

REVIEWS

Mechanics of Fluids. By J. W. IRELAND. Butterworths, 1971. 481 pp. £4.50 (hardback) or £2.50 (paperback).

A Textbook on Hydraulics and Fluid Mechanics, Volume I. By V. G. GARDE and R. M. ADVANI. Macmillan of India, 1971. 652 pp. Rs. 25.00.

Elements of Fluid Mechanics. By C. V. SESHADRI and S. V. PATANKAR. Prentice-Hall of India, 1971. 236 pp. Rs. 20.00 or \$ 4.00.

The reviewing of new textbooks is a frequent but rarely a happy event. It is, however, a task which should not be undertaken lightly since texts can come to have considerable academic influence. These three texts have been reviewed from the standpoint of an engineering student; indeed the comments of three first-year undergraduates who briefly examined the texts helped to confirm the reviewer's conclusions.

The books were read in the opposite order to that in which they are reviewed, Mr Ireland's 500-page offering being completed after four days of fairly intensive reading. This book, succinctly titled, purports to give a modern treatment of fluid mechanics suitable for degree *and* Higher National Certificate students. To aid these students a large part of the book is given over to questions and solutions originating from examination papers of the University of London and the Professional Institutions. The content of the remainder of the book would appear to have been completely determined by the knowledge required to solve these problems.

It is no criticism of examiners, many of whom are far-sighted educationalists, to say that to use their products as the basis for instruction is to allow the academic tail to wag the intellectual dog. In the slow cycle of academic change it is the examination which must move at the slowest pace so as not to penalize the student with a conservative teacher. Surely an author should lead and not follow the examiner, who is tied to his syllabus. Might we not expect, for example, that on the topic of fluid momentum the sixteen exercises in this book should cover more than flow in pipe bends and impinging jets.

Were the book a collection of worked examination questions it could be deplored merely for its limited scope. However the title suggests greater pretensions and consequently the book's deficiencies appear more glaring. To criticize in detail may sometimes be unfair, but there are so many cases of poor presentation in this book that some comment is necessary.

The author confuses dimensions and units and goes on to use precise terms like *streamline*, *system* and *control volume* without definition. Not a mention is made of boundary layers or stagnation and the two references to separation are linked with the vapour pressure. Perhaps these omissions are intentional since the continuity equation is said (p. 93) to express the requirement that all flow should be steady. The presentation of "Model Analysis" purely in terms of flow

resistance, and the discussion of aerofoils in pumps with no reference to stalling are typical of the limited view which is taken of the subject.

Although fluid mechanics has stimulated some of the liveliest intellects of our time, this author has reduced the subject to a form of drudgery. If this is the best we can present to our students then it would be better to leave them to their own natural curiosity, stimulated perhaps by a few sketches from Leonardo da Vinci's notebook.

Turning to the book by Professors Garde and Avani, one notes that the title includes the word "Hydraulics" and the foreword suggests that it is aimed at practising engineers as well as students. The book can best be described as a compendium of hydraulic information which has been gathered by the authors over many years. Unfortunately the compilation has been done without much comment on the relative importance of each item and little has been done to bring the book up to date. Even the S.I. system of units, in the adoption of which India preceded the United Kingdom, appears only in an appendix. Consequently the numerous examples, both worked and for the student, contain a confusing mixture of metric and imperial units with non-standard abbreviations. The educational value of their examples is debased by a lack of originality and an excess of algebraic manipulation. It must be noted in passing that an answer to a pipe-flow problem is given to six significant figures!

It is, however, in the enunciation of the principles of fluid mechanics that the dated and imprecise nature of this book is revealed. Most arguments are conducted in terms of the specific weight of the fluid while the density makes only an occasional appearance in the context of Bernoulli's equation. The analyses are performed without reference to systems, control surfaces or control volumes, and although there is a short section on boundary layers the accompanying illustration is badly drafted. Regrettably the flow through the control volume on p. 101 violates the continuity equation, and on p. 200 ten free streamlines enter an orifice but only five leave it.

While this book has little to offer as an introduction to fluid mechanics it may be of use in its own country as a handbook of hydraulics. It is the only book among those reviewed which includes references to other literature, although many of the references given at the end of each chapter have long been out of print. The comprehensive list of books and papers in Appendix III would have been more useful if arranged according to topic.

It was perhaps fortunate that *Elements of Fluid Mechanics* by Seshadri and Patankar was read first as it achieved standards of brevity, clarity and precision far above those of the other two texts. The reviewer hopes that this book will become widely available as it merits serious consideration by teachers.

