

They cover the cell model, the theorem of corresponding states, a little bit about mixtures, and a little bit about direct calculation of the radial distribution function. The French is remarkably clear and easy to read. Indeed, because the book contains essentially nothing of the new developments in the theory of liquids, its primary use will be as a French reader for students studying for the PhD language examination. I have already tried it out for this purpose and find it to be very good because the subject matter keeps the student interested.

To sum up, the material presented in the monograph is not sufficiently modern to warrant purchase of the book except under conditions where the fact that it is written in a foreign language can be put to good advantage.

Parametric and Tunnel Diodes. By Kern K. N. Chang. 256 pp. Prentice Hall, Englewood Cliffs, N.J. 1964. \$10.95.
Reviewed by H. J. Hagger, Albiwerk Zürich, Switzerland.

Modern electronics has a wide field of application for parametric and tunnel diodes. The author of this book aimed to present a combined treatment of both the physics and the application of parametric and tunnel diodes, but in such a short volume there is not enough space to treat this complex subject thoroughly.

Almost every book on semiconductor devices starts with an introduction into band theory of solids, and the same happens here. One may ask whether a reader of such a book should not already be very familiar with this theory. In the reviewer's opinion it is not necessary to devote one-eighth of a book just to the remark that the capacitance of a semiconductor diode varies exponentially with the applied voltage. This criticism does not apply in the same sense to the twenty pages of theory on tunnel diodes, which is quite valuable. In the chapter on manufacturing these diodes, more recent fabrication methods are mentioned, but they are not explained to the extent one would have wished. The chapter on parametric amplification considers the non-degenerate, the degenerate, and the converter cases. Some rough drawings

of experimental designs are included. One chapter deals with harmonic and subharmonic wave generation, and even microwave logic circuits are mentioned. Very often the author refers to applications which have been suggested, but he does not give credit to the inventor of a device or a circuit, nor does he refer to the bibliography at the end of the book.

The amplifier and the oscillator sections give a reasonable survey of tunnel-diode applications; the section on digital elements with tunnel diodes, however, is just a brief mention that these elements exist. In the section on converters, experimental results are given, but there is no reference to the source. The few photographs in the book show laboratory models in some breadboard stage, which is neither characteristic nor informative. The photographs are so unhappily taken and badly explained that the reader does not gain any profit from them.

In the last part, on recent progress in the field, the only definite statement the reviewer could find was that development work on parametric and tunnel devices has shown some progress. The book finishes with a bibliography on these diodes and their applications, covering publications through 1962 and some part of 1963. One comes to the conclusion that the author has mostly written about the things that interested him. The book does not contain enough information for the specialist to be indispensable to him, but it may serve as an introduction to the subject provided that it is well supplemented by reading the references. But sorting them out is difficult because the text contains no references to the bibliography.

Uranium, by J. H. Gittus. 623 pp. Butterworths, Washington, D.C., 1963. \$24.75.
Reviewed by M. E. Straumanis, University of Missouri at Rolla.

This book is the eighth in the series of "Metallurgy of the Rarer Metals". The dust cover reveals that *Uranium* provides a concise and up-to-date account of the production, properties, and applications of uranium metal, its alloys and compounds. It covers a wide range of related topics, in-

cluding geology, mineralogy, mining, some chemistry, chemical engineering, nuclear physics and technology, and metallurgy.

There are 15 sections in the book, and at the end of each section there is an extensive up-to-date bibliography which includes references to Russian publications. As one of the purposes of the book is to permit and facilitate the design of power-producing nuclear reactors, space is devoted to a discussion of the effects of pile irradiation on the metal. In appendices some data useful for reactor design are tabulated, such as nuclear cross sections of the elements and various conversion factors. Tables are also given, describing the main features of 270 reactors of the world.

The book gives very extensive information on uranium metal. It is well written, supplied with many good drawings and photographs. It is well printed on good paper, and is easy to read and can be well used by all those who are interested in uranium. There is no author index at the end, but a fairly extensive subject index. Of course, one cannot expect in a comparatively short book a deep treatment of the subject in each of the chapters, but it seems this was not the intention of the author.

Fluid Flow. A First Course in Fluid Mechanics. By Rolf H. Sabersky and Allen J. Acosta. 393 pp. Macmillan, New York, 1964. \$8.95.
Reviewed by H. A. Liebhafsky, General Electric Research Laboratory.

