

REVIEWS

Mechanics of Fluids. By R. A. DUCKWORTH. Longmans, 1977. 275 pp. £4.95.

Advanced Fluid Mechanics. By A. J. RAUDKIVI and R. A. CALLANDER. Edward Arnold, 1975. 325 pp. £12.00 (hardback) or £5.00 (paperback).

Both these books are written by engineers for engineers. The former is an introduction to the mechanics of fluids for university students and the latter is for the minority of engineers who become involved with advanced theoretical fluid mechanics.

It is doubtful whether it is now possible to write an elementary textbook on fluid mechanics for engineering students which is truly new. I am sufficiently old fashioned to think that the last 'new' book was by Hunter Rouse in 1946, but its main disadvantage these days is that it does not use S.I. units. Dr Duckworth has nevertheless made a good attempt at a new book and the style, format and diagrams are pleasantly clear. It is aimed at civil, mechanical and aeronautical students with the object of giving them a 'conceptual understanding of physical principles'. This claim is valid with the proviso that the book is primarily for first-year students. Nevertheless even at this stage it is perhaps slightly more suitable for mechanical engineers than the others. It certainly does not cover much second-year work because, as the author indicates, topics such as aerodynamics, turbomachinery, tribology and open-channel flow are left for further study.

However as a first-year book it is a good one, containing some historical background information together with thoughtful comments by the author on his philosophy of the subject. The usual topics are covered and the section on kinematics, path lines and streaklines is particularly good. Diagrams are informative and well labelled. From the student's point of view it has the advantage of containing worked examples together with many problems for practice selected from a wide field of applications, together with numerical answers.

Its price is relatively high but not perhaps unreasonable. Nevertheless, if quantity is any guide, it contains far less than some of its competitors which are not only cheaper but also cover second-year course material.

The second book, by Raudkivi & Callander, is more unusual and might therefore be termed new. It is intended to equip those engineers who become involved with advanced fluid mechanics and wish to learn the techniques of three-dimensional theoretical analysis. Most advanced books on fluid mechanics have been written by applied mathematicians and are therefore, with no disrespect, not easily digested by the average engineer who has only a limited mathematical education. Although the analytical treatment goes far beyond the needs of the average engineer the aim of the book is laudable because it will help the relatively few engineers confronted with such problems. For instance advanced students and research engineers should find it helpful when trying to follow existing theoretical papers or when attempting to evolve or apply new theories.

The second chapter, on fundamental relationships, is particularly good because physical explanations of the conventions and terms in the equations are clearly presented with the aid of comprehensive diagrams. Whereas mathematicians can absorb notation, conventions and unfamiliar mathematical systems more intuitively

using conceptual aids such as mathematical symmetry, the engineer tends to prefer a picture to help him get a better physical understanding.

The remaining chapters, on potential-flow theory, turbulent flows, boundary layers, diffusion and dispersion, provide a good basis for anyone venturing far into these fields. The chapter on potential flow is more conventional but nevertheless well described and that on turbulent flows is most helpful to the layman. The chapter on boundary layers, jets and cavities is somewhat unbalanced because there is so little on cavities, only two pages. However, the remainder covers boundary layers and jets adequately. Diffusion and dispersion are well described; in fact it is not surprising that the emphasis throughout reflects the authors' research interests. There are three useful appendices on moving co-ordinate systems, tensor analysis and the derivation of equations. These, together with the bibliography at the end of each chapter make this an excellent reference book for the mathematically inclined engineer who wants to go further.

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