Book Reviews

Introduction to Nuclear Engineering. Simmons-Boardman, New York, 1960. 2 vols. $26.00.

This two volume set is a collection of twelve previously published "Nuclear Engineering" monographs. The monographs were originally published in soft bound form by Temple Press, Ltd., London, in association with their monthly journal, *Nuclear Engineering*, during the period from 1958 through 1960. In bringing out *Introduction to Nuclear Engineering*, the present publisher has bound six monographs in each of the two hard cover volumes and supplied a new title. All else, including the numbering of the pages, remains unchanged.

The monographs included in the set are:

Volume 1:

Introduction to Nuclear Power Costs by Arnold Rochman, 1959, 50 pp.
Elementary Nuclear Physics by W. K. Mansfield, 1958, 60 pp.
Nuclear Reactor Theory by J. J. Syrett, 1958, 80 pp.
Reactor Heat Transfer by W. B. Hall, 1958, 68 pp.
Nuclear Reactor Shielding by J. R. Harrison, 1958, 68 pp.
Nuclear Reactor Control and Instrumentation by J. H. Bowen, 1959, 78 pp.

Volume 2:

Steam Cycles for Nuclear Power Plant by W. R. Wootton 1958, 66 pp.
Nuclear Reactor Materials by B. R. T. Frost and M. B. Waldron, 1959, 79 pp.
Nuclear Radiation Measurement by J. Sharpe, 1960, 61 pp.
Nuclear Reactor Optimization by P. H. Margen, 1960, 81 pp.
Approaches to Thermonuclear Power by R. F. Saxe, 1960, 65 pp.
Nuclear Reactor Stability by A. Hitchock, 1960, 61 pp.

To the reviewer's knowledge, the above titles are still available individually in the soft bound form for slightly under $3.00 each.

The first monograph, *Introduction to Nuclear Power Costs*, is a random collection of information and does not warrant reading. Some of the material is of questionable pertinence and all of it hopelessly out of date. It is unfortunate this title was included in the set and doubly so that it was selected as the lead article.

All of the remaining monographs are of a very much higher quality. All of the authors are active workers in the U.K. nuclear energy program and many are well known. Much of the writing possesses the crisp clarity we have come to expect from our British co-workers. The books are remarkably free of errors.

The eight consecutive monographs, commencing with *Elementary Nuclear Theory* and terminating with *Nuclear Radiation Measurement*, possess a certain unity when considered collectively and can, by some elasticity of definition, be considered an *Introduction to Nuclear Engineering*. As such, they are comparable in level to Glasstone's *Principles of Nuclear Reactor Engineering*. In the "monographs" the corresponding material is more concise, but the approach is generally similar. In a few places this brevity has resulted in rather large steps to be made in derivations; it would have been better to simply state the results. As might be expected, emphasis is toward gas cooled, graphite moderated, natural uranium reactors. This bias appears not only by predominantly using this system in illustrative examples, but also in the selection of material presented and depth of treatment. For example, *Reactor Heat Transfer* is devoted almost entirely to problems central to gas cooled reactors. Water, as a reactor coolant, is treated in two pages within a chapter titled "Miscellaneous Topics." Similarly, in *Steam Cycles for Nuclear Power Plant* the greatest emphasis is on indirect cycle systems in which the primary coolant experiences a substantial temperature rise in the core, i.e., gas cooled systems. Similar examples could be given in reactor theory. This bias does not detract from the presentation; in fact, it is somewhat refreshing.

Of the three remaining monographs, the two on optimization and stability treat these reactor problem areas employing classical techniques. The third, *Approaches to Thermonuclear Power*, presents a review of the principles underlying present efforts to achieve a controlled thermonuclear reaction. Here, the manner of presentation is such that the serious reader might do better by going directly to the source papers.

The bibliographies in all of the monographs are excellent.

In a foreword, the original publisher states the monographs are "intended for university and technical college students, research assistants, and qualified technicians who require a broad understanding of those topics of nuclear engineering outside their own field of study." The monographs are not elementary. To obtain a "broad understanding of these topics . . . outside their own field of study" considerably more effort than a single reading of the monograph is required.

One cannot help but reflect upon the publishing of twelve previously available monographs in a two volume set under a new title. It is true that once the prospective purchaser has decided how many of the monographs are of value to him, arithmetic will determine whether buying individual monographs or the bound set is most advantageous. In this judgment, it is not difficult to see how a certain value might be assigned to the hard cover binding; it is rather more challenging to establish the worth of the new title.

