle the paper work of the firm and to control the manufacturing process. This latter use is, at present, a fringe use of computers, but its importance is bound to increase with time. *Progress in Automation* is devoted to British experience in this field. This collection of articles consists of an introduction by the editor and two parts, "Methods" and "Applications." The papers in part 1 deal with some of the fundamental tools and techniques useful in automation, while those in part 2 discuss systems which are already in operation and which have a computer as one of their principal components. The articles are fairly technical and should be of great interest to engineers concerned with the field.

The information-handling aspect of computers is becoming more and more widespread, and we no longer speak of computers but of data-processing systems. A very thorough treatment of this field is given in *Automatic Data-Processing Systems.* Its 22 chapters are divided into seven parts: "Orientation," "Automatic equipment," "Programming and processing procedures," "Principles of processing systems," "Systems design," "Equipment acquisition and utilization," and "System re-examination and prospective developments." In addition there are three appendixes: "History of computation and data-processing devices," "Questions and problems," and "Glossary of automatic data-processing terminology." Each paper is followed by a detailed summary, which indicates the coverage of the chapter, and by a list of references and supplemental readings. (These entries are accompanied by a brief summary of their contents, which greatly increases their usefulness.) Finally, there are 11 tables giving up-to-date information on most of the data-processing systems now on the market. This work contains a storehouse of information suitable for the needs of the various groups concerned with data processing,

and the authors are to be congratulated for the excellent presentation.

Of more limited scope is the book *Management Organization and the Computer*, which is the proceedings of a seminar sponsored by the graduate school of business of the University of Chicago and by the McKinsey Foundation. This book is concerned with the changes a company has to undergo when a computer is introduced. It contains articles relating to what the editors call information technology as well as articles relating to the concepts and problems of organization. An additional series of articles involves the experience of five companies that have installed computers. Many of these papers are followed with discussions and comments made by the participants; these remarks help clarify the subject matter. The book is intended for the higher levels of management where major decisions are made; the decision to install a data-processing system in a company, with all the upheaval involved in such an act, is indeed a major decision. However, in view of the rapidly increasing flow of information throughout the business enterprise, the question is not whether to install a computer, but rather how to do it most efficiently. This book should help to find the answer.

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Henry Cavendish. His life and scientific work. A. J. Berry. Hutchinson, London, 1960. 208 pp. Illus. 35s.

When Cavendish died in 1810, Humphry Davy said of him: "His name will be an object of more veneration in future ages than at the present moment . . . it will remain illustrious in the annals of science. . ." In a biography of Cavendish published in 1851, George Wilson probed deeply into the "water controversy" between Priestley, Watt, Cavendish, and Lavoisier; Wilson's study of what these men meant by *inflammable air* and *phlogiston* is still indispensable to the specialist. Since then, Cavendish's many unpublished papers have become available in print. Now Berry gives us the first comprehensive survey of this work which extended to many different fields of science. This man of "morbid shyness and timidity" had "the remarkable gift of knowing almost intuitively what kinds of problems were worth investigation" (page 21). Berry considers him to be the founder of water analysis and points out that Cavendish had clear concepts of chemical proportions and equivalent weights. In a paper published in 1781, Cavendish spoke of the particles of his electric fluid, but he adhered to Newton's opinion of heat as the internal motion of the particles of bodies against Black's hypothesis of a matter of heat. In his electrical researches he was, as Maxwell said, "his own galvanometer." This master of the accurate experiment noticed that "1/120 of the bulk of the phlogisticated air" remained unreactive. More than a century later this observation led to the discovery of the inert gases. Berry's account here conflicts with that of Ramsay himself.

The historians of science will be grateful to Berry for his well-balanced and thorough study. Those interested in "the" scientific method will find here much to capture their attention, particularly in Cavendish's approach to the problem of the "Electric Ray or Torpedo." Berry has painted a fascinating picture of a living embodiment of that abstraction, the pure scientist.

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Progress in Solid Mechanics. vol. 1. I. N. Sneddon and R. Hill, Eds. North-Holland, Amsterdam; Interscience, New York, 1960. xii + 448 pp. $15.50.

The aims and scope of this book are best described by quoting from its preface: "At the present time the mechanics of solids is perhaps the most rapidly expanding branch of applied mathematics. . . . It is becoming more and more desirable for engineers and physicists as well as applied mathematicians to study solid mechanics as a whole, and yet increasingly difficult for them to do so since important papers may appear in journals of widely differing character. This impasse may be met only by review articles of the highest standard which from time to time summarize and unify the most recent work in a particular field or group of fields. The present volume is the first in a series directed toward that end. The papers it contains are mainly concerned with reviewing recent theoretical studies in solid mechanics, but it is hoped that future volumes will contain surveys of recent experimental investigations. . . . The main emphasis [of this series] will be on basic principles and mathematical techniques of continuum mechanics, in all its aspects, together with experimental work of a fundamental kind."

The British editors are well qualified for this task, and it may be said that this first volume is highly successful in meeting the purpose set forth in the preface. Five of the contributors are British, and there is one each from Germany, Holland, and Japan. Five of the chapters cover subjects of rather broad general interest, while the other three discussions present results of more limited scope, yet of considerable interest.

The chapter on viscoelastic waves, by S. C. Hunter, is an interesting and logically developed account of the recent work on wave propagation in viscoelastic (or anelastic) materials. Both the Fourier and Laplace transform approaches are covered, with both their equivalence and the cases in which one or the other approach has practical advantages clearly pointed out. The various formulations of the constitutive equations applicable to linear materials showing viscoelastic or anelastic behavior are derived in a fashion suitable for the purposes of this chapter, although neither this section nor the discussion of the experimental results for polymers is, or was intended to be, complete.

The material on matrices of transmission in beam problems, by K. Marguerre, presents a formulation of the dynamics of framed structures with members of variable section not necessarily straight. Torsion can also be included. This paper should be of value to engineers and computers interested in numerical analysis.

H. G. Hopkins discusses the dynamic expansion of spherical cavities in metals produced by explosive loading. Although it is necessary to introduce drastic simplifications—such as neglect of the outgoing shock wave in the metal and the oscillatory character of the gas pressure in the early stages—in order to obtain a manageable problem, nevertheless it is possible to reach conclusions of both practical and theoretical interest.

W. T. Koiter presents a concise but quite complete survey of the general theorems of the mathematical theory of plasticity for isotropic bodies. Existence and uniqueness theorems are discussed, together with minimum principles and the bounds associated with limit analysis, including plastic collapse and shake-