analysis, including only a brief outline of some formulas developed from the old point of view (pre 1955). The chapter on slowing down is rather disappointing, perhaps because the analytical models used are not the most satisfactory. Many of the essential ideas, such as the asymptotic flux distribution and resonance absorption, could have been better developed by means of the continuous slowing-down model. The author chose, instead, a rather coarse treatment based on a one-group representation. The very briefest mention is made of more sophisticated models, such as two-group, Fermi-age, and multigroup, too brief to convey any important information. The concept of age and the use of the age parameter is entirely omitted. The last two chapters consist of a total of only ten pages and may be of value to persons with no knowledge of the field; but it is questionable, since about all that is accomplished is the introduction of the nomenclature and language.

The essential purpose of this monograph, in the opinion of the reviewer, is to provide a survey of the subject for the benefit of technicians not directly involved in the physics of nuclear reactor design. Perhaps it is aimed too at providing managers with a superficial knowledge of the field and a vocabulary. The only similar work to which this monograph might be compared is Soodak and Campbell's "Elementary Pile Theory," published by Wiley in 1950. Syrett's work is, of course, more up to date, both in data and viewpoint. Actually, it may well be considered an abbreviated version of Littler and Raffle's "Reactor Physics," published in 1955.

On the basis of the author's stated purpose, this work is perhaps a success, but a limited one. Limited, because it is concerned principally with the physics of heterogeneous, natural uranium-graphite power reactors. Consequently this monograph will enjoy at best a short-lived popularity. Its usefulness could have been greatly enhanced if the treatment of the subject had been broader. There are, after all, many other types of reactors, some with a considerable history of design and operating experience. Unfortunally, this criticism applies to other recent publications by the English nuclear technologists as well. The English have enjoyed a significant success with their uranium-graphite power reactor development program, and it is to be expected that their technical literature will reflect this experience, certainly through the publication of papers and reports. The reviewer questions, however, the incorporation of such material into a text (albeit a monograph), when the point of view is so restrictive. It is very apparent that this work, and the course from which it was developed, was intended to help train in rapid order a generation of nuclear technologists to design and operate the current model of the United Kingdom's power reactors.

For a survey work, the text is well written and shows understanding and style. The inclusion of so many recipes, however, detracts from its quality. If the purpose of the monograph is to provide a rough understanding of the subject, why then does it contain working formulas with dimensional constants? The implication is that the student with these results can now design a reactor for himself by simply inserting his own set of numbers. This is not in the best tradition of engineering education.

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**Fast Reactor Cross Sections.** By S. YIFTAH, D. OKRENT, AND P. A. MOLDAUER. Pergamon Press, New York, 1960. 130 pp., $5.00.

This work would have made a fine technical report, but it is hardly worth the delay, expense, and publicity involved in the publication of a hard-cover book. Technical books should really be reserved for discussions of more general principles, or at least the subject matter ought to be of widespread and long-lived usefulness.

This report presents fast reactor constants for a particular group structure and calculation scheme. The reasons for choosing certain values for the cross sections are well described, but the emphasis is clearly on what was done, rather than what is a good thing to do. As for usefulness, the conclusion is reached on the very last page that more precise measurements are needed since these constants fail to predict criticality. It is not that the above features should have, or ever could have, been changed to make the report a better book; it is simply that a technical report would have been the appropriate outlet for this project.

Unlike several of the books on nuclear energy issued by Pergamon Press lately, this volume contains much more than has been reported at the Geneva Conferences. Sixteen-group cross sections, ranging from 500 ev to 10 mev mostly in half lethargy intervals, are presented and discussed for 25 important nuclei from data collected up to March 1960. Preliminary comparisons with experimental reactor systems are also included.

While the results of this study are likely to be only of passing value, some of the techniques used in the art of "guesstimating" values are quite clever and presently very useful. For example, the fission cross section of $Pu^{241}$ is taken to be that of $U^{233}$ because their spins are equal and resonance parameters similar (the values have since been found to be about 10% too high when measured). Extensive theoretical calculations have been utilized to supplement the data. Many types of experimental tests, like sphere transmission measurements for fission spectrum neutrons were made, but probably because the cross sections are for fast reactors, no attention was paid to age experiments or resonance integrals. Success with reactor systems is a goal yet to be achieved, and no constants were adjusted by matching such data.

