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REVIEWS

Wave and Stability in Fluids. By D. Y. HSIEH and S. P. HO. World Scientific, 1994. 416 pp. ISBN 9 81021 870 2. £38.

The reader of this book with its awkward title may expect the worst. But the scientific content is actually quite interesting and useful. Obviously the mother tongue of the authors is not English and the text suffers from frequent grammatical errors. But since most of the book is devoted to mathematical derivations the sometimes missing definite and indefinite articles are only a minor nuisance.

The book provides a modern introduction to two major fields of fluid dynamics. As must be expected of a book of this size, the treatment of waves in fluids and of hydrodynamic instabilities is not comprehensive. Instead the authors have selected topics that have received special attention in recent years and that have been the subject of their own research. After a short introduction to the linear theory of waves, acoustic waves are treated with the inclusion of nonlinear effects such as acoustic streaming and shocks which are described on the basis of Burgers equation. Next water waves are discussed and mathematical tools like the inverse-scattering method for the treatment of solitons are developed. A special chapter deals with waves in stratified media and in bubbly liquids. Hydrodynamic instabilities are introduced in a long chapter of nearly 150 pages. The major classical mechanisms (Kelvin–Helmholtz instability, and Orr–Sommerfeld, Faraday, Rayleigh–Bénard and Taylor–Couette problems) are described and in a few cases nonlinear aspects of the evolution of disturbances are considered. Finally the book includes a short chapter on chaos, based on a discussion of the Lorenz equations and of the logistic map.

The book has not evolved far from its original state as lecture notes. While the mathematical derivations by and large are done carefully, little effort has been made to put them into a physical context. There is hardly any comparison between theory and experimental observations, and figures are restricted to a few sketches of geometrical configurations. The list of references includes only 17 items, eight of which refer to the authors' papers. The reader thus must consult other books to find more details. It seems that with some extra effort and the appropriate editorial support a much more attractive book could have been produced. In its present form the volume can be recommended as a reference for the library shelf. But students and scientists not familiar with the fields will get a rather incomplete impression of two of the most exciting areas of fluid mechanics.

F. H. BUSSE

Free Liquid Jets and Films: Hydrodynamics and Rheology. By A. L. YARIN. Longman (in USA, Wiley), 1993. 446 pp. ISBN 0 582 10295 2. £68.

Free-surface flows fall naturally into three categories: examples where the surface is part of the boundary of a volume of liquid, as for waves on the surface of liquid in a container; drops and bubbles where the free surface encloses an isolated volume of liquid or gas; and the topic of this book, where the liquid issues forth from some pipe or container into an elongated shape such as a jet or sheet of liquid. The subject is important in a number of industrial processes and has relevance to other flows. As is indicated by the title of the book, the liquids considered are not just the traditional inviscid and Newtonian models. There is a strong slant towards other fluids with more complex material properties. Indeed, examples are drawn from various topics relevant to polymer processing such as fibre spinning and the blowing of polymeric films, rather than examples where liquids are projected to enhance heat or mass transfer or provide drops for one purpose or another.

The topics covered in the book are introduced in the first chapter. The following three chapters are on jets. After a short chapter on the 'Dynamics of free liquid jets' which includes brief derivations of equations of motion, there are two very substantial chapters on 'Breakup of liquids jets' and 'Mechanics of fibre spinning'. The final chapter is on liquid films, and the book concludes with four appendices on the rheology of polymeric liquids. A substantial part of each chapter is devoted to the non-Newtonian examples: these often contrast with the simpler examples which precede them since the elastic stresses may dominate the flow behaviour.

As might be expected, most of the analysis makes use of approximations that the jet or film is thin and slender compared with any other dimensions in the problems. There is little analytical discussion of such approximations but there are frequent examples of comparison with experiment and opinions given as to the cause of discrepancies. The relevance, and the shortcomings, of the rheological models are discussed.

A large part of the book builds on the work of the author and his colleagues. Where this has appeared in the Soviet/Russian literature this is helpful for the Western reader, especially when the reference given is not in a translated journal. However, it is frustrating when too many details are omitted: this is especially so for the experimental comparisons where, in all but one case, virtually no details are given of the experimental procedure, etc.

The book is not very friendly for the beginner. There is a tendency for the more classical results, such as Rayleigh's treatment of jet instabilities and G. I. Taylor's work on thin sheets, to be treated in a manner which assumes that the reader is fully familiar with such work. The author is also rather unfortunate in that this book was published just before the recent substantial advances on the breakup of liquid jets: see Eggers (1993) and subsequent papers of which the most recent at the time of writing is Papageorgiou (1995).

Overall, the book is a research monograph with a strong bias to analytical modelling of polymeric applications. As much it is likely to be of value.

REFERENCES

EGGERS, J. 1993 Universal pinching of 3D axisymmetric free-surface flow. *Phys. Rev. Lett.* **71**, 3458–3460.

PAPAGEORGIOU, D. T. 1995 Analytical description of the breakup of liquid jets. *J. Fluid Mech.* **301**, 109–132.

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