



BOOK REVIEW

FLUID DYNAMICS FOR PHYSICISTS, T. E. Faber, Cambridge University Press, Cambridge ISBN 0521 419433 Hardback, 0521 429692 Paperback.

The emergence of a new textbook in the already crowded field of fluid dynamics inevitably leads to questions of justification. The author of *Fluid Dynamics for Physicists* is, of course, aware of such questions, and takes pains to emphasize that this book is intended for physicists seeking an introduction to the subject. His aim is thus to avoid undue concentration on either mathematical analysis or specific applications, features that might be expected by mathematicians and engineers, respectively, and to present his material at a less advanced level than existing works intended for physicists. In this respect, he has largely succeeded, and the result is a clear and accessible volume covering a broad range of fluid-dynamic phenomena.

The book opens with a discussion of the flow in a syringe, which is used as a vehicle to introduce the subject matter of subsequent chapters. Such an approach runs the risk of seeming contrived, but the combination of a well-chosen example and a nicely judged exposition, in fact, turns it into an enjoyable introduction to fluid mechanics, and whets the appetite for the material to follow. This consists of chapters on ideal (Euler) fluids (2), gas dynamics (3), potential flow (4), surface waves (5), viscosity (6), vortical flows (7), fluid instabilities (8), turbulence (9) and non-Newtonian fluids (10). There is also an appendix dealing with one-dimensional sound waves.

Unsurprisingly, the viewpoint of the book is very much a physicist's, trivially in terms of the background assumed of the reader (e.g. the use of magnetic analogies whenever possible), and more fundamentally in terms of its organization and choice of examples. It may therefore not be to the taste of those of a mathematical or engineering bent – the latter, in particular, might find the explanations of some phenomena lacking in detail and slightly glib – but to criticize the work on these grounds would be unfair. In terms of its stated aims, it must be judged a success. The exposition is elegant and lucid, and proceeds in a sound logical order. A particularly attractive feature is the large number of familiar phenomena which have been chosen to illustrate the physical principles under discussion; for example, plug-hole vortices, bores and the Coanda effect (ideal fluids), the Föhn, explosions and rockets (gas dynamics), tornadoes and smoke rings (potential flow), ship wave patterns (surface waves), emptying bottles (viscosity) and secondary flows in teacups (vorticity). The accuracy of the text and equations, typographical and otherwise, is of a high standard, and the figures are clear and informative. There are occasions when one would wish for additional figures rather than a textual description of a geometry, but this is a minor caveat.

As far as the appropriateness of the book for its target audience of novice fluid dynamicists is concerned, the first six chapters may be unreservedly recommended. The topics covered here can be dealt with satisfactorily from first principles at the required level, and should be accessible to anyone with the appropriate scientific and mathematical background. However, in Chapter 7 (vorticity), the material starts to become more advanced, and the arguments increasingly have to be taken on trust. This tendency is even more marked in the final three chapters (instabilities, turbulence and non-Newtonian fluids), whose subject matter is quite advanced for an introductory text. These chapters sit

somewhat uneasily between purely qualitative accounts, intended to give simply an appreciation of their topics, and the more in-depth discussions appropriate to specialist readers. This said, the presentation remains attractive, and an undergraduate could still be expected to gain from the material, without necessarily following it fully.

In summary, this is a good, distinctive book, whose individual approach evidently arises from the author's careful reflection on, and interpretation of, its subject matter. It is largely suitable for its intended audience, and is thus a valuable addition to the existing constituency of fluid mechanics textbooks. Furthermore, although it does not aim to treat its material at an advanced level, its broad scope and its clarity make it a worthwhile volume for the bookshelves of more experienced fluid dynamicists.

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