

cations described and some analysis of mathematical models. Surprisingly, there is only one specific study of nonlinear control functions. Several control papers are primarily concerned with measurement devices. The section on physical methods of chemical analysis is oriented towards laboratory measurements rather than industrial applications. A majority of the papers deal with mass spectrometry and other spectrum methods. The powerful newer field of gas chromatography is almost ignored compared to what might be expected. The nuclear-instrumentation section concerns both radioactivity measurements, as in the human body, and industrial isotope applications. The widest variety is in the section on electric and magnetic measurements. Besides techniques for measuring many different quantities, there are a laboratory description and discussions of digital handling. The section on reactor control discusses the instrumentation and reports the experiences at a number of nuclear power installations.

An Introduction to Magneto-Fluid Mechanics.

By V. C. A. Ferraro and C. Plumpton. 181 pp. Oxford U. Press, London and New York, 1961. \$4.00. *Reviewed by L. Talbot, University of California.*

TO quote from the authors' preface, "The object of this book is to provide an introduction to magneto-fluid mechanics for the use of physicists and engineers." There is a need for a book which fulfills this stated object, but unfortunately this volume does not quite succeed.

The introduction of the book is in essence the text of an address given by Ferraro at the British Theoretical Mechanics Colloquium in 1960 on the history of magnetohydrodynamics research. This interesting and informative review is, however, marred by the almost complete absence of adequate source data for the references cited. In fact, this defect persists throughout the entire volume; it is a frustrating and often impossible matter to track down the locations of many of the references, even with the aid of the annotated bibliography.

The main body of the text is divided into two parts. Part 1, Magnetohydrodynamics, comprises five chapters in which the topics discussed include a review of general principles, magnetohydrostatics, magnetohydrodynamic waves, turbulence and hydrodynamic shock waves. Mks units are used in Part 1. Part 2, entitled Plasma Dynamics, comprises three chapters which contain material on particle motion, collision theory based on a relaxation-model of the Boltzmann equation, and additional material on plasma waves. Gaussian units are used in Part 2.

Although some of the individual sections of the book are well written, the volume as a whole is poorly organized from a pedagogical point of view and gives this reviewer the impression that it was rather hastily assembled. The worker in the field of MHD may find certain portions of this book useful, but it is not the answer to the quest of a scientist, newly arrived on the

MHD scene, for a slim volume which will take him carefully through the first principles of the subject and prepare him for more specialized study. (In fact, the fluid dynamicist may be shaken rather early by reading in Chapter 1 that the transition Reynolds number for pipe flow is of order unity!)

Progress in High Polymers, Volume 1. J. C. Robb and F. W. Peaker, eds. 340 pp. Academic Press Inc., New York, 1961. \$12.00. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, University of Chicago.*

EVERY time a new review volume or a new journal appears on my desk, my emotions range from an involuntary shudder to violent rage. The multiplicity of journals and review volumes is truly enormous and each case must be examined carefully to determine its value.

Fortunately, I believe the volume under review to be a useful addition to the literature. In my own work, I have already found the article by W. Cooper on stereospecific polymerization to be of considerable assistance. The article by R. S. Lehrle on ebulliometry is an authoritative and relatively exhaustive discussion of the subject. The review articles by G. M. Guzman on fractionation of high polymers and G. J. Howard on molecular distribution are also quite useful. However, I found the article by T. B. Grimley on the theory of high-polymer solutions to be deficient in a number of respects. For a review volume to be truly useful, there must be as little overlap as possible between the article and standard texts. The article must also present to the reader as much as possible of the latest development in the field. It is therefore with surprise that I found in Grimley's article reviews of elementary light scattering theory, the McMillan-Mayer theory, and general statistical mechanics, but no mention of the work of Yamakawa or of the recent work of Fixman.

