BOOK REVIEWS

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

Theory of Magnetically Confined Plasmas
(Proceedings of the Course held in Varenna, Italy)

Editors	B. Coppi, T. Stringer, R. Pozzoli, E. Sindoni, J. P. Carnihan, and G. G. Leotta
Publisher	Pergamon Press, Elmsford, New York (1979)
Pages	513
Price	$55.00
Reviewer	N. V. V. J. Swamy

This 513-page paperback contains the proceedings of the course on "Theory of Magnetically Confined Plasmas" held in Varenna, Italy in September 1977 by the International School of Plasma Physics. The topics covered in the course include magnetohydrodynamic theory, transport phenomena and codes, modes and instabilities, heating, alpha particles, and new concepts, and the book is well organized into appropriately titled chapters. The school had participants and invited lecturers and the book is essentially a transcript of the talks given by the latter. The invited speakers being experienced researchers in their fields, there can be no question about the quality of the contributions. There is an understandable variation in the presentation of the material, some starting at an introductory level and some tending to be more research reports than lectures to the less informed. As the editors put it in their Foreword, the lectures were followed by illuminating discussions that really enhance the value of the lecture itself, all the more because the discussions were objective and candid even to the point of disbelieving the results of calculations presented. Although it is supposed to be a course on "The *Theory* of Magnetically Confined Plasmas," there is not only a good deal of incidental experimental material, but even a review of tokamak experiments. There is a section on a possible future objective of alpha-particle heating in a deuterium-tritium (D-T) plasma. While it is a course, it certainly is not at a level where, for instance, the instructor expatiates on the beauty of Maxwell's equations or the cleverness of Vlasov's approach, but is more in the nature of an advanced course with prerequisites. The people who can get most out of this book are those who have a background in tokamak plasmas and a research interest in confinement, transport, instabilities, methods of heating, and so on. It is somehow typical of papers in plasma physics that many references cited related to conference proceedings or reports of national laboratories, some of which are not readily available in many universities. The paper on "Ignitor Experiments" is a typical example. The recent work on second harmonic electron cyclotron resonance heating of a plasma and numerical simulation of disruption in tokamaks makes one wish that this book had come out soon after the course, but this probably is a circumstance that cannot be helped.

N. V. V. J. Swamy is a professor of physics at Oklahoma State University in Stillwater, Oklahoma. He is the author of a book and several publications relating to nuclear structure, nuclear fission, relativistic quantum mechanics, symmetry and group theory, astrophysics, and plasma wave dispersion relations. In 1975, he spent his sabbatical at the Plasma Physics Institute of Kernforschungsanlage in the Federal Republic of Germany, where the dominant theoretical activity was the study of radiofrequency heating of tokamak plasmas, and at Cambridge University in England. Because of the levitation experiments that seem to establish the existence of fractionally charged particles (quarks) and the contention of particle physicists that the existence of quantized charges implies the existence of magnetic charges, Dr. Swamy's current research interests include the investigation of consequences in plasma physics (other than nuclear fusion) of the existence of such charges.

Fundamentals of Pipe Flow

Author	Robert P. Benedict
Publisher	John Wiley & Sons, Inc., Somerset, New Jersey (1980)
Pages	531
Price	$39.95
Reviewer	K. Almenas

When American National Standards Institute standards for the review of comprehensive texts are written, one can be certain that the job of the reviewer will become a great deal harder. It is certainly hard enough at present; however, in the absence of a standard (which is certain to include detailed instructions regarding completeness), the reviewer can at least avail himself of the privilege of talking about aspects of the text that fit his knowledge and prejudices and gloss over the remainder. I hope the

prejudices and expertise of this reviewer are similar to those of most nuclear engineers who have been in the business for a decade or more. Usually, we start out with the conviction that the Boltzmann transport equation is the summation of most of the knowledge we will ever require and then find out to our surprise that most of the nuclear power plant problems actually lie in the thermal-hydraulics area. Thermal hydraulics is thus a subject we must learn largely on our own. This necessity colors our evaluation of the texts and the reference books we have assembled on our bookshelves. The main question that I address in reviewing R. P. Benedict's *Fundamentals of Pipe Flow* is how well it meets these rather special needs.

But first an attempt at a general overview.