The book is founded on a basic course given to engineers and resembles, to some extent, a set of lecture notes. This concise presentation does not give rise to any difficulty in comprehension and has enabled a thorough exposition to be provided in a little over two hundred pages. The authors' thoughtful use of problems has saved much space; many of the routine derivations have been set as exercises, and those which are most important to an understanding of the topics have been especially commended to the student. There are other signs of

originality in the book such as the separation of integral and differential flow analyses, but nowhere are they more welcome than in the numerical examples. Here, in contrast with the other texts, we have rockets, astronauts, cooling ponds etc. to bolster the flagging interest of the student.

It is unfortunate that the book should end with a chapter entitled "Further Reading" which, like the rest of the book, contains not a single reference. In a country where other texts are presumably in short supply and very expensive, a critical appraisal by the authors of recommended reference books would have been particularly valuable. A final criticism, which could be levelled at the authors of all three texts, is the lack of encouragement given students to observe fluid flows in the laboratory. The most sophisticated analysis is worthless if based on an incorrect flow pattern. When one considers the contribution of flow visualization to our knowledge of fluid mechanics, it is disappointing to find authors giving so little stimulus to students to see for themselves.

P. J. MINTON

Hydronautics. Edited by H. E. SHEETS and V. T. BOATWRIGHT. Academic Press, 1970. 454 pp. \$22.00.

This book is described in the preface as a "text" on ocean technology. It is hardly that. Although it is certainly a useful reference book for ocean engineers, both fully fledged and fledgling, it is difficult to imagine what kind of a course could be taught from it. Rather than a text, it is a collection of seven monographs on a variety of topics. These monographs are almost completely independent; there is no continuity in the book and only the very occasional reference from one section to another. Further it is a very 'American' book, with almost all its illustrations drawn from United States sources and almost all the problems discussed treated from an American viewpoint.

The first article on "Ocean Resources" by J. H. Clotworthy reads very like an article one might expect to find in *Fortune* magazine. The coverage is fairly comprehensive and includes a discussion of petroleum, mineral, living resources and energy. Pollution is briefly touched upon as a sort of 'negative resource' and there is a disappointingly brief mention of recreational aspects.

I identified enough factual errors in the areas in which I am well informed to be a trifle nervous about those on which I know less. For example, under energy from tides, we find the following curious sentence: "Locked away in these flowing waters are *unlimited* supplies of energy that could provide power for our industrial world." (my italics). In fact, the total oceanic tidal energy theoretically available hardly exceeds present energy demand, and the amount practically available from the tides is so small that it could only have very local significance, even if fully developed.

The second chapter, by F. N. Spiess, is entitled "Oceanic Environment". However, I believe that, considering the way in which the word environment is used nowadays, most readers would find the topics discussed did not coincide with their expectation. Except for a brief discussion of gravitational variations and background radioactivity the article concerns influences on information transmission within the ocean by acoustic and electromagnetic systems, with

a great emphasis on the former. Spiess is one of the world's leading experts on underwater acoustics, and despite its somewhat misleading title this is a valuable chapter.

Chapter 3 is a discussion of "Oceanic Dynamics" by R. L. Wiegel. To physical oceanographers the balance of emphasis given to topics under this title will seem rather strange. There is a comprehensive, albeit somewhat dated, discussion of ocean waves. The other great emphasis, rather curiously, is on turbulent jets, some of which is of doubtful applicability to the ocean. There is a rather primitive discussion of the Ekman layer and Ekman drift, but on the vorticity theory which dominates almost all modern discussions of the great ocean circulations there is hardly a word. Stommel's classic "Gulf Stream" is not even quoted! I did not find any mention of Rossby waves. There is nothing on wave-induced coastal motions. Can it really be that these questions, so prominent in the oceanographic literature, are of no interest to the technologist?

Chapter 4 is on "Underwater Navigation" by F. A. Andrews. There is a very readable account of the way in which this technology developed from the need to reconstruct the events of the *Thresher* tragedy. The principles involved in underwater location by acoustic means are very lucidly outlined. Of all the articles in the book this one comes as close as any to being of the 'textbook' variety.

Chapter 5 on "Marine Vehicles and Structures" by O. H. Oakley is very comprehensive, ranging over a wide variety of the specialized ships used in oceanography and for the recovery of marine resources, research and military submersibles and submarines, and other structures such as offshore drilling rigs. There is considerable discussion of the nature of materials being used, the way in which controls are effected and the way in which various vehicles respond to the seaway. The fact that the article is somewhat dated is particularly unfortunate as far as the submersibles are concerned; the discussion of these deals with the first generation "Cadillacs", which were constructed in the days when there were high hopes that oceanography would get the same kind of funding that space research got in the 1960's. The much cheaper contemporary "Volkswagens" like the Perry Cubmarine and the Pisces, which do most of the real work nowadays, are hardly mentioned.

