

BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.



A FIRST OF ITS KIND

Title Electron-Stream Interaction with Plasmas

Author Richard J. Briggs

Publisher The MIT Press, 1964

Pages xi + 187

Price \$7.50

Reviewer Gordon S. Kino

This MIT research monograph is derived from the author's PhD dissertation. It provides an excellent review of the interaction of electron and ion beams with a plasma. The methods used derive more from the microwave tube field than the fusion plasma field, and so the emphasis is far more on the boundary conditions pertaining to finite systems rather than the effect of temperature, although this is taken into account to some extent.

The second chapter of the book gives a very detailed description of mathematical criteria for distinguishing between amplifying waves and absolute instabilities. These criteria, which were first presented by Sturrock, Landau, and Lifschitz, have been generalized by the author and Bers so that they are now applicable to almost any linear physical system. This material should be of interest in many research fields where instabilities are of importance and certainly not just the plasma field.

The rest of the book is devoted to detailed derivations of dispersion relations and physical discussions of beam-plasma interaction. The book will be extremely useful to anyone interested in this subject, as it is the first published work of this kind outside of research papers. I would expect it to become a standard reference on the subject.

Gordon S. Kino is Professor of Electrical Engineering at Stanford University's Institute for Plasma Research, where he has been since 1957. He has done fundamental studies on electron and ion guns and is in charge of a group which was the first to verify quantitatively the growth rates in beam-plasma interaction and to develop techniques of design and

analysis of space charge flow of ion and electron beams that have been adopted by others as standard. Formerly with the Mullard Radio Valve Co. (England) and Bell Telephone Laboratories (New Jersey) as a researcher, he holds BS and MS degrees from London University and the PhD degree from Stanford.

UNLABELED MIXTURE OF IMMISCIBLE INGREDIENTS

Title Nuclear Space Propulsion

Author Holmes F. Crouch

Publisher Astronuclear Press

Pages xv + 432

Price \$15.00

Reviewer R. E. Schreiber

This newest book on nuclear space propulsion is intended, according to the publisher's preface, to fill the need of the "professionally oriented nonexpert" and is represented as a "blend" of design principles, design philosophy, practical applications, and advanced concepts. In the opinion of the reviewer, the blend is more an unlabeled mixture of immiscible ingredients with the overall flavor dominated by the author's pet enthusiasms rather than by the information being developed in the ROVER program.

A major criticism of the book is the lack of differentiation between recognized basic principles and "rules" stated without proof and between established design considerations and untried concepts. These are mixed together in a continuous (but sometimes discursive) narrative, presumably to present a unified picture to the nonexpert. This is exasperating to the expert who sees controversial and sometimes incorrect statements presented with the same assurance as Newton's laws of motion. It is surprising to read that: it is almost impossible to design a reactor which will operate smoothly and consistently in the resonance region because of the unpredictability of the fission cross section; it is generally agreed that 2 MeV is

the upper limit of controllable fission; a fundamental concern is the diffusion leakage of hydrogen through the engine piping; and the number of control drums must be some multiple of four.

The book simply seems to miss the point in many discussions. Trivial effects are accorded the same treatment as basic design considerations. In some cases, a correct result or conclusion is stated but is then supported by an irrelevant or inconsequential rationale. One could almost conclude that the book deliberately avoids the obvious (but basic) points, which have already appeared in other published works, in a search for something different. This might be a provocative approach to intrigue the advanced reader, but it presents a very confusing picture to a person wishing to understand the why and how of nuclear propulsion.

The book includes a considerable amount of basic information based on the extensive bibliography cited in an appendix. It is unfortunate that the references are not cited in the body of the text, since the reader is dependent on his own prior knowledge to sort out the information and the speculation. The book itself has an attractive format and is liberally illustrated with tables, graphs, and line drawings. Mathematical expressions are used profusely, but it is not obvious that they always serve a useful purpose, since the discussion is basically descriptive and qualitative. Many of the equations represent the result of complex and detailed considerations, such as neutron diffusion theory, and it can be wondered what they convey to the reader who has just been introduced a few pages ago to a very elementary discussion of the concepts of fission, nuclear cross sections, and reactor criticality. At the same time, the lack of a rigorous mathematical development makes the stated final equations of little value to the technically qualified reader unless he recognizes them as familiar friends.

Aside from a brief mention of the successful 1964 ROVER reactor tests early in the book, the existence and accomplishments of the national effort in the development of nuclear rocket engines are ignored. A rationale for this omission can be made if the book is intended (as stated in the preface) to have a slow rate of obsolescence in a fast-moving technology. However, this same rationale also properly limits the contents to those basic principles and concepts that are unlikely to change rapidly. Unfortunately this limitation was not recognized, and a great deal of the book is devoted to specific design proposals, some of which solve problems already proved to be trivial or nonexistent or else problems which result from situations or applications invented by the author. The result is somewhat less than informative to the reader who wishes to know what is really going on.

In summary, it can be said that the book discusses in some form almost all of the aspects of nuclear propulsion ranging from the discovery of uranium to the layout of the nuclear-astronauts' consoles. It is essentially devoid of any information on what is actually being done in this program and contains much speculation about the way in which reactors, engines, and spacecraft *might* be designed. As a guide to the nonexpert, it is of dubious value unless read in conjunction with the more factual reports that are

appearing in increasing numbers. It is of essentially no value as a reference document to the engineer or scientist seeking exact and complete information, although it might be a challenge for such people to match wits with the author.

R. E. Schreiber is the Technical Associate Director of Los Alamos Scientific Laboratory. He was Division Leader for the nuclear rocket propulsion work at LASL from the time that program was started in 1955 until assuming his present position three years ago. He has been the author of a number of papers and articles on nuclear propulsion and has served on advisory committees of NASA and USAF dealing with this subject. Earlier work at Los Alamos included reactor research and nuclear weapon engineering. He received a PhD degree from Purdue University in 1941 and an honorary DS degree from Purdue in 1964. He is a Fellow of the ANS, AIAA, and APS.

THERE HAS BEEN A SLIP

Title Radioisotopes and Their Industrial Applications

Author H. Piraux

Publisher Charles C. Thomas, 1964

Pages xiv + 266

Price \$14.50

Reviewer Jerome Kohl

As is cited in the bibliography to *Radioisotopes and Their Industrial Applications*, there have been a number of British, American, and other texts on properties of radioisotopes and on industrial applications of radioisotopes. This book was prepared by a scientist from the Phillips Laboratories. Originally written in French, it has been translated by Phillips into German, Spanish, and English. It is stated in the preface that the book is intended for the general public, or "layman," and it may be useful to such readers. I do not recommend this book for radiochemists, or for any scientist familiar with radioisotopes and their application; and, unfortunately, I cannot recommend it for industrial scientists who are seeking possible radioisotope applications, because its value to such people is severely limited by the lack of references to most of the applications of radioisotopes cited in the book.

The author states "we have thought it useful to include in the bibliography the titles of works on every subject discussed in the present book." Unfortunately, between this intention and the actual production of the book there has been a slip. There are only 34 references cited in the book for material described in the text. Of these 34, 5 are on detectors and 4 references have no titles, so there are 25 references to applications; and yet, in the text, 261 applications are described. Thus, a serious worker who becomes interested in a particular application has a very low probability of finding a reference to the original work, or to