Fluid dynamics rests upon a deceptively simple theoretical foundation that is a combination of the principle of conservation of mass with the equations of motion into which the Newtonian law of fluid shear has been introduced. The equations built on this foundation are complex and cannot often be used to describe flows as they are. The situation is saved by recourse to dimensionless ratios, such as the Reynolds number, and to empirical coefficients. The authors take great pains to show how fluid dynamics has become a useful science in spite of the contrast between the simplicity of the theoretical foundation and the complexity of the actual phenomena. The student who understands how this



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Edited by EDWIN F. BECKENBACH, *University of California, Los Angeles*. Internationally recognized authorities discuss many of the problems in combinatorial mathematics encountered in the physical, biological, social, and mathematical sciences. They emphasize both theoretical and applied aspects, arrangements, operations, problems of control, application of digital computers, information transmission, behavior of neural networks, and selections within a finite or discrete system. A publication in the University of California Engineering and Physical Sciences Extension Series. 1964. 608 pages. \$13.50.

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The latest volume in a series edited by F. ALBERT COTTON, *Massachusetts Institute of Technology*. "We are indebted to Frank A. Cotton of M.I.T. and an advisory board of distinguished chemists for providing, as Dr. Cotton puts it, a new forum for the exchange of ideas and for critical and authoritative review of advances in inorganic chemistry."—A. W. Adamson, in *Chemical and Engineering News*. Contents and contributors of Volume 6: Reaction of Metal Halides with Ammonia and Aliphatic Amines, by G. W. A. FOWLES. The Magnetic Properties of Transition Metal Complexes, by B. N. FIGGIS and J. LEWIS. Reactions of the Noble Gases, by JOHN H. HOLLOWAY. The Coordination Model for Non-Aqueous Solvent Behavior, by RUSSELL S. DRAGO and KEITH F. PURCELL. An Interscience Book. 1964. 356 pages. \$14.00.

SEMICONDUCTOR SURFACES

By A. MANY, Y. GOLDSTEIN and N. B. GROVER, *all of the Hebrew University, Jerusalem*. A clear, up-to-date, and self-contained presentation of theories, techniques, and experimental data on the electrical behavior of semiconductor surfaces. Bulk properties are surveyed, and although the main emphasis is on electrical aspects of the subject, a detailed summary of the lattice structure and chemical reactivity of the surface is also given. A North-Holland (Interscience) Book. 1965. Prob. \$14.50. In press.

PROGRESS in OPTICS

Volume IV

Edited by E. WOLF, *University of Rochester*. The latest volume in a series that provides review articles about current optical research, both theoretical and applied. Articles dealing with progress in related fields (e.g., electron optics, X-ray structure analysis, microwave antenna design, and radio astronomy) are also included. All the articles are in English, but the authorship is international to insure broad and expert coverage. A North-Holland (Interscience) Book. 1965. Prob. \$13.00. In press.

STUDIES in STATISTICAL MECHANICS

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Edited by J. DE BOER, *University of Amsterdam, Netherlands*; and G. E. UHLENBECK, *The Rockefeller Institute, New York*. The third volume in a series of studies and reviews of various topics in statistical physics, that reflect the recent progress and search for basic understanding in this field. Includes new techniques for treating the mathematical problems connected with the statistical mechanics of systems in equilibrium. The techniques provide new understanding of superconductivity and superfluidity. "An extremely valuable contribution to the growing literature of statistical mechanics."—*Physics Today*. A North-Holland (Interscience) Book. 1965. Prob. \$14.75. In press.

A TREATISE on ANALYTICAL DYNAMICS

By L. A. PARS, *Jesus College, Cambridge, England*. Gives an accurate, complete, and well-written account of the subject of analytical dynamics as it now stands. A pre-publication reviewer writes: "... no English-speaking person knows more about this subject than Mr. Pars, and he has here assembled his knowledge in a clear, readable manner. It would be a tragedy if this enormous amount of material were not put in some permanent form." 1965. Prob. \$29.00. In press.

was done will have learned a valuable lesson. If he works (as the reviewer did not) the numerous problems carefully integrated with the text, he can scarcely escape this understanding.

The foundation of the subject is in the first four chapters of the book. In the fifth, entitled "Similitude", the dimensionless ratios are brought in, and they are applied to important flow problems involving friction, lift, and drag. Flows of a perfect fluid are discussed in the sixth chapter, and those of real fluids in the seventh, in which the theory of boundary layers is introduced. The last three chapters deal with practical matters, mainly flow in open channels and various aspects of turbomachines.