Yet, there seems to be more mileage for the publisher in this concept. On the next round, perhaps the monographs could be brought out in looseleaf form in a handsome buckram binder available at a graduated price scale according to the number selected. Of course, a new title is in order, *Selected Topics in Nuclear Engineering.*

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Protection Against Radiation. By John D. Abbatt, J. R. A. Lakey, and D. J. Mathias. Cassell, London, 1961. 235 pp., $6.50.

This is a useful text and to the layman, the physician, or the engineer it could be a prized first introduction to the subject of radiation protection. It covers a wide range of subjects including elementary physics of radiation, sources of radiation, medical care of radiation workers, dosimetry, instrumentation, maximum permissible exposure, personnel protection, shielding, and treatment of radiation effects. Because of this wide assortment of topics, all discussions are cursory and at a rather elementary level. Thus, the physicist or engineer might profit considerably from reading the chapters on radiation dosimetry, instrumentation, and personnel protection and should not waste his time reading the elementary discussions on physics of radiation or shielding. Although the health physics technician would benefit by a careful study of the entire text, the senior health physicist would not find in it much—if any—new information. For the college administrator who needs a better understanding of the problems of health physics or for the medical man who wishes to develop a greater insight into this field and better prepare himself to assist in radiation emergencies, this is a very valuable book.

A few examples of statements in the text that should be qualified are: "Radioactive elements observed in nature have a very long half-life" or "Gamma rays are a penetrating electromagnetic radiation similar to X-rays but very much more powerful." There are several statements with which the senior health physicist would take issue; for example, "Radiation dosimetry is the measurement of the intensity of radiation" or "gamma curies are curies of gamma activity." The text contains a very good assortment of tables and graphs that are useful in the rapid estimation of shielding factors, counting errors, unit conversions, etc. Some of the tables, although of value as a principal source of information for the layman or as a quick reference for the scientist, are a poor substitute for the more detailed discussions provided in the NCRP and ICRP handbooks. For example, the health physicist or engineer could refer more profitably to ICRP publication numbers 1, 2, and 3 for the authoritative and detailed discussions on maximum permissible exposure, internal dose, x-ray protection, etc. Likewise, the NCRP-NBS Handbooks provide a wealth of detailed information that can only be touched upon in this book. For example, NCRP-NBS handbooks numbers 63, 72, and 75 provide some of the best available information on the measurement of neutron flux, neutron dose and the protection against neutron radiation.

The discussion of health physics instruments not only furnishes the layman with a good, quick review of the types of instruments in use but also provides the health physicist from other countries with the opportunity to make comparisons with those instruments in common use in England. The table of levels of maximum permissible surface contamination for radioactive materials lists values that are higher than corresponding values used in the U. S., e.g., 70 times higher than those used at Oak Ridge National Laboratory. The general philosophy expressed by these authors is very good. For example, they state that since any unnecessary exposure is undesirable, we must always balance risk against acceptable potential benefit to the individual and to the community. They point out that, "In radiation work the doctor has a new colleague in the health physicist, and it is of the utmost importance that the health physicist and medical practitioner should work together as equal professional colleagues" and to the medical practitioner they caution, "It must be constantly remembered that the primary purpose of examining patients prior to or during radiation work is to protect the patient and it must never be regarded as an instrument of management."

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(About the Reviewer: Karl Z. Morgan is editor of the journal Health Physics, *and a member of the International Commission on Radiological Protection and the National Committee on Radiation Protection. He is chairman of the National and International Committees on Maximum Permissible Dose of Radiosotopes. As director of the Health Physics Division of the Oak Ridge National Laboratory, he supervises a large program of research in basic and applied problems of health physics. He is one of the original health physicists, having joined the metallurgical laboratory at the University of Chicago in 1943. He is a fellow of the American Physical Society and of the American Nuclear Society.)*

Reactor Heat Transfer. By W. B. Hall. Temple Press, London, 1958. 68 pp., 15 figs.

Reactor Heat Transfer is a monograph written for engineers and physicists working in nuclear reactor engineering by W. B. Hall, research manager at the Windscale Research and Development Laboratory. The monograph is divided into three chapters.

Chapter 1 presents a review of some of the elements of convective heat transfer. The heat transfer coefficient or conductance and the mixed mean fluid temperature are defined. The classical differential equations for the transient transport of heat and momentum in flowing fluids are also derived. The empirical convective heat transfer and friction relationships are summarized and the analogy between heat and momentum transfer is referenced. Discussions of entrance region convection and high gas velocity heat transfer are also presented.

Chapter 2 deals with fission heat source distributions in idealized solid fuel element reactor cores. The common