motivates the authors' idea that the expansion of our Universe might be accounted for by an event similar to a classical explosion.

The book represents an excellent attempt to present the subject area of mathematical fluid dynamics to a readership in fluid dynamics, applied mathematics, and general mathematics. It is addressed to researchers and to graduate students.

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V. A. Vladimirov

Fundamentals of Computational Fluid Dynamics. By Tapan K. Sengupta. Universities Press, Hyderabad, 2004. 350 pp. ISBN 81 7371 478 9. 750 Indian Rupees (paperback). Distributed by Orient Longman Ltd.

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CFD (computational fluid dynamics) has clearly become a central tool in fluid mechanics and the number of textbooks published on this topic demonstrates the complexity of this field. How to teach CFD and what a good textbook should contain are also issues of major importance in many research centres and universities. The description of how a modern CFD code works on unstructured meshes and parallel computers could fill whole books just to present the numerical technology. Such a presentation would not even address numerical analysis issues such as why the chosen method works, if it is stable and which other methods could replace it. Therefore, writing a textbook on CFD today is a difficult and challenging task which must either focus on very limited aspects or only present very general concepts. This book by T. K. Sengupta *Fundamentals of Computational Fluid Dynamics* actually mixes these two approaches:

Firstly, it is a general introduction to CFD, following the usual line of presentation found in most CFD textbooks: equations of motion, classification of PDEs (partial differential equations) found in fluid mechanics, discretization methods, solution of parabolic PDEs, solution of elliptic PDEs, solution of hyperbolic PDEs, meshing techniques, finite volume and finite element methods, examples of solutions for Navier–Stokes examples. These chapters do not provide any really new information but present it in a reasonably compact way which allows easy reading.

Secondly, in addition to this standard and general CFD course, the author uses approximately one third of the book to address much more detailed and modern issues which all relate clearly to his own field of research: the precision of high-order schemes in terms of wave propagation and their applications to DNS (direct numerical simulation) and LES (large-eddy simulation). One important question is the capacity of numerical schemes to propagate waves at the right speed (dispersion effects) and with the right amplitude (dissipation). Even though dispersion and dissipation have been discussed in many places before, it is clear that these properties were not essential in most present industrial codes which use RANS (Reynolds-averaged Navier–Stokes) turbulence models: RANS turbulence models make the flow so viscous that no wave can propagate into it, independently of the numerical scheme. This situation is changing rapidly: with the development of DNS and the explosion of LES for practical applications, CFD users have re-discovered that waves indeed exist in fluids and that capturing these waves numerically is a difficult task.

These two different levels of CFD description are an important characteristic of the book: while the sections devoted to the general description (chapters 1 to 9, 12 and 13) are fairly easy to read and could be an adequate textbook for beginners, the second part (chapters 10 and 11) which addresses spectral analysis and high-order schemes performance for dispersion and dissipation is more advanced and difficult to read. These two chapters should be read by all experts involved in the development of high-order schemes for DNS or LES. They contain an excellent summary of the author's work together with parallel recent studies on these topics. The classical book by R. Vichnevetsky & J. B. Bowles (*Fourier Analysis of Numerical Approximations of Hyperbolic Equations*, SIAM, 1982) on spectral analysis of numerical schemes is probably better organized and should be read first but the present book contains multiple new developments which are certainly important today because they include DNS and LES applications which were not considered by Vichnevetsky & Bowles.

The size of the book (340 pages) is reasonable and will not frighten beginners. It also allows easy searches. However, this limited size implies that more information is found in books like the monograph by C. Hirsch (*Numerical computation of Internal and External Flows*, Wiley, 1988). For example, nothing is said on boundary conditions (which are also a critical aspect of LES and DNS). More generally, the whole text is limited to structured meshes while most modern algorithms use unstructured meshes. The presentation of the book is good even though many typos could be corrected.

In conclusion, this book will be useful for beginners and for students who are looking for a compact description of CFD but also for CFD experts who are developing high-order schemes for DNS and LES on structured meshes.

T. Poinsot