Book Review

Numerical Heat Transfer, by T. M. Shih, Hemisphere Publishing Corporation, New York, 1984, 563 pp., $42.00.

The task of writing a book on the numerical/computational aspects of heat transfer is a very complex one. This is due to the multitude of available methods, the rapid rate of advance of the state-of-the-art, the complexity of the subject matter, and the rivalries which have existed in the recent past between finite difference and finite element practitioners. Given the awesome nature of such an endeavor, Professor Shih has done an admirable job in his published manuscript. The text includes a very broad spectrum of both methods and phenomena and very successfully intermixes the use of finite difference and finite element methods where appropriate.

Although stated as being suitable for university seniors and graduate students who study numerical heat transfer, realistically it is probably more suitable for graduate students. By the very nature of the completeness and relative timeliness of the material included in the text, space limitations, it is presumed, have demanded that some detail of development has necessarily been left to the reader. As a relatively knowledgeable reader, I do not find this troublesome. However, placing myself in the situation of a senior undergraduate student learning much of this material at first exposure, I would anticipate some difficulties. Conversely, from a graduate student viewpoint, the mix of detail omission with completeness of overall presentation, including where appropriate relative comparison of performance, may provide just the right amount of tantalization to stimulate some of the further reading and investigation necessary to fully comprehend the subject matter.

Examples which aid the reader considerably in comprehending the subtleties of the various methods discussed are used freely throughout the text. In this regard, particularly with reference to finite difference and finite element methods, the examples are presented using sufficiently coarse grids that manual calculation can be performed in setting up the equation system as well as in effecting its solution. This approach permits the reader to actually work through these examples. In so doing, the reader becomes considerably more familiar with the mechanics of the procedures so that the construction of a code to automate the procedures should be relatively painless.

In presenting a multitude of methods that relate to numerical heat transfer, certain areas receive somewhat restricted treatment. Of particular note here is the treatment given to the prediction of the fluid flow equations for recirculating flows where the coupled equations for velocity and pressure must be solved. While this subject area belongs more appropriately to the realm of computational fluid dynamics, many heat transfer problems require that the fluid flowfield be determined before the heat transfer problem itself can be solved. If there is a flaw to be identified in the text, the terse treatment of the coupled fluid flow problem is perhaps the prime candidate. Understandably, however, this subject area forms the basis of complete texts in itself and those who must deal with the fluid flow problem will need to refer to other sources for this aspect of the problem. Notably, *Computational Fluid Mechanics and Heat Transfer** by Anderson, Tannehill, and Pletcher will offer a good complement to *Numerical Heat Transfer* in this area.

The text is comprehensive and includes conduction heat transfer, laminar forced convection, laminar free convection, radiation heat transfer, introductory turbulence modeling, and introductory combustion considerations. Given the broad coverage of subject matter, it is not surprising that certain elements of computational fluid dynamics receive relatively brief consideration. The text contains a wealth of information related to all aspects of numerical heat transfer and should be viewed as a welcome and highly useful addition to the scientist's/engineer's library.

G. E. Schneider
University of Waterloo

*Reviewed in *AIAA Journal*, Vol. 24, Feb. 1986, p. 352.