wide variety of topics covered. The contributed papers are currently arranged in the volume in alphabetical order according to the last name of the first author. This arrangement is convenient for locating the paper of a specific author, however, to facilitate locating papers on a particular topic, it would be convenient to have them arranged in groups according to subject matter. Therefore, would like to suggest that future volumes include, perhaps as an appendix, the technical program of the Conference, so as to also provide an arrangement of these papers grouped according to subject matter.

Furthermore, to include over 100 papers in a book and yet keep the book size practical, requires limiting each paper to a maximum of six small pages. Frequently, results appear to get excluded from the papers. Perhaps books of this type would be of greater value if only those papers which contain new contributions substantiated adequately by results, were selected for inclusion.

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Computational Methods for Fluid Flow, by Roger Peyret and Thomas D. Taylor, Springer-Verlag Inc., New York, 1983, 358 pp., $22.00.

This welcome addition to the CFD literature is clearly a reference book rather than a text book, with an audience of active researchers, although some sections are clearly and successfully didactic. The trans-atlantic coauthorship by two highly regarded researchers gives a nice perspective, including both U.S. and French contributions.

Some of the material is really outstanding. There are detailed discussions of pitfalls and subtleties of boundary conditions in both directional- and operator-splitting methods. There is also a very complete analysis and organization of two-step Lax-Wendroff schemes (pp. 48-57), based on original work coauthored by Peyret. The methods of Godunov and Glimm are covered in some detail, and good introductions are given to "specialized methods" like potential flow, panel methods, discrete vortex methods, and cloud-in-cell.

The treatment of the artificial compressibility method (Chorin, etc.) is very good, including a discussion of the advantages of a staggered mesh (but without a discussion of difficulties of artificial compressibility on nonstaggered and nonorthogonal meshes), and an excellent original analysis of the persistent (nonconsistent) error of linear reflection applicable to all staggered mesh methods. Chorin's other method, fractional steps (called a projection method), is also well explained, but the discussion touches too lightly on the compatibility condition for Neumann boundary conditions. Their comparison with MAC is good work, a big effort on a tough subject, and very helpful.

Chapter 9 gives a necessarily brief introdution to turbulence modeling, covering turbulence in 12 pages, including closure, large eddy simulations, and direct simulations. It would be easy to criticize the brevity, but I actually thought that the chapter was good. Likewise, the introduction to finite element methods was brief but successful. On the other hand, I found the description of spectral methods much too fast.

In their explanation for upwind corrected schemes, they do understand that the oscillations of centered difference steady-state solutions are simply the discrete solutions, and are not cured by the iterative procedure. On the other hand, they present upwinding with no rationale. Similarly, conservation is defined in terms of algebraic sums, but with no interpretation or motivation.

The stability analysis for the forward time, centered space method (inadequately defined as just "the explicit scheme") does not get caught in the common error of identifying the cell Reynolds number limit with von Neumann stability. It is unfortunate that the authors did not emphasize the past errors polluting the literature, probably out of courtesy to the guilty authors (including myself). On the other hand, they did repeat the erroneous simple-minded extension of the stability limit from one to two dimensions. (I suppose neither error really does much harm, and it is amusing to watch them propagate and reflect about the literature. I wonder, will we ever converge?)

The higher order Hermitian and OCI related methods are presented, though rather quickly. But no mention is made of conventional higher order methods or deferred corrections or Richardson extrapolation. Only briefest mention is made of skew upstream methods.

The book has a surprisingly detailed presentation of delta formulation of the Beam-Warming method, and the difference from the earlier Briley and McDonald method. (Also, the authors do not make it a big issue or offend anyone, but the correct historical precedence is there.) The discussion of ADI methods (p. 66) does not distinguish the Peaceman-Rachford from the Douglas-Gunn methods.

The book unfortunately uses nonstandard technical terminology in some important areas. For example, the reader will look in vain for the "Thomas algorithm" or any of its aliases. Instead, the authors use the uncommon term "method of factorization." "Successive over-relaxation" or SOR is not used, rather it is called the "successive-relaxation method," with no references. (It is also given as a two-step method, which is misleading.) Even worse, the term "multigrid" is not used, but instead is called "multiple-grid method."

The 2½ page appendix on multigrid methods misses the mark pretty badly, in my opinion. Besides the wrong terminology, the description is incomplete, fails to give the proper historical credit to Brandt, and does not indicate anything of the frequently remarkable performance of multigrid. I challenge any newcomer to get a code working based on this appendix alone.

