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Book Reviews

Proceedings of the 1966 Heat Transfer and Fluid Mechanics Institute. Edited by Michael A. Saad and James A. Miller. Cloth bound. Stanford University Press, Stanford, California. 444 pp. $12.50.

The Heat Transfer and Fluid Mechanics Institute concerns itself with current fundamental research in fluid mechanics, heat transfer, and related fields, according to the editors of the present volume, and in this reviewer's opinion, this is an accurate summation of the contents of the present volume. The 1966 meeting, the 19th Annual Meeting of the Institute, was held at Santa Clara, California, June 22-24, 1966, jointly sponsored by the University of Santa Clara and the US Naval Postgraduate School. National technical societies cosponsoring the Institute are: American Institute of Aeronautics and Astronautics; American Institute of Chemical Engineers; American Society of Heating, Refrigerating, and Air-conditioning Engineers; and American Society of Mechanical Engineers.

A very broad range of papers is included, which may be broken down roughly into the following topic areas: 1) boundary-layer flows including stability, non-Newtonian flow, and shock-boundary layer interactions; 2) two-phase flows and change of phase; 3) free and forced convective heat and mass transfer; 4) wakes and separated regions, and radiation gas dynamics; 5) special problems such as vortex flows, fluid motion in modified force fields, radiation heat transfer, and heat transfer in restricted areas.

To this reviewer, the quality of the papers seems uniformly high. The bulk of the material presented is oriented toward high-speed aerodynamics applications and, hence, from the viewpoint of the nuclear scientist and engineer, perhaps would be of interest mainly in space propulsion applications. Of the 24 papers in the book, 10 are in this general topic area.

On the other hand, there are single papers on natural convection in a closed space, liquid-metal flow and heat transfer, condensation in nozzle flow, wall turbulence, effect of electric fields on gas heat transfer, gas dynamics of particulate-gas flows, and the behavior of the free surface of liquid under off-axis acceleration. In addition, there are three papers concerned with two-phase flow phenomena, and three (including one with abstract only) concerned with thermal radiation. There are no papers directly concerned with nuclear technology or techniques.

In this reviewer's opinion, the book should definitely be available on the shelves of technical libraries in the area of coverage that includes fluid flow and heat transfer. It is a questionable item for those concerned only with nuclear technology.

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September 22, 1966

About the Reviewer: Professor Hammitt has been at the University of Michigan since 1956; first with the Mechanical Engineering Department and more recently with Nuclear Engineering, where his research interests have been in fluid flow and heat transfer. Earlier, he had about ten years' industrial experience in design and development of turbomachinery. His graduate training was at Pennsylvania, Stevens, and Michigan.

Neutron Dynamics and Control. Proceedings of Symposium at University of Arizona, April 5-7, 1965. AEC 7 Symposium Series, USAEC Division of Technical Information, Oak Ridge, Tennessee. David L. Hetrick and Lynn E. Weaver, Coordinators. (May 1966). $4.50.

Neutron Dynamics and Control is the state-of-the-art compilation of papers presented at The Symposium on Nuclear Engineering at the University of Arizona in April, 1965. These Proceedings are the sequel to *Reactor Kinetics and Control,* the papers resulting from a similar conference in 1963.

In the selection of papers for a conference, sometimes individual papers are difficult to classify or to fit into preselected topic areas. In this volume, the papers fall into five general categories with a few exceptions. These are nonlinear stability, optimal control, pulsed-neutron measurements, reactor-noise analysis, and large power burst reactor phenomena.

At the conference, and reflected in the papers, particular excitement was generated in new concepts and treatments of reactor stability. New, and undoubtedly later to be proven elementary, nonlinear stability critera of coupled cores fill about one-third of the volume. To be "in," one must now discuss stability in terms of Lyapunov, Welton, and Lagrange; Nyquist and Bode are dead.

The old school dies hard, however, particularly in the field of space-time dynamics. The struggle of those experimenters and theorists who are attempting to extend point-source lumped reactivity kinetic concepts to the more complex larger reactors with those who have almost completely abandoned these techniques to think in terms of spacial kinetics and modal concepts, is recorded between the lines of the conference proceedings. The two schools are typified by the interpretation of the now well-known experimental result that neutron flux oscillations corresponding to a localized oscillating absorber seem to be functions of both the frequency of oscillation and the position of the neutron detector.

Gyftopoulas ("Some Applications of Mathematical Methods to Nuclear Engineering at MIT") asks the question "Are the parameters of transfer functions space dependent?" Rajagopal ("Measurement of Local Kinetic Parameters in the Saxton Reactor"), Kylstra, Gallagher, and others, say "Yes." Rajagopal presents several curves and interpretations whereby using a local mechanical absorption-type oscillator—having a fixed assigned reactivity—he is able to determine various feedback coefficients in the classical manner from the oscillator to multipositioned detectors.

Gyftopoulas, Henry, Kaplan, and their more sophisticated new school, say "No." Their argument is ". . . that the same high modes that contribute to the dependence of the flux oscillations on position contribute also to the reactivity that corresponds to the oscillating absorber." And ". . . if reactivity is computed in a consistent manner, then the ratio of flux-to-reactivity is independent of position."