This is a text and a handbook covering precisely what the title promises—flow of fluids in pipes. Benedict not only knows but evidently also loves his subject. This is illustrated by his concern for the historical development of hydraulics. The historical dimension adds depth and interest to the subject and at times also contributes to the insight that can be gained. Thus, for example, the first hydraulic engineer mentioned is Hero of Alexandria, and Leonardo de Vinci is represented by a well-chosen quotation describing the law of continuity. All through the text historical development is noted and precedence cited. The names mentioned include the familiar like Bernouli, Reynolds, and Fanno, and the not so familiar ones of Regnault, Rouse, and Hagen. At times, this adds color, at other times real information. After all, historical development to a degree mirrors the sequential steps by which an individual can best acquire knowledge in the subject. A good example of this is Benedict's presentation of boundary layer theory (Chap. 4). In an economical ten pages, he first describes the gulf that developed in the nineteenth century between the elegant yet unsolvable equations of Navier and Stokes and the entirely empirical relationships of Darcy-Weisbach. Placed in this context, the deceptively simple yet subtle concepts of boundary layer theory proposed by Prandtl, which succeeded in bridging the gulf, acquire a new significance.

This is not to suggest that the book is overly theoretical. Actually, the balance between theory and application is decidedly shifted toward the application side. It is foremost an engineering book and includes numerous worked out numerical examples of pipe flow problems. The examples are solved in a clear stepwise manner and all the equations used are flagged right in the solution process. This will be appreciated by engineers who use the book as an occasional reference. Further features enhancing its reference character are an extensive chapter on loss coefficients and several brief but informative chapters on flow measurement techniques.

And now back to the nuclear engineer's point of view. From this vantage point, the book has several serious shortcomings and can be recommended at best as a special supplemental reference text covering steady-state flow of single-phase fluids. A number of hydraulic problems of primary importance to nuclear engineers are not covered at all or are covered incompletely. An example of the later is two-phase flow. Although there is a chapter on the subject, it completely ignores the large experimental and theoretical contributions that have been made in this area by reactor-safety-related work. Thus the only Moody noted is L. F. (the one of the Moody diagram), and there is no recognition of the important influence that thermal nonequilibrium conditions can have on critical two-phase flow. The extensive experimental data produced by facilities as the loss-of-fluid test and Semiscale is ignored. Even more limiting is the fact that the book deals only with steady-state flow. Probably because of this restriction, no notice is taken of the large advances that have been made in the application of finite difference methods to the solution of hydraulics problems. Even the basic standby computer codes as RELAP, COMPARE, and their simpler predecessors are not mentioned.

Maybe it's not fair to complain that some subjects are missing that are not really promised in the title. The title indeed states "pipe flow." Thus there is no information about the behavior of fluids after they have left the pipes. For nuclear engineers this constitutes an important omission. A large class of reactor-safety-related hydraulics problems deals with the behavior and impingement of fluid jets after they have left a pipe break. A related class of problems deals with the dynamic forces imposed on piping systems by the occurrence of a break.

A final disadvantage of the book is that it adheres exclusively to the British units. However, this seems to be consistent with its general tone. It is a solid, single purpose engineering text, thorough, but somewhat old fashioned in its approach. Nuclear engineers will find its applicability to be limited.

K. Almenas is an associate professor of nuclear engineering at the University of Maryland. He obtained his PhD degree in 1968 from the University of Warsaw and has worked at the Argonne National Laboratory. His research papers have been mostly concerned with thermal-hydraulic aspects of the light water reactor safety field, particularly containment design.

Modern Physics

Authors	Robert L. Sproull and W. Andrew Phillips
Publisher	John Wiley & Sons, Inc., Somerset, New Jersey (1980)
Pages	682
Price	$27.95
Reviewer	J. N. Anno

I first encountered one of the coauthors, Dr. Robert L. Sproull, in 1958 when I read from cover to cover his then relatively new book, *Modern Physics (A Textbook for Engineers)*. Frankly, at that time I was not impressed; in my opinion that book lacked a depth of treatment of even the survey of the topics it covered. However, in this new book, *Modern Physics* (third ed.), Dr. Sproull and Dr. W. Andrew Phillips have completely eliminated my earlier objection. In one magnificent volume they do indeed cover the world of modern physics in the proper depth to make this work a valuable text (and reference book) to those working in peripheral areas of nuclear science and technology. To such members of the American Nuclear Society (ANS), I recommend this book most highly. It has, in my opinion, at least one other appeal to certain ANS members,