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REVIEWS

Theoretical Hydromechanics. By N. E. KOCHIN, I. A. KIBEL and N. V. ROZE. Wiley Interscience, 1964. 577 pp. £7. 10*s*.

Principles of Ideal-Fluid Aerodynamics. By K. KARAMCHETI. Wiley, 1966. 636 pp. $20.00 or £8.

These two books, though different in character, both deal with the theory of the ideal fluid. *Theoretical Hydromechanics* is a translation of the fifth Russian edition and so presumably is successful in the country of origin. Indeed the authors clearly know their subject and deal with it competently.

The description on the fly-leaf begins 'The two and three dimensional motion of bodies in fluids is discussed extensively and in detail', which is fair comment provided one remembers that the fluid is inviscid and incompressible apart from 10 pages on waves in a compressible fluid. There seems little point in listing the contents. The book follows the classical pattern laid down by the earlier works on this subject, apart from one or two modifications. The most important additions are as follows: the design of cascades, an advanced problem in conformal transformation; some fairly recent work on cavitation using free streamline techniques; the flow of a stratified fluid over an obstacle, showing the appearance of lee waves; and a quite detailed account of the stability of a Kármán vortex street using the techniques devised by Liapunov.

The style, as well as the contents, reminds one of the older works on fluid mechanics. In the main the authors prefer to manipulate the equations in Cartesian form, although vectors do appear. Also a great deal of the mathematics is presented with no discussion of its relevance to the real situation. This is one of the difficulties of presentation in this subject, where there is no background knowledge of the real fluid that can be invoked. The author who finds a solution, and still writes a genuine introduction to the subject, will be assured of success. As it is, the book can be kept in mind for reference purposes and the student will be grateful for the exercises—in Russian style the more difficult problems are followed by a detailed solution. It is doubtful, however, that the book has sufficient special appeal to inveigle many students from their favourite text on a more permanent basis.

Superficially the *Principles of Ideal Fluid Aerodynamics* has a similar aim, but on closer inspection it appears that the author takes a more specialized view and is true to his title. All the necessary background theory is there, but the particular needs of the aerodynamicist are his real concern.

The first section of 230 pages takes the reader from the basic ideas to a discussion of Euler's equations of motion. In the first chapter the various concepts and non-dimensional parameters which arise in fluid dynamics generally are introduced. Their significance over the various ranges which might typically occur in practice is carefully explained, and the conditions under which ideal fluid theory might reasonably be used are discussed. This is a good introduction. It explains the role played by the ideal fluid in the subject of fluid mechanics as a whole, and sets the scene for the rest of the book.

The second chapter consists of 100 pages on vector algebra. This seems

a mistake. Apart from the break in presentation, this chapter relies a great deal on appeal to the reader's intuition. The distributive law for vector products is assumed. The derivation of the alternative expression for a triple vector product is incomplete. There is no proof that angular velocity is a vector. The algebraic definition of a vector is mentioned but not stated. Tensors appear but are not well defined. Some students prefer this highly practical approach to mathematics, and the criticism is not that the author should cater for those who do not. It is that the writer of a book on fluid mechanics need feel no longer that he is responsible for introducing the reader to the mathematical methods he employs. The student who embarks on a study of this book ought to know his vector algebra already, and there are adequate texts available from which he can take his choice.

The rest of the chapters in this first section deal with the kinematics and dynamics of fluid motion. Here and there the presentation might be improved, sometimes by judicious omission, such as the inadequate account of the singularities at stagnation points in two-dimensional flow, and one derivation of the equations of motion rather than two, and elsewhere by a more adequate discussion, as on page 153 where one reads 'we can show that when the stress vector at a point is wholly normal in all directions, its magnitude is the same for all elemental planes passing through the point'. Otherwise the author has given a reasonable account of the equations of motion.

The next section of the book, another 230 pages, deals with the usual classical results for irrotational motion and the boundary value problems governed by Laplace's equation. It also contains a 40-page chapter on the theory of functions of a complex variable which starts with the definition of a complex number, goes on to contour integration and finishes with a discussion of the Taylor and Laurent series. This chapter is either inadequate or unnecessary according to the background of the reader and is another example of a topic that can be studied from other sources.

The rest of the book is concerned with aerofoil theory, and it is here that the author is at his best. It is well written and includes most of what ideal fluid theory has to offer, from the simple Joukowski aerofoil to the elements of finite wing theory. The figures are beautifully drawn and a real aid to the text, as indeed they are throughout the whole work. The student of aerodynamics should not overlook the book as a possible source of information.

One final comment is provoked by the price of these books. The publishers might ask themselves if they are doing the average student a service by offering such expensive products. Apart from one or two notable exceptions, which will always be necessary when greater detail is required, the type of book which becomes more and more popular as a student text is one of limited range, cheaply produced, with the quality in the presentation of the material. There are several reasons for this. Few authors can maintain a high standard of presentation over a wide range of topics. The flexibility which a good selection of such books offers is more suited to the demands of the present-day university courses. Lecturers do not care to lean too heavily on one particular author. And, deplorable though it may seem, a student's decision to buy a book is influenced very much by the price.

W. CHESTER