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Book review

Review of Computational Gasdynamics, edited by **Culbert B. Laney** (Cambridge University Press, Richard Knott, the Edinburgh Building, Cambridge CB2 2RU, UK, 1998, 613 pp.) £ 32.50, US $ 54.95 paperback, £ 80.00, US $ 110.00 hard cover. ISBN 0 521 62558 0 pb, 0 521 57069 7 hc.

Computational Gasdynamics, by Culbert B. Laney is an excellent text for advanced engineering, math and physics students studying numerical techniques in compressible fluids. Laney explains that he purposely limits the discussion to gasdynamics rather than cover the breadth of computational fluid dynamics (CFD). The text, therefore, focuses on solution methods suitable for the Euler equations in fluid mechanics.

The book is full of detail and well written explanations. As a text for introductory graduate courses in CFD it might be too overwhelming. However, for students who have an introductory background and wish to pursue computational gasdynamics in their research or to become a knowledgeable user, this book makes a great addition to a personal library. Professionals who use CFD for solving aerodynamic or compressible fluid flow problems will also find this book useful.

The text is broken into five parts. The first begins with a discussion of the compressible Euler equations. It then proceeds to break the system of equations into waves and presents models for analysis. The discussion of waves in compressible flow is a good review of characteristic methods and wave systems. The first section ends introducing the Riemann problem and some approximate Riemann solvers.

The second section reviews the mathematics needed to develop and understand algorithms. For example, chapters on orthogonal functions and piecewise-polynomial reconstruction are presented here. This chapter is a good place to learn the mathematics behind algorithms, but the beginning CFD student may have difficulty wading through this section if his background is mostly engineering. On the other hand, students approaching CFD from applied mathematics will have no trouble understanding where the book is heading. For the professional or advanced student, this section provides a great summary review.

The third section gets to the basic principles: conservation, stability, and convergence. There is a chapter on non-linear stability, which is enlightening. Laney uses real world analogies to make a point. For example, in the discussion of domain of dependence he relates it to blind spots in a car. This sort of presentation is part of the book's strength.

Section four gets into algorithms, first scalar equations and then the Euler equations. This part of the book is a great reference. Many fundamental ideas and algorithms are presented and the nuances between them are discussed. These nuances may be lost on beginners, but for advanced students or professionals, this part of the book is of great value.

The final section is filled with algorithms which grew out of concepts from the previous chapter. Professionals and advanced students can read these last two sections over and over and still learn more. The beginning student, on the other hand, will have difficulty because they will not yet have the experience to appreciate the detail that is presented. Many algorithms are presented and the author tells the reader how each algorithm compares to

one another. Simple performance tests on temporal accuracy are also performed. This reviewer found it to be an excellent review of many things forgotten.

Computational Gasdynamics, by Culbert Laney, is a wonderful resource. It belongs in the library of any engineer solving problems in compressible flow. It will make an excellent text, but perhaps not for introductory courses. This reviewer commends the author for organizing this material and presenting it in clear, concise and understandable manner.

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