

ever, they are invaluable. The papers are by specialists in each area, and, since the IAEA secretariat imposed no limit on length, some articles soar through their field with an excellence and completeness that exists nowhere else. Two outstanding examples are the forty-page review by Holmes of the mathematical models for calculating the ranges of energetic atoms in solids and the fifty-page article by Simmons, Koehler, and Balluffi evaluating the present knowledge of point defects in face-centered cubic metals.

Volume I includes five papers on general theory and fifteen papers on radiation damage in pure metals, with reference to comparison of experiment with theory, radiation hardening, the nature of defects, and the annealing of damage. Volume II contains nine papers on radiation damage in nonfissionable alloys and six on special techniques such as low temperature reactor irradiation and x-ray diffraction techniques. These volumes do not include the papers for the panel discussions held at the conference, which covered radiation damage in graphite, fissionable material, and semiconductors. The IAEA plans to publish these papers in a third volume and it is to be hoped that it will be available soon. Volumes I and II appeared within less than a year after the conference; the scientific community could easily be spoiled by such rapid publication and come to expect it.

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*(About the Reviewer: A. C. Damask is a Guest Physicist at Brookhaven National Laboratory from Frankford Arsenal. He has been active in the field of radiation damage for several years, has published a number of papers on the subject, and is co-author (with G. J. Dienes) of the forthcoming book "Point Defects in Metals." A review of radiation damage in nonfissionable alloys which he presented at the IAEA Venice Symposium appears in Volume II of the above books.)*

**Nuclear Power Engineering.** By M. M. EL-WAKIL. McGraw-Hill, New York, San Francisco, Toronto, London, 1962. xv + 556 pp. \$15.00.

Those in the nuclear engineering field who have some responsibility for hiring share a familiar frustration. So often a young graduate in Nuclear Engineering may appear to have excellent background and great promise, but may not be expert enough in any particular branch of the technology to be immediately productive. To those outside the field of education but ready to use its product, it appears that the major problem of the nuclear engineering curriculum is to provide a broad and basic understanding of the field while at the same time giving the student enough specialized skill to be useful on some specific assignment.

*Nuclear Power Engineering*, a textbook at the level of the senior or first-year graduate student, faces up to the problem of developing some expertness in a particular area. The student who masters a course based on the text should be ready to go to work as what is usually called a "thermal" or "heat-transfer" man in the design of nuclear plants. The book concentrates frankly on the problems of removing heat from the reactor and of converting it to mechanical energy; its treatment of other aspects of nuclear engineering can be considered adequate only for illuminating those problems.

The book is divided into three parts of roughly equal lengths. The first, a concession to those who may undertake the course without previous study of the nuclear aspects of power reactors, covers briefly reactor physics and the necessary background of nuclear and atomic physics. Although the coverage is adequate for its purpose of preparing the student to understand the remainder of the volume—no mean accomplishment in 150 pages—it is regrettable that so long a prologue must precede the real meat of the book, which is contained mainly in Part II. The content of that part, subtitled *Fundamental Concepts of Nuclear Power*, is indicated by the chapter titles: *Some Thermodynamic Aspects of Nuclear Power* (power cycles); *Heat Generation and Removal, I and II*; *Reactor Coolants: Heat Transfer and Fluid Flow*; *Heat Transfer with Change of Phase*. Part III of the text, *Nuclear Reactors and Power Plants*, discusses specific types: boiling-water, pressurized-water, gas-cooled, organic-cooled, liquid-metal-cooled, and fluid fuel. Again the emphasis is upon thermal behavior. There are numerous illustrative examples throughout the text, and rather extensive collections of problems for the student after the chapters in Parts I and II.

The limitations of the book are mainly those which go along with some specialization of objective. Thus, although the text covers briefly the activation of various specific reactor coolants, it fails to give the characteristic "flavor" of nuclear design, with its continuous emphasis on problems of radioactivity, safety, and reliability of components. The one serious deficiency within the chosen field of concentration appears to be the failure to provide adequate and specific treatment of shutdown and emergency cooling. There are a few misleading comments on the nuclear behavior of reactors: for example in the discussion of the effect of coolant/fuel ratio on the void coefficient of reactivity in boiling reactors, and in attributing a power peaking effect to the tips of control rods; but it would be difficult to avoid a few such slips in the highly condensed and simplified discussion required.

The treatment of reactor engineering from the thermal point of view inevitably limits the faculty for critical evaluation of reactor types, and tends to focus attention on those types which pose interesting thermal problems. The boiling-water reactor for example receives a good deal more attention than the pressurized. Some of the "advanced" reactor types discussed are given an amount of attention which is probably out of proportion to their promise; but if this has the effect of leaving the student a bit starry-eyed, it at least has the advantage of exposing him to a variety of problems in fluid flow and heat transfer.

*Nuclear Power Engineering* is a good text on the fundamentals of the thermal engineering of nuclear power plants. Although there is a great deal more than that to the complete engineering of a nuclear plant, the volume covers its chosen segment of the technology at a level which will give the student some real competence in an essential area of nuclear engineering.

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