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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[*Editor's Note: Mr. Lipinski has been engaged since August, 1950 in reactor control and instrumentation activities at Argonne National Laboratory. His personal interest in the stability of nuclear reactors began with participating in the BORAX experiments in 1953. His investigation of boiling reactor stability was continued with greater emphasis on EBWR through analysis and experimental measurements. Presently he is Head of the Reactor Control and Instrumentation Section of the Reactor Engineering Division at ANL.*]

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 melting points above 1000°F published between 1940 and 1957. The sources of data used were: (a) Chemical Abstracts, (b) Ceramic Abstracts, (c) Metallurgical Abstracts, (d) Nuclear Science Abstracts, and (e) Armed Services Technical Information Agency (ASTIA).

The physical properties listed include density, melting point, latent heat of fusion, latent heat of vaporization, latent heat of sublimation, specific heat, thermal conductivity, thermal diffusivity, emissivity, reflectivity, linear thermal expansion, vapor pressure, and electrical resistivity. The first five properties are given as point functions at standard temperature and pressure, while the remaining properties are given as a function of temperature. The most probable values of the first five properties are collected on a single page for each element with the sources of these data on the reverse side of the page. The remaining properties are plotted individually, one to a page for each element, with reference data on the reverse side, with the exception of the thermal diffusivity for which no data are given in this volume. Reference data include names of principal investigators, a reference to the bibliography in Volume 5, and information relating to material composition and test methods. This volume, as well as the others in the series, is designed to be expansible so that additional or revised data sheets may be added. Additional data sheets will be published when available.

This book is a valuable reference on physical properties of the elements and should serve to eliminate much of the searching often required to obtain properties data. The indexing system permits the desired property of a given element to be easily located. The units in which the properties are quoted are clearly indicated and conversion factors for the physical properties, except for electrical resistivity, are included in the front of the volume. The "reference information" sheets contain most of the information the user would want in addition to the data points on the opposite side of the page. However, it would be convenient if a bibliography were included in each volume. It would also be helpful if conversion factors for electrical resistivity were given.

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1960 Nuclear Data Tables. Part 1. Consistent Set of Energies Liberated in Nuclear Reactions Targets in the Mass Region $A \leq 66$. By F. EVERLING, L. A. KOENIG, J. H. E. MATTAUCH, AND A. H. WAPSTRA. U. S. Government Printing Office, Washington 25, D. C., February, 1961. 214 + xvi pp., $1.50.

Part 2. Consistent Set of Energies Liberated in Nuclear Reactions Targets in the Mass Region $67 \leq A \leq 199$. By L. A. KOENIG, J. H. E. MATTAUCH, AND A. H. WAPSTRA. U. S. Government Printing Office, Washington 25, D. C., February, 1961. 456 + xii pp., $2.75.

The user of these two volumes has at his finger tips a happy blending of two strong European schools of nuclear systematics. Mattauch, the leading European mass spectroscopist, and Wapstra, well known for his work on decay schemes of radioactive nuclei, both have prepared tables of systematized nuclear data in the past. Each of the 670 pages in these two volumes is a self-explanatory tabulation, for a single nuclide, of the energy liberations (Q-values) in up to 63 low energy nuclear reactions that can be produced on it by γ-rays, neutrons, protons, deuterons, tritons, He^3, and α-particles. In addition, each page gives the mass of the nuclide in the form of its "mass excess," in micromass units and in kilovolts, both on the scale that makes $O^{16} = 16$ exactly, and on the newer advantageous scale that makes $C^{12} = 12$ exactly.

Each page is a reproduction of a print-out from a digital data-processing machine which computed masses to give a best least-squares fit to experimentally measured values of: (a) mass spectrometric data, (b) nuclear reaction Q-values, and (c) beta and alpha disintegration energies. The Introductions contain eight illuminating diagrams indicating the nature of and interconnections among the input data. The manner of computation is described in considerable detail; but the choice of input data is left unexplained, except for a promised publication by the same authors in *Nuclear Physics.* If that promised publication was the brief paper, "Relative Nuclidic Masses," by Everling *et al.* that appeared in 1960 (*Nuclear Phys.* **18,** 529), the promise made in the Introduction was not kept; for that paper does *not* give a "full account" of the input data. However the reputations of Mattauch and Wapstra guarantee that the choices were as good or better than any that could have been made in 1958 and 1959 when the input data were "frozen" for this computation. Some more light on the input data, and on the whole process of preparation of the final tables, is to be found in the first few papers and in the discussions following them in the *Proceedings of the International Conference on Nuclidic Masses* at McMaster University, Hamilton, Ontario, Sept. 12–16, 1960 (H. E. Duckworth, editor, University of Toronto Press, 1960).

The open style and large size of print on the page is easy to read; but the two volumes could have been compressed into one half their size if conventional type setting (and its added possibility of errors!) had been used. The user may be momentarily disturbed at finding the pages arranged in order of A first, Z second. Thus all nuclides of a given mass number are adjacent to each other, following the custom of the Nuclear Data Project of the National Academy of Sciences, National Research Council. He may be more permanently upset at finding that there are no pages corresponding to a number of nuclides; for example, there are none whatever for mass 101. These are nuclides about which no quantitative energetics information is known, and these tables do not attempt more than a summary of what has been measured. He may finally wonder why the tables confine themselves to masses under 200. No explanation for this is given; possibly the authors feel that the Berkeley work on the heaviest nuclides (Ashby and Catron, Tables of Nuclear Reaction Q-Values, UCRL-5419, 1959) is sufficient for present purposes.