The preface points out that fluid mechanics has changed from a specialized subject to a fundamental discipline common to several branches of science and of engineering. That this change is part of a broader movement is shown, for example, by the growing recognition of the importance of transport processes in electrochemistry. A page early in the book might have been allocated to showing how transport processes in fluid dynamics fit into the broader framework that includes transport processes of all kinds, even though other indications of this broader relationship are given (e.g., p. 6, second paragraph; pp. 55, 56, and 57; and p. 79).

This is an excellent, clearly written textbook aimed at the junior level.

Modern Developments in Electron Microscopy. By Benjamin M. Siegel, ed. 432 pp. Academic, New York, 1964. \$13.50.
Fundamentals of Transmission Electron Microscopy. By Robert D. Heidenreich, 414 pp. Interscience, New York, 1964. \$14.50.

Reviewed by L. Marton, National Bureau of Standards.

It has often been said that the lead time between discovery and its practical application is shortening, to the extent that some time from now, the practical application may precede the discovery itself. I would like to establish here a similar principle applicable to a good part of the modern scientific literature. Instead of lead time we may call it something like the "active time" of any branch of sci-

ence, which, according to many publications, is being shortened tremendously. What I am referring to is that many modern publications ignore completely what they may consider ancient history, but what I consider the logical antecedents of the part of the science they are reporting. The usual argument in favor of omitting all kinds of historical detail in the presentation of any scientific field is that, "We do not have time to go into ancient history, and anyhow most of it is obsolete." I would like to suggest that one day a PhD thesis in the history of science be devoted to the subject of how much time is wasted by the average researcher due to lack of knowledge of the literature of his own subject, in particular, of the antecedents of his own subject.

Having made these comments, let us proceed to a discussion of the book edited by Siegel.

As you may have guessed, the present "critical evaluation of a wide cross section of current development in electron microscopy" applies the principle of the almost zero "active time" and compresses electron microscopy into the last ten or twelve years of its existence. It would be all right if it were really a critical evaluation of current developments only, but the first chapter (on the physics of the electron microscope), written by the editor himself, presents the general principle of electron optics and of image formation and contrast. I tried to find out for whom this contribution was really written, and the preface states, "The present volume is directed primarily to the research worker who has only recently started to apply the electron microscope in his research. Each contribution has been written so that it will be understandable to research workers outside the particular discipline. The technical vocabulary of the specific fields could not be avoided entirely, but none is so intricate that reading a given contribution would be impossible or without profit." As the book contains eight chapters written by eight authors and only two of the chapters are on physics, I will limit my comments to the two physical chapters; that is, Chapter 1 on "The Physics of the Electron Microscope" by B. M. Siegel and Chap-

ter 5, "Applications of the Electron Microscope in Physics" by D. W. Pashley. Chapter 1 starts with reference to Hamilton's work. Here I would like to inject a remark on a very minor item: Hamilton's middle name is misspelled (on page one, it is given as "William Korvan Hamilton", in the reference list it is given as "Hamilton, W. K., in Mathematical papers of Sir William Rowen Hamilton").

I feel that the author completely misunderstands Hamilton's contributions to the principle of least action. He writes, describing the focusing effect of an electric or magnetic field on electron beams: "In a most elegant manner it was now possible to make a direct application of the theory developed by William Korvan Hamilton in 1831 to the trajectory of an electron in the electromagnetic field of an electron optical system. The 'Hamiltonian analogy' described the path of light rays through media with continuously varying refractive index in terms of the trajectory of material particles in potential fields." It seems that, here and later, the author's emphasis is on the continuously varying refractive index; whereas to me, at least, the basic feature of Hamilton's method in optics is the reconciliation of a minimal principle (least action or Fermat's principle) with a contact transformation (construction of Huygens), and the carrying over of this fundamental duality into dynamics.

A little later the author states flatly that in contradistinction to light optics, which has both convergent and divergent lenses, electron lenses having axial symmetry can only be convergent. The level of presentation alternates between the relatively low and the moderately advanced, so for instance on page 19, in explaining the light microscope, the author finds it necessary to go into explanation of actual distances and focal length used in this instrument and fails to discuss in any manner the resolution of the instrument. Yet on the following page, in using the electron microscope, he states, "The higher resolution available with electron optics does permit higher useful magnification". A discussion of the resolving power of the microscope starts on page 36 and un-