to the more deeply committed student of the subject.

This book should have a wide appeal to applied scientists and engineers who seek an introductory (or refresher) account of steady-state neutron-transport theory with applications to nuclear reactors. Furthermore, it should prove valuable to students in nuclear engineering who have reached at least an intermediate level in their study of reactor theory.

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About the Reviewer: Professor R. K. Osborn teaches in the Department of Nuclear Engineering of the University of Michigan. He is a coauthor, with S. Yip, of Fundamentals of Neutron Transport Theory, *a forthcoming ANS monograph. He was previously at ORNL where he worked in nuclear and reactor physics and taught at ORSORT.*

Advances in Computers, Volume 4. Edited by Franz L. Alt and Morris Rubinoff. Academic Press Inc., New York, (1963). 312 pp. $12.00.

This book, Volume 4 of *Advances in Computers*, is the latest, but perhaps the least interesting to people in the nuclear science and engineering fields, of the four volumes which have been published in this series. It was the intention of the editors to present in this volume a broader coverage of various aspects of the computer field. This has been accomplished, but at the expense of making the book less interesting to people involved in technical applications of computers.

The book consists of five articles:

Article 1 - "The Formulation of Data Processing Problems for Computers" by William C. McGee, page 1 through 52.

Article 2 - "All-Magnetic Circuit Techniques" by David R. Bennion and Hewitt D. Crane, page 54 through 133.

Article 3 - "Computer Education" by Howard E. Tompkins, page 135 through 168.

Article 4 - "Digital Fluid Logic Elements" by H. H. Glaettli, page 169 through 243.

Article 5 - "Multiple Computer Systems" by William A. Curtin, page 245 through 303.

Even though Articles 2 and 4 deal with computer hardware, it is not the hardware of the commonly used scientific or engineering computer. Article 1 is concerned with data-processing problems and again is not aimed for technical computing people. The article on computer education is of considerable interest. The final article dealing with multiple computer systems does have relevance for technical computations but is of secondary importance for most scientific calculations.

The first article is concerned with the commercial use of computers for the solving of data-processing problems. Although data-processing problems have been run on computers for a decade, it is only in the last four years that there has been deep interest in the fundamental aspects of data processing. One of the basic problems has been the choosing of an efficient and convenient programming language. The major effort, without too much success, has gone into developing a machine-independent data-processing language. COBOL, FACT, and COMTRAN are leading representatives of the procedural languages. Presently there also exists considerable interest in non-procedural (not step-by-step) languages. It would appear that data-processing problems and languages are less well-formulated and determined than their technical counterparts.

The article dealing with all-magnetic circuit techniques appears to be quite thorough and comprehensive. This article reviews the status and the techniques involved in replacing magnetic cores and wires, and perhaps resistors. The interest in all-magnetic logic circuits was originally justified on the basis of their reliability. The all-magnetic systems are limited primarily by speed and are therefore not suitable for general purpose, high-speed computers. In certain special applications, such as easy input-output communication and for reliability in nuclear radiation fields, it appears that all-magnetic circuit techniques will have considerable use.

Article 4 also deals with hardware but of a non-electronic nature. The logical elements are determined by hydraulic or pneumatic circuits. Again, this article deals with recent exploratory work and the applications to computers is not yet clear. It would appear that these fluid logic elements may have distinct advantages in situations where either mechanical input signals are initiated or where mechanical output signals are desired, and a limited amount of computing is required.

The article on computer education is in many ways the most interesting one in the book. A number of questions immediately arise in the mind of the reader of this article. Typical of these is the question of the proper relationship between universities and industry in the educating of computer personnel. Comments are made concerning present computer education in industry, colleges, high schools, and communities. Remarks are also

made concerning standards and programmed instruction.

In the previous volume, a discussion was given of multiprogramming. The final articles deal with multiple computer systems and is a dual to the article on multiprogramming. A multiple computer is not easily defined out certainly implies the use of multiple arithmetic elements and multiple memory units, and probably multiple input-output devices. One section deals with a system-design approach for a hypothetical multiple computer. A later section discusses four existing multiple computer systems. Comments are given on general programming considerations and multiple computer scheduling. The multiple computer art is just well-started and undoubtedly there will be considerable advances during the next few years.

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About the Reviewer: Ward Sangren is a vice-president of Computer Applications Incorporated. He is the author of a book on digital computers and nuclear reactor calculations. From 1956 to 1961 he was at General Atomic. Prior to that he was at Curtiss-Wright and at the Mathematics Panel of Oak Ridge National Laboratory, and was for two years an assistant professor of mathematics at Miami University.

Theory and Method of Nuclear Reactor Calculations. Edited by G. I. Marchuk. Authorized Translation from the Russian by Consultants Bureau, New York (1964). 199 pp. $40.00.

This book is a collection of papers by many authors, describing original work done prior to 1962, and frequently citing Second Geneva Conference articles. Thus, the book closely resembles a back issue of a nuclear science journal—an issue worth reading by those who follow the literature in transport theory, resonance absorption, and neutron cross sections. These three topics account for twelve papers in the collection; another six deal with miscellaneous topics in reactor calculation methods.

Among the six papers devoted to transport theory, two concern the properties and application of even-order P_N approximations—a topic which has only recently come under investigation in the United States. The extensive treatment (35 pp) includes numerical examples of problems for which the even-order solutions are superior to the odd, owing to an improvement in the accuracy of the fundamental relaxation length. Additionally, these papers comprise an application of the Russian difference-equation factorization method discussed by Marchuk in his textbook on reactor calculations[1].

Three papers deal with a particular transport problem, namely the distribution of neutrons from a point source. In the first of these, the problem of singularities in the space-angle distribution from an isotropic point source is treated by a modification of the S_N technique; in the second, by application of the P_N expansions. The third of these papers is a numerical example of the inversion of the moments method to produce space-energy distributions in infinite hydrogeneous media.

The sixth transport-theory paper deals primarily with the internationally vexatious problem of the slow rate of convergence of the S_N equations. The techniques of renormalization, extrapolation and over-relaxation as applied to the S_N equations, are shown to significantly accelerate pointwise convergence.

The set of three fundamental papers on resonance absorption are concerned, as the recent United States effort has been, with improving the treatment of deviations from the basic narrow-resonance formulae. In a paper concerned with direct numerical solution of the Boltzmann equation for homogeneous media, the departure of the collision density from the narrow-resonance shape is computed—a technique which should be much more conservative of machine time, for comparable accuracy, than the corresponding brute force attack taken in the United States.

The three papers on fast-neutron cross sections include an extensive (16 pp.) discussion of the application of statistics to nuclear physics measurements, optical-model transport cross-section calculations, and some results of inelastic scattering cross sections for iron.

The translation from the Russian has produced a quite readable text, with two minor exceptions. In many places, the term "kinetic equation" appears in place of "transport equation." Thus, the paper "Solution of the Kinetic Equations by the S_N Method" is only a teaser to the reader interested in space-dependent kinetics. Secondly, the names of some American authors have been transliterated rather than translated; however, references to J. Chernik and N. Korngold will probably not bother American readers (except, possibly, J. Chernick and N. Corngold). The only serious defect of the

[1] G. I. MARCHUK, *Numerical Methods for Nuclear Reactor Calculations*, Translated from Russian by Consultants Bureau, New York, (1959). Reviewed in *Nucl. Sci. Eng.*, **12**, 317 (1962).