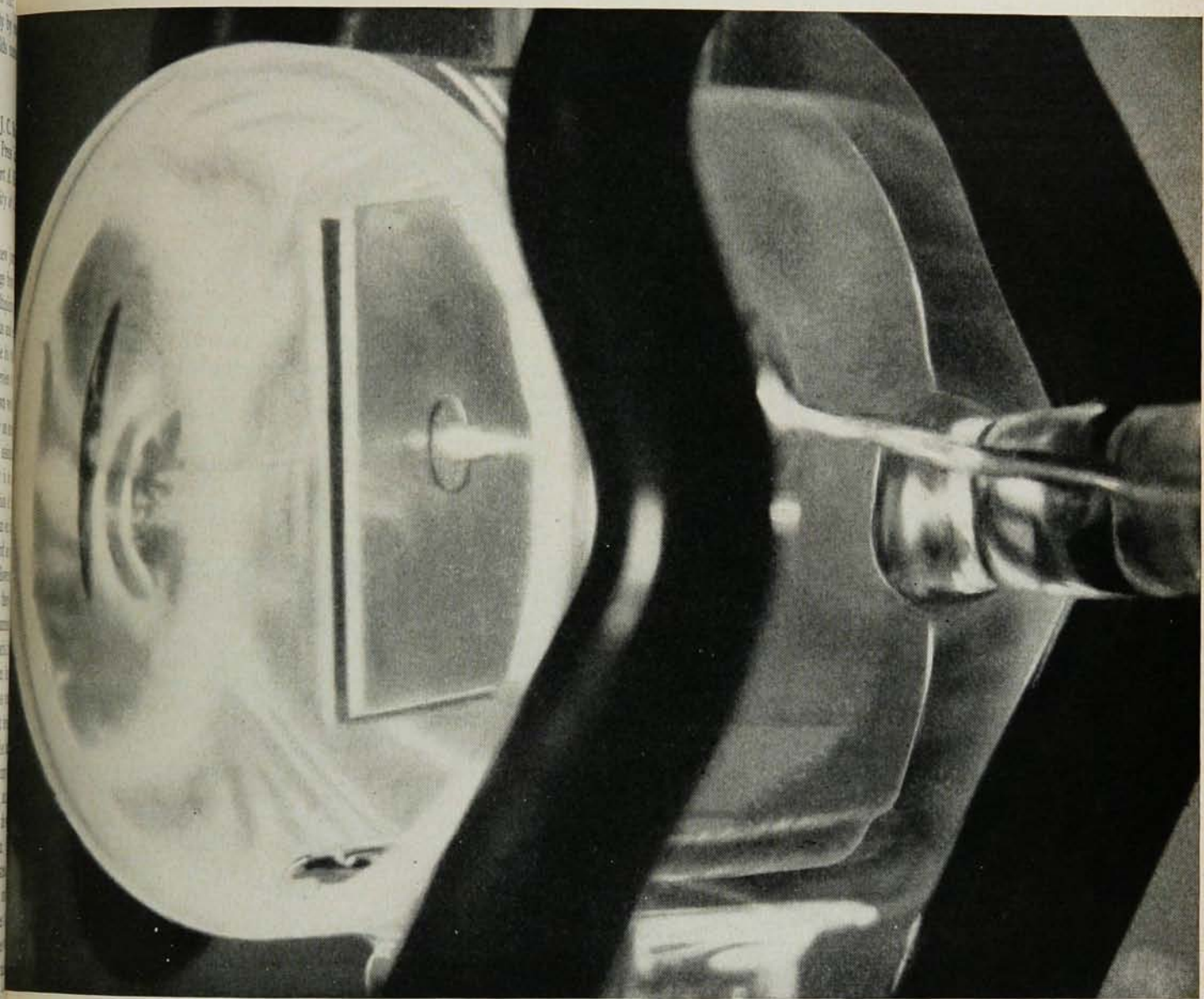
In all, the current volume justifies its existence. It will be necessary, however, for the editors to continue to exercise judgment and to choose only articles of importance. It would be best if the review volumes would appear only when sufficient articles of merit accumulate rather than on a regular annual or semiannual schedule.

Instrumental Optics. By G. A. Boutry. Transl. from French by R. Auerbach. 544 pp. Interscience division of John Wiley & Sons, Inc., New York, 1962. \$27.50. *Reviewed by W. T. Wintringham, Bell Telephone Laboratories.*

USUALLY one finds upon study that a new text fits neatly into a well-defined niche. The reviewer's task in such cases is easy and straightforward. However, Professor Boutry's *Instrumental Optics* is different and there seems to be no simple way of categorizing it. Nevertheless it is interesting, although at times tedious reading.

Professor Boutry's major premise is that an optical instrument should be designed to match the receiver with which it is to be used, i.e., the performance of

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existence of liquid hydrocarbon semi-conductors has been established in recent experiments by Dr. Eric O. Rorster, an Esso Research scientist. The data show that semi-conductors can exist in the liquid state in other than molten salts or liquid ammonia. Experiments with a series of C_6 type hydrocarbons show that conductance takes place in these liquids by means of trapped electrons or delocalized π electrons. With increasing unsaturation, the number of π electrons available, increases to make benzene 1000 times more conductive than n -hexane. In the latter compound, only trapped electrons are believed to be available for conductance.

A number of relationships have been established which support the electron conductance mechanism. In these systems conductance has an exponential temperature coefficient and increases reversibly when excited by irradiation with ultraviolet or gamma rays.

Both the trapped electron and delocalized π electron mechanisms require only short range molecular order. This is quite different from the relatively long range order commonly visualized in solid semi-conductors. Obviously the liquid state, with its high mobility of molecules, is ideally suited to meet the short range order requirements. It also makes it easier to establish electrode contacts.

Although the conductance level of these hydrocarbon compounds may be too low to make them of significant practical interest, the findings provide a better understanding of electron transport in liquids and they show that excited electrons have to be included in our normal considerations even though their population may be very small. Future studies will try to expand this concept to other structures.