Chapter 6 "Sea Systems" by J. P. Craven and P. R. Stang is a discussion of a number of topics of importance to ocean engineers. Nothing is very comprehensive, but there is very useful introductory information on a wide range of topics, including platforms, life-support systems, communication systems and object delivery and retrieval.

Chapter 7, by one of the editors, H. E. Sheets, is on "Policy Planning". It contains some rather useful information on such things as the territorial sea and fishing jurisdiction claimed by various nations, and the past and projected rates of growth for marine science. However, these seem to be incidental to a main purpose which I must admit I was unable to discern. Neither could I identify for whom the article was intended.

Overall, one would guess that this book should be in the library of most

institutions concerned with marine problems, but I find it difficult to imagine any individual who would keep it on his desk. One of the problems is probably associated with the fact that the individual chapters seem to have reached the editors over a rather long time interval, and although the book is dated 1970 several of the chapters seem to have been written in 1967.

Physically, the book is not very prepossessing. The paper is good and the diagrams and photographs have reproduced well and the print is clear. However, the margins are very cramped and the book leaves none of the sense of opulence which one finds in most contemporary American hardcover publishing. The proof reading leaves something to be desired. Although the number of errors are not really disturbingly large, some of them are of the kind which one does not expect to see in hardcover publications. For example, on page 32, there is an example of the kind of line displacement which one finds frequently in newspapers but very rarely in books, and on page 420 the figure caption is inverted in an extremely misleading fashion.

R. W. STEWART

Flowing Gas-Solids Suspensions. By R. G. BOOTHROYD. Chapman & Hall, 1971. 289 pp. £4.30.

This is one of a series of books treating clearly defined topics in the field of Powder Technology. The present volume concentrates on rather dense, flowing suspensions and deals only incidentally with aerosols and fluidized beds. It is aimed at engineers working in the process industries and at novice research workers. The author's stated intention is to introduce the scattered literature and to reveal the basic mechanics of the two-phase system (rather than to present the alternative rheological approach).

The problems of flowing suspensions are grouped into chapters on: fundamentals of particle mechanics and of turbulent flow, similarity methods, momentum transfer, turbulence generation, experimental techniques, heat transfer, electrically charged suspensions, compressible flows, boundary layers, and various industrial applications. About one-quarter of the book is occupied by the supporting apparatus of indices and lists of nomenclature and references. In my opinion, the basic scheme is sound, and the treatment of the last six of the eleven topics listed above does, broadly speaking, fulfil the author's intentions. I have serious reservations concerning the other half of the book. Regrettably, this includes the topics of greatest direct interest to the author; seemingly, he has not been able to find a proper balance between reviewing the field and advancing his own ideas.

The book as a whole, and particularly its less convincing chapters, is marred by dozens of minor errors: equations incorrectly set (among others, 2.11, 2.48, 5.9, 6.2, 7.14, 7.18, 7.23, 9.20, 9.23, 9.30); terms not defined (for example, Magnus effect, iso-disperse, Péclet number, Fermi levels, equivalent sphere); symbols not defined (on pp. 35, 41, 49, 61, 87); frequent changes in symbols and their significance; and unusual terminology. The most distressing instance of the last failing is the use of the term 'saltation' in a sense almost contrary to its usual interpretation.

The lack of attention to detail is symptomatic of more serious faults. (i) The discussion of turbulence, which is central to the presentation, is scattered, confused, and in some respects simply wrong. (The passage on pp. 49–50 can only do harm.) (ii) Topics are touched on several times rather than being systematically treated in one place; flow in bends, for example, is considered at three points in a single chapter, with two relevant figures on pp. 145–6 not referred to in the text until p. 156. (iii) The references, though numerous, are by no means comprehensive. (iv) Complex mathematical formulations are set out (for example, those beginning on pp. 36, 56, 183, 197, 219) with insufficient explanation of their derivation, significance and possible application. (v) Finally, I regret that Owen's penetrating survey of the domains of particle/flow interaction is relegated to the very end of a chapter and is presented there in a rather apologetic manner. His analysis should, in my opinion, form the core of the exposition.

Despite the failings listed above, this book does provide a convenient survey of its field. However, it is less likely to be helpful to the novice, for whom it was intended, than to the experienced and canny reader who does not have to lean heavily on it.

A. J. REYNOLDS