Book Review

Heat Conduction. By M. Necati Ozisik, John Wiley & Sons, New York (1980). 687 pp.

Heat Conduction. By S. Kakac and Y. Yener. Middle Eastern Technical University, Ankara, Turkey (1979). 431 pp.

It is somewhat unusual to be in the position of reviewing two books on the same subject with identical titles. The situation is even more remarkable when one notes that the authors of both texts were born in Turkey and received their undergraduate education in Turkey.

The work by Ozisik is clearly the more ambitious of the two efforts. It is clothbound, 687 pages in length, and typeset. The Kakac-Yener work, on the other hand, is paperbound, 431 pages in length, and reproduced directly from a typed manuscript.

Ozisik provides a comprehensive description of the analytical methods useful in heat conduction problems. After an introductory chapter on conduction fundamentals, he considers the separation of variables technique in the next three chapters. These are followed by chapters on Duhamel's theorem, Green's function, and Laplace transforms. The Laplace transform presentation is particularly to be commended for its inclusion of a description of Laplace transform inversion by contour integration, a subject with which most engineers are not familiar and which is generally not discussed except in texts on complex variable theory.

Ozisik continues with a discussion of conduction in composite media, phase change problems, approximate analytical methods, nonlinear problems, integral transform techniques, and conduction in anisotropic media. The presentation is clear and understandable but does require an appreciable level of mathematical sophistication.

The major criticism of this book is that it has relegated numerical procedures to a single chapter of 50 pages. In view of the current importance of these methods, one must conclude that the author's choice of subject material is somewhat unbalanced. Ozisik ignores simple graphical and numerical techniques. Shape factors, Heisler charts, and the Schmidt method are not discussed. In addition, the finite element method is not presented at all. In the introduction to his numerical methods chapter, the author defends this latter omission on the grounds of limited space. However, 560 pages were available for analytical approaches.

A less serious criticism is that nearly all of the problems in the Ozisik text are mathematical derivations. The reader is rarely required to obtain a numerical solution. This is consistent with the author's lack of interest in numerical techniques.

If one judges Ozisik's work on the basis of whether it provides a good comprehensive discussion of conduction, one must conclude that it is flawed because of its limited discussion of numerical approaches. Since these approaches have supplanted analytical methods for many realistic problems, the limitation is serious. However, if one were to consider this book only in terms "analytical methods in heat conduction" (indeed this might have been a more suitable title), one would have to conclude that the author has done well. If a modern, comprehensive view of the analytical approach to heat conduction is desired, then the addition of Ozisik's book to your library would be worthwhile.

Kakac and Yener's initial arrangement of material is somewhat similar to that of Ozisik's although on a simpler level. The first two chapters discuss heat conduction fundamentals and the third steady-state heat flow in one-dimensional systems. Orthogonal functions and Fourier expansions are then examined. This is followed by two chapters on the separation of variables technique. Examination of analytical methods concludes with chapters on integral and Laplace transforms. The work concludes with a chapter on numerical methods which does include a discussion of the Schmidt plot procedure. The Heisler charts are included with the discussion on steady-state conduction. The advanced analytical techniques discussed by Ozisik are not presented.

Kakac and Yener's text is on a more elementary level than that by Osizik. The level of mathematical sophistication required is considerably less than demanded by Ozisik and yet the presentation is lucid. The Kakac-Yener book would certainly be suitable as a text for students having no more than a single semester course in general heat transfer as a background. Another reason for use as a textbook is the low cost of the Kakac-Yener book. A cost of about ten dollars is certainly a bargain for students in these days of high book prices. A drawback is the poor quality of some of the illustrations.

For the practicing engineer who is not particularly familiar with conduction problems, the Kakac-Yener text can be recommended as a useful, low-cost introduction. However, the Ozisik text would provide the heat transfer specialist, or anyone with a strong heat transfer background, with a good modern, fairly comprehensive review of analytic methods applied to heat conduction. Only a limited view of numerical methods would be provided but nevertheless the book would be a very useful reference.

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About the Reviewer: As professor of nuclear engineering at the University of Cincinnati, Joel Weisman has been a contributor to Nuclear Science and Engineering *as a manuscript referee, as a book reviewer, and as an author, most recently of a Critical Review, his second, now in press. Additionally, he, with L. S. Tong, is an author of* Thermal Analysis of Pressurized Water Reactors, *a Society monograph that recently appeared in its second edition. Professor Weisman received his academic training at the College of the City of New York, at Columbia University, and at Pittsburgh. He has had extensive experience in industry, most recently at Westinghouse.*