Another large fraction of the book is devoted to optimal control solutions. Optimal control has gained very little headway in conventional power reactor systems, probably because simpler methods do the job adequately and economically. In the case of nuclear rocket control, however, a number of factors contribute to the usefulness of a more complex control system. In particular, it will be realized that nuclear rocket control is accomplished primarily by the use of propellant flow as the principal control parameter. As the amount of propellant available in today's type of nuclear rocket is strictly limited, it is essential that the control function be performed with precision. Several useful aspects and systems are presented in the conference proceedings by Kliger, Mohler, Weaver, and others.

The noise-analysis papers in the volume are few in number and represent only the spot thinking of some of the leading theoreticians. More comprehensive information will be available from the Proceedings of the University of Florida Noise Symposium Series. The papers on pulsed-neutron operation are more numerous and of a great variety, making cohesive comment difficult. The one by Becker and Quisenberry ("Spacial Dependance of Pulse Neutron Reactivity Measurements") does, however, attempt to bridge the gap between the above-mentioned classical fixed local reactivity measurement theory and the newer modal interpretations.

For a most interesting historical state-of-the-art reference as of 1965, *Neutron Dynamics and Control* is a must for all serious scientists in the field. Messrs. Hetrick and Weaver are to be commended not only for the fine conference and the excellent editorial coordination, but also for the obvious quality leadership they have brought to the University of Arizona in this field.

M. A. Schultz

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October 27, 1966

About the Reviewer: M. A. Schultz is one of the early workers in neutron kinetics and control. At the conference in Tucson where the above proceedings were generated, he was described by Jack Chernick to the local newspaper, as an old dinosaur who still used analog computers. Mr. Schultz has since reformed and he is now selling digital equipment as President of Milletron, Incorporated of Pittsburgh, Pennsylvania.

Introductory Nuclear Theory (Second Edition). By L. R. B. Elton. W. B. Saunders Company, Philadelphia, Pennsylvania (June 1966). 332 pp. $6.75.

Since the first edition of the book under review was published in 1959, the main interest in nuclear physics has shifted from the investigation of nuclear forces to that of nuclear structure. Reflecting this trend, Professor Elton has carefully recast this new edition. Many chapters have been brought up to date, and new sections have been added which account for a net increase of 43 pages. Among the main additions are a treatment of the scattering of polarized beams, a more thorough treatment of parity violation and the coupling constants in β decay, and a section on the newly developing field of direct reactions.

The present textbook is written for seniors or first-year graduate students in physics or nuclear engineering. The book is almost self-contained and should be helpful also to students who wish to study the subject independently outside the classroom. No previous knowledge of the properties of nuclei is assumed and a knowledge of elementary nonrelativistic quantum mechanics is sufficient for its reading. By his masterly treatment of principles and judicous selection of topics, Professor Elton presents the essentials of theoretical nuclear physics in a compact and elegant form.

The content is suitably organized and most subjects are covered well. The first two chapters are concerned with qualitative facts and general properties of nuclei. Two-nucleon systems at low energies and nuclear forces are dealt with in the next two chapters. A fairly complete outline of various nuclear models is given in Chapter 5 with special attention given to the shell and collective models. It is followed by a chapter on nuclear reactions including recent developments in optical model and direct reactions. Treatments of nuclear disintegration, interaction of nuclei with the electromagnetic field, nuclear beta decay, and an outline of the meson theory of nuclear forces form the last four chapters. Because of his many contributions to several aspects of scattering and reaction problems, the author is able to write authoritatively and lucidly on these subjects.

The problems at the end of each chapter should be useful to the student to test his understanding of the topics discussed. Many are mathematical exercises in the use of quantum mechanics on nuclear physics problems. In the new edition, some mathematical material needed in several chapters is put into an Appendix. A comprehensive, up-to-date, 20-page Table of Nuclear Constants should be useful to both students and research workers in the nuclear field. For detailed studies beyond the scope of the present text, a list of books and adequate references to the original literature is given. Almost all the references listed in the second edition are new, indicating the rapid progress being made in nuclear physics.

The book would have been more challenging and useful with the addition of the general and powerful tools of angular momentum theory often called Racah algebra. Since the deuteron stripping is the best-known direct reaction and plays an important role in nuclear spectroscopy, the omission of its elementary theory based on the plane-wave Born approximation is somewhat disappointing.

The book is, as a whole, by far the best introductory text on nuclear theory available today. The relatively low price is another attractive feature of this excellent book.

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November 4, 1966

About the Reviewer: J. Y. Park is an assistant professor of Physics at North Carolina State University. He received his BS from Seoul National University, MS from Rensselaer Polytechnic Institute, and PhD from the University of North Carolina at Chapel Hill. His main research interest lies in the areas of nuclear structure and reactions, especially direct reaction theories. He is a member of the American Physical Society, American Association of Physics Teachers, Sigma Xi, and Sigma Pi Sigma.