Proceedings of the Symposium on Nuclear Instruments, Harwell, September 1961. J. B. Birks, ed. Academic Press, New York and London, 252 pp. $10.00

Several instrumentation conferences ranging from large scale ones, such as that held in Belgrade (1960), to small specialist meetings such as those sponsored by the National Academy of Sciences, have been held in the past five years. Reading the published proceedings, one inevitably makes comparisons between the types of meeting and, in view of their frequency, one looks for repetition of material. Regarding the type of meeting, we conclude that delegates to this conference must have suffered from severe indigestion after sitting through 32 papers presented in two days. This may explain the unfortunate omission of any discussion in the published proceedings. However, the proceedings do contain a most useful collection of research reports, very little of the material being repeated from previous conferences. Workers interested in instrumentation, ranging from physicists concerned primarily with it as a tool to assist in research, to electronics engineers, interested mainly in circuit design problems, will find this book a useful addition to the literature.

The bulk of the book is concerned with three important and rapidly developing topics:

(a) Particle Track Imaging and Processing Techniques (9 papers including 6 on spark chambers).

(b) Detectors and Their Limitations (7 papers including 4 on solid-state detectors).

(c) Complex Nuclear Data Recording and Processing Systems (9 papers).

In addition, three papers deal with particle identification systems, one with transistor circuits, and four with miscellaneous physical measurements, machines, etc. While this coverage is excellent one must observe that some aspects of Nuclear Instrumentation (e.g., health, reactor, and neutron physics instrumentation) receive no attention and, in this sense, the title is somewhat misleading. The level of the presentation varies from paper to paper, but many of the papers, taken individually or collectively, contain sufficient background information to allow the nonspecialist to understand the contents while also containing detailed information of interest to the specialist.

A useful purpose of this book might be to partially bridge the gap which presently exists between low- and high-energy nuclear physicists. Low-energy physicists reading the papers on semiconductor detectors would do well to look at the papers on spark chambers which follow. Similarly, the high-energy physicists might notice the existence and advantages of some of the complex data processing systems finding increasing use in low-energy physics. As any worker in instrumentation knows, physicists are frequently reluctant to recognize the similarities between systems used in different areas of physics. Generally, conferences are restricted to either low- or high-energy physics instrumentation but here they receive almost equal attention, no attempt being made to separate the subjects. The editor and the conference organizing committee are to be complimented on their action in refusing to recognize the artificial distinctions which seem to exist in instrumentation for the two areas of nuclear physics.

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Radiation Damage in Solids, Proceedings of the Venice Symposium, May 1962. International Atomic Energy Agency, Vienna, 1962, International Publications, New York. Vol. I, 385 pp. $7.00. Vol. II, 289 pp. $6.00.

Not many years ago scientists were irradiating samples of almost everything in reactors, from watch springs to rock candy. They were searching for effects. And they found them—almost too many. Although some very clever theoretical treatments of radiation effects in materials were devised, the effects persisted for a while in outnumbering theoretical predictions. Gradually the gap between theory and experiment narrowed and, as the effects were grouped and correlated, the theories were generalized to accommodate them. The correlation of radiation effects in solids was first presented in review articles, then in 1957 in a book by Dienes and Vineyard, and in 1961 in a book by Billington and Crawford. Effects and interpretation now maintain a reasonably equal pace, but, with the advent of more sophisticated experiments and computing machines to perform the theoretical calculations, the accumulation of knowledge in the field of radiation damage continues to accelerate. In fact, it would be difficult to write a book that would adequately cover the present knowledge in this field, and such a book, if written, would be considerably out of date by the time it appeared in print. When an area of research reaches this stage, it is highly desirable that the accumulated knowledge be summarized by specialists and made available in a book or in published conference proceedings. "Radiation Damage in Solids" is an example of the latter category.

The conference reported in these volumes was arranged by the International Atomic Energy Agency and held in Venice in May 1962. The scope of the conference included radiation damage in many solids but not in all; it had been suggested that the topic of the papers submitted be radiation damage in reactor materials. In spite of this original emphasis, the majority of the papers are quite basic and therefore of interest to the research scientist as well as to the reactor designer. An unavoidable shortcoming of the books as a compendium of available information is that important gaps and omissions occur, because the papers were contributed, not invited. Although the scientific secretaries of the IAEA were further handicapped by the fact that 1962 was a vintage year for conferences on damage in solids, e.g., on color centers at Stuttgart, on radiation at Harrogate, and on defects at Kyoto, they did an admirable job of assembling some important papers. One other shortcoming of these volumes for the American reader is the use of Russian. This is one of the official languages of the IAEA (German is not) and some papers are published in Russian, including the authors' names. English abstracts of the papers are included, but no Anglicization of the names is given to facilitate finding translations. However, of the thirty-five papers, only four are in Russian, five are in French, and the rest are in English.

These books are not for a student or a beginner in the field of radiation damage. For an active researcher, however, 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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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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