...adapted from the scientist's notes at
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Humble Oil & Refining Company

the eye should be taken into consideration in the design of a visual instrument, and the limitations of photographic emulsions should be a major factor in establishing the requirements for a photographic instrument.

Since *Instrumental Optics* was published in French in 1946, this insistence on a close relation between the performance of an instrument and the capability of a receiver tends to reduce the book to the status of a text of historical interest only. For example, the over-all performance of some photographic systems today is established by fundamental limitations set by the optics, in contrast to Professor Boutry's assumption that the photographic emulsion is the bottleneck. In the same vein, present-day use of photoelectric receivers in place of the eye imposes new and different requirements on optical instruments.

Professor Boutry has covered his subject in four major steps, following which he devotes the last third of his book to discussion of representative types of optical instruments. Nowhere, however, does he come to grips with the very real problems of tolerances, ease of construction, etc., which are of real concern to the manufacturer of instruments.

The first section of the book is a presentation of the principles of geometric optics. The second is an analysis of the aberrations of images formed by centered systems (including discussions of objectives and of eye-pieces), and the third is an analysis of the performance of prisms and of cylindrical systems. The performance of the eye, its relation to optical instruments, and the subject of ophthalmic correction are treated in the fourth section of this text.

Unfortunately the treatment of this material is not such that one can recommend the use of *Instrumental Optics* as a reference book. Provided one's teaching methods are such that one requires a text in which every step of a geometric or trigonometric proof is set down in detail, the book could be recommended. However, it is this reviewer's opinion that such wealth of detail tends to confuse rather than aid the student.

Introduction to Space Dynamics. By William Tyrrell Thomson. 317 pp. John Wiley & Sons, Inc., New York, 1961. \$11.50. Reviewed by Jacques E. Romain, *General Dynamics/Fort Worth*.

AT the intermediate or graduate level of instruction, this book provides a good introduction to the practical problems of space dynamics. This is achieved by emphasizing techniques directly applicable to actual dynamical situations and showing the general lines of approach to such situations.

At variance with more elementary books (such as Berman's), in which the emphasis is on physical principles illustrated by a wide variety of topics, the present book assumes previous knowledge of the physical principles and is restricted to technical dynamical problems of space flight. Since full solutions to the most advanced problems cannot be given in a 300-page book,

the author deals with simplified versions of problems representative of the field, in which the treatment is elaborate enough to bring about a thorough exposition and discussion of the underlying principles and mathematical techniques involved.

The book begins with a short introduction to basic concepts of kinematics and coordinate transformations (good enough as a reminder, but certainly too sketchy as an introduction to elementary dynamics). The chief topics studied in the main part of the book are point particle orbits (including their determination and perturbation), dynamics of rotating bodies and gyroscopic applications, motion and propulsion of space vehicles, and optimization problems. The last chapter is devoted to an introduction to Lagrangian dynamics and its application to space problems. Moderate use is made of matrices, dyadics, calculus of variations, and Laplace transformations. Short appendices give a rough outline of the first three of these techniques; the same might usefully have been done for Laplace transformations.

The exposition is clear and didactic. Numerous very good illustrations and a few charts are a real help. Quite a few worked-out representative examples and many proposed problems of physical interest (unfortunately without answers) are included. Bibliographical references are given both at chapter ends and in a general bibliographic index.

A few misprints should be corrected: for instance, the second half of Sect. 6.4 is none too clear, apparently because of a mislabelling of axes; in Sect. 9.4 the same angle is differently designated in the text and in the illustration.

Gmelins Handbuch der anorganischen Chemie (8th Revised Ed.). *Barium*: Suppl. to Syst. No. 30; 569 pp.; \$88.50. *Lithium*: Suppl. to Syst. No. 20; 525 pp.; \$81.50. *Mercury*: Sect. 1, Syst. No. 34; 466 pp.; \$71.00. *Oxygen*: Sect. 4, Syst. No. 3; 366 pp.; \$56.00. *Strontium*: Suppl. to Syst. No. 29; 306 pp.; \$49.00. *Sulfur*: Part B, Sect. 2, Syst. No. 9; 758 pp.; \$116.50. Verlag Chemie GmbH, Weinheim, Germany, 1960. Reviewed by H. A. Liebhafsky, *General Electric Research Laboratory*.

HE who has passed a camel through the eye of a needle might next attempt the harder task of reviewing adequately a single volume of Gmelin. After scanning the six volumes under consideration here, this reviewer will merely repeat that "the virtues of the work continue unabated" (*Physics Today*, August 1960, p. 42) and then try to select from each volume a little sampling that might attract physicists to this impressive storehouse of knowledge.

The *Barium* volume concludes with a treatise (pp. 536-569) on the oxide-coated cathode, that important electron emitter which continues, hopefully in diminishing degree, to be temperamental and enigmatic. The section on the preparation of such cathodes is introduced in a way that can serve as a model for any complex, important, and predominantly empirical field.