In treating the "equivalent equation" analysis, the authors miss an essential contribution of the keystone paper by Warming and Hyett: that the method, properly applied, is not merely heuristic but is equivalent to a von Neumann analysis.

The book has a big problem with perpetuating a misconception regarding conditions on accuracy for a tridiagonal solver. (For the model advection-diffusion equation, the condition gives as a limit on the cell $Re<2$.) The book states "It can be proven... that the algorithm gives accurately bounded results if the following conditions are satisfied..." But no specific mention is made that the conditions are sufficient, rather than necessary; nor do the authors define "accuracy" or indicate the nature of the problem, although they raise the subject at least eight times in the book, and the implication is strong that the condition is necessary. (Not only can we often get away with violating this condition, it has essentially nothing at all to do with stability limitations on ADI methods, e.g., we could use pivoting in the tridiagonal solution and have no effect.) Similarly, the book states the SOR converges for a symmetrical positive definite matrix, with no indication that it can converge for an unsymmetric matrix.

Chapter 5 is a very short (five page) attempt to examine the "relationship between numerical approaches," namely FDM equivalents of a FEM, the spectral scheme, and the Godunov method. This chapter was a good idea, but it is unsatisfying, somewhat vague, and strained.

Somewhat surprisingly, the book does cover the method of characteristics, traditionally reserved for gas dynamics books. I found it not well motivated in the essential step of finding the characteristic relations. A welcome topic would have been the seldom used but effective Hartree version of MOC.

The discussion on vorticity wall boundary conditions covers the methods, but misses the important distinction between Israeli's and similar type methods, which are essentially global and therefore have elliptic coupling, and the older point-wise methods, which fail as $\Delta x \rightarrow 0$ and, strictly speaking, require intra-time step iterations to be consistent in a time-dependent solution. Also, the discussion does not note that the Israeli type is easily extended to higher order accuracy, and to nonorthogonal coordinates. The time spent on the Green's formula approach (with a terrible quality figure) is inadequate, since no hint is given on how to pick the inner integral surface, on operation counts, or on conservation. It was a good idea to compare various methods on a nonsingular driven cavity model but they did not include Israeli's method.

Chapter 7 on FEM applications to incompressible flows is generally good, with specific recommendations on methods. However, some "impressive" results of a least-squares FEM solution are presented which are not at all impressive to me. Chapter 8 is on "Spectral-Method Solutions for Incompressible Flows," but the division of methods/solutions fails, and most of the chapter is a continuation of the description of methods begun in Chapter 3. Some notation is bad, and there still are not enough details to indicate just how the calculations are performed. Also, the status of some of the "suggested" methods is not clear. Some calculations using correct vs zero wall pressure gradient are incorrectly interpreted as indicating little effect, but actually show a significant 16% error in velocity.

In Chapter 10 they twice state (p. 268, ambiguously, and p. 270, clearly) that the Thompson, Thames and Mastin grid-generation method "amounts in principle to generating streamlines and potential lines," a clearly erroneous understanding of this most popular grid generation method. Their history of inviscid compressible flow calculations is brief, but properly emphasizes the major contribution of Moretti and the excellent study of boundary conditions by Abbett. The authors are often too easily satisfied by rather poor agreement between calculations and experiment, a long-standing historical problem in the open literature as well (e.g., see the discussion of Fig. 10.1.8, which I think shows pretty poor agreement with experiment). For another calculation, they approve of "very satisfactory results" (Fig. 10.1.14) when there are no experimental data, but only aesthetics to judge the results.

Chapter 11 on viscous compressible flows is surprisingly good. There is a good discussion of the nonrigorous approach to boundary conditions. However, I think they do not understand the problems with using the normal momentum equation to evaluate the wall pressure gradient. Also, I disagree that implicit schemes can only be efficient if they do not require intra-time step iterations.

Another excellent point about the book is the clear distinction made, for noncartesian grids, between discretizing in the transformed space vs discretizing in the physical space, a distinction of which many people are oblivious. A discussion of relative merits would have been valuable, e.g., the advantage in transformed space of easily using higher-order methods, contrasted to its more demanding requirements for smoothness in the grid-generation methods.

In spite of this broad range of subject matter, there remain a number of methods omitted, such as PNS, Lagrangian, boundary layer, grid generation (a few references are given), higher order upwind, and TVD. But this observation is not made as a criticism; it is just indicative of the richness of the field.

In summary, the authors have made a major contribution to the long term literature of the field, and are to be congratulated. I learned a good deal from the book, and can recommend a cover-to-cover reading.

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