a set of problems to solve, ranging in scope from fairly simple questions to quite substantial programming projects.

It is worth noting that the entire development is firmly rooted in the Imperial College school of CFD, with its strong emphasis on structured meshes and pressure-correction algorithms. This is not necessarily a disadvantage in an introductory text especially since so many of today's commercial CFD codes can trace their ancestry back to the same point of origin. On the other hand, a broader perspective might have been useful in the later chapters, where the advantages and disadvantages of other approaches to CFD could have been discussed with educational benefit. The underlying focus on heat transfer is also slightly too obtrusive in a general text on CFD, and the chapter on phase change seems oddly misplaced.

In terms of the exposition, the English is perfectly readable but does contain some delightfully old-fashioned turns of phrase and rather too many missing articles. CFD is already blessed with too many acronyms: it is not necessary to invent still more such as TSE, IOCV, LRE and HRE. For the explanations, read the book. Concise notation for numerical analysis in CFD is notoriously difficult to achieve, but here some of the notation is downright irritating: does the symbol for the internal heat generation rate really need to have three primes? Worst of all is the use of 'e' instead of the universally accepted 'k' for the turbulence kinetic energy: who has ever heard of the e-epsilon model?

Finally, the book's author is greatly concerned about the need to ensure compatibility between the continuous and discrete forms of the transport equations. There is a most illuminating discussion relating to the implications of this for the discrete pressure field, and a particular formulation is suggested. Nevertheless this difficulty is inherent to many spatial discretisation methods for CFD and can be alleviated in other ways. Again, some broader perspective would have been helpful.

In summary, this is a useful introductory text covering a topic where good books are scarce, and is worthy of inclusion on CFD course reading lists.

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Fluid Dynamics: Theoretical and Computational Approaches, 3rd Edn. By Z. U. A. Warsi. CRC Press, 2006. 845 pp. ISBN 0 8493 3397 0. £39.99

J. Fluid Mech. (2007), *vol.* 572, doi:10.1017/S0022112006224352

A review of the first edition of this text in 1996 (vol. 318, p. 408), by my late friend and colleague David Crighton, suggested it was insufficiently user-friendly for the highly competitive market made up by Engineering and Applied Mathematics students. Personally I feel the problem with this volume remains that it is too predominantly theoretical for the former and yet not sufficiently deeply mathematical to suit the latter. Thus, while it provides a good solid text covering all the basics each require, it does so without really satisfying or stimulating students of either discipline.

The present edition adds new sections on free surface flows, on flow instability, chaos and nonlinear dissipation, and on large eddy simulation (LES), but each of these exhibits some clear deficiencies. Particularly notably, in the first of these sections, there is no discussion of surface tracking or volume of fluids methodologies. Then, in the second, the description of 'current approaches to nonlinear modelling' discusses only the output of a single research group over the period 1990–1995, and nothing is included on the latest transition prediction developments. Indeed this key topic receives only scant mention; whilst the misspelling of the title to the chaos subsection, some poor positioning of figures, changes to reference style, and incomplete index updating, all reinforce the impression that the addition of the new material has been done at a less complete level than that attempted for the original volume.

The section on LES is also very basic, with just four references, of which the best is to Sagaut who has certainly covered this subject far more comprehensively and better. Those interested in this level of modelling would do well also to study the 2002 Cambridge University Press volume on *Closure Strategies for Turbulent and Transitional Flows* (Eds. B. E. Launder & N. D. Sandham) which was one of the significant outcomes of the 1999 Isaac Newton Institute Programme on Turbulence, and covers the whole hierarchy of both turbulence and transition modelling as well as simulation.

The set of Mathematical Expositions, together with end of chapter problems, provides one of the best features of the book and these do include some new example problems and exercises that reflect topics of current interest, but it is questionable whether the student reader would agree that this third edition is an indispensable guide to the methodologies needed to solve new and unfamiliar problems in fluid dynamics, at least in the manner it has been advertised to be.

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