The book leaves an impression that progress in developing calculational techniques has varied inversely with the speed of reactor systems. Although "honest" constants at all energies have been tested in slow reactor systems for years, the authors of *Fast Reactor Cross Sections* describe their own corresponding investigation as a rather unique undertaking (and apparently decided that if a previous tabulation contained hydrogen, it should not be mentioned). Even though they also have to consider thermal flux and more details of elastic scattering, thermal designers now often use a finer group structure, with inelastic scattering, fast fission, and fission spectra treated in detail. Also, the MUFT Code was produced in order to eliminate the clumsy and questionable flux averaging procedure for group constants apologetically adopted here in Chapter VI.

This book is one more in a long line of cross section tabulations. While much data came simply from BNL-325, many involved situations were skillfully handled when results were unavailable or inconsistent. The text is extremely well written and concise, and many tables and small-sized graphs conveniently illustrate a maze of data. This study is far above average in quality and definitely worth consulting.

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[*Editor's Note: Dr. Amster received his PhD from M.I.T. in 1954 after writing a thesis on the nuclear optical model under V. F. Weisskopf. Since that time he has maintained his activity with neutron cross sections at the Bettis Atomic Power Laboratory, where he was an Advisory Scientist. He is presently Associate Professor of Nuclear Engineering at the University of California, Berkeley.*]

**Nuclear Reactor Stability.** By A. Hitchcock. Temple Press, London, 1960. 61 pp., 8 figures. Distributed in U. S. A. by Simmons-Boardman, New York. $2.75.

*Nuclear Reactor Stability* is a 61 page Nuclear Engineering monograph 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 author points out the need for stability consideration for reactor systems as a result of limits set on the materials of construction through temperature or heat flux. If the power or power distribution oscillates or diverges, the steady rating must be reduced to accommodate the oscillations within the limits, and there is a loss of potential output. The consequent temperature and pressure cycling are likely to have a deleterious effect on the life of the fuel elements, and thus it is important to determine in advance whether instabilities can occur.

The monograph explains how such instabilities can arise and derives, in elementary fashion, stability criteria for several different kinds of instability. The treatment deliberately avoids the use of specialized techniques and associated terminology of control theory.

The author analyzes stability by its response after a small signal disturbance causes it to deviate from the steady state. It is stable if it returns to the steady state and unstable if it moves continuously away from the original steady state.

The diffusion equations are presented and coefficients of reactivity are derived for small variations. Conditions effecting stability and their associated time constants are discussed.

Stability analysis is carried out by setting up the linearized system equations and obtaining the roots of the characteristic equation. Stability rules are presented for the three simple cases of linear, quadratic, and cubic equations. The treatment of spatial variations is dealt with by modal analysis.

Examples of unstable systems are presented for the following: over-all positive coefficient, prompt positive with over-all negative effect, and delayed negative effect.

Temperature instability is analyzed and a numerical treatment is presented for the gas cooled reactor of the Calder Hall type. Radial variations are analyzed by modal analysis and the form of variations in different modes is presented graphically.

Xenon instability is analyzed using linearized equations. Radial variations are considered, resolved into modes, and the characteristic equation is derived. A numerical example for the Calder Hall type reactor is presented. A treatment of axial variations is also presented.

Void instability is treated in a very elementary manner, and the direct effect of power on voids is analyzed. The author admits to this cursory treatment and recommends for an analysis with quantitative exactness that the following be taken into account: boiling boundary effect, flashing effect, and water acceleration.

The control of instability is presented. If the uncontrolled system is unstable in several modes, then there must be roughly at least as many detecting instruments and control rods as unstable modes.

In conclusion, the author has attempted to present a complex subject in a brief presentation and succeeded in pointing the way. The investigation of complete instability is not sufficient. Many systems can be determined by the author's methods to be stable, but can have unsatisfactory transient responses that are as undesirable as completely unstable systems. The author carefully avoided the use of the associated "jargon" of control theory, but in the quantitative analysis of practical systems, the use of the techniques and terminology of control theory is invaluable.

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**Handbook of Thermophysical Properties of Solid Materials, Vol. I—Elements (Melting Temperature Above 1000°F).** By A. Goldsmith, T. E. Waterman, and H. J. Hirschhorn. Pergamon Press, New York, 1961. 758 pp., 5 vols., $90.00.

This volume is the first of five volumes composing a compilation of the thermophysical properties of solid materials prepared by the Armour Research Foundation under contract with the United States Air Force. This first volume contains values for the physical properties of elements with