BOOKS

Digital Computing and Numerical Methods, B. Carnahan and J. O. Wilkes, Wiley, New York (1974). 477 pages. $13.95.

The title of this book suggests two distinct goals: to teach digital computing and to teach numerical methods. Indeed, the authors have attempted to do exactly that, but the quality of the results is as dichotomous as their purpose. First, elements of digital computer programming are presented in a rambling style with insufficient focus and excessive detail. Then, numerical methods for use in digital computing are explained in as praiseworthy an introduction to the subject as this reviewer has seen.

To be more specific, the latter six chapters of the book are—in the authors' accurate words—"devoted to an introduction to numerical methods, including the solution of single and simultaneous equations, numerical approximation and integration, the solution of ordinary differential equations, and optimization techniques." In addition, the authors anticipate the use of the book as a teaching text and note that the "level is suitable for the early years at a university, and the orientation is toward engineering and applied mathematics." More importantly, and this is the salient virtue of the book, the presentation is by means of clear, succinct descriptions of the use of numerical methods on a digital computer. The often tortuous application of each method is made evident with the aid of concise mathematical notation and carefully documented example programs. Flow charts, provided with the examples, are especially helpful. In fact, this reviewer sees the book, with its precision and simplicity, as an excellent reference work. Many a graduate student or practicing engineer will find it an invaluable guide when he is confronted by an intricate task in numerical programming. In addition, for the beginning student, each chapter includes 20 (usually more) study problems, primarily drawn from diverse areas of chemical engineering.

Occasionally, the book provides shallow coverage of seemingly important subjects; for instance, the existence of round-off error and its related problems are barely acknowledged. Still, more advanced treatises on numerical methods are available and this criticism is minor compared to the impressive merits already described.

On the other hand, the first four chapters of the book, on digital computing, might well have been omitted. It has been this reviewer's teaching experience that novice programmers require considerable instruction on how to start an algorithm, how to develop it into a detailed program, and how to spot its potential and real errors. Yet the present book dispenses an all too glib discussion of basic procedural thinking, a chapter in which algorithms always appear full blown, rather than step-by-step with periodic errors as in real life (especially a student's real life). Two chapters on hardware and operating system organization seem overly laden with minutiae for an introductory text. Worse, another chapter duplicates a whole host of programming manuals by describing in detail the Fortran IV, Watfor, and Watfiv languages and in the process consumes 30% of the book.

To put matters briefly then, most readers of this book will find the first chapters an unimpressive vehicle for learning computer programming. But once past that section, they will find the second part of the book an exemplary guide to the use of numerical techniques on digital computers.

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Radiative Transfer and Interactions with Conduction and Convection, M. N. Ozisik, Wiley, New York (1974). 575 pages. $18.95.

Professor Ozisik has written an excellent book on thermal radiation which covers most of the engineering aspects of the subject. The book encompasses (1) a summary of the basic physics, associated with the thermal radiation (electromagnetic wave and quantum theory) along with a summary of how basic radiation properties can be calculated (Chapters 1, 2); (2) an exposition of the basic engineering computational methods used to calculate radiation exchanges in an enclosure with nonparticipating media (Chapters 3 to 7 inclusive); and (3) a coverage of the more difficult areas of radiation exchange in participating media along with the equations which are necessary to describe coupling with the conservation laws of mass, momentum, and overall energy (Chapters 8 to 14 inclusive) in fluids and the overall energy equation in solids.

This book forms an excellent reference book of thermal radiation. It could be used as a book for a graduate level course. Alternatively, the first two portions could be used for an undergraduate course. However, it would be necessary to supplement the book with homework problems. The background needed for the first two sections of the book would require ordinary differential equations and undergraduate fluid conservation laws although a course in integral equations would be helpful. The third section of the book would require transport phenomena and higher level mathematics courses including partial differential equations.

Each chapter is introduced with a description of why the material in that chapter is of use in engineering problems. This description is followed by a summary of background references for the material in that chapter. The scope of the chapter is described as well as the limits on that scope. References of further information beyond the scope of that chapter are given.

In summary, this is an excellent book on the complex area of thermal radiation.

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Thermodynamics and Its Applications, Michael Modell and Robert C. Reid, Prentice-Hall, Englewood Cliffs, N. J. (1974). 553 pages.

Thermodynamics is both the joy and despair of engineering educators. It is the pre-eminent engineering science, with so elegant and secure a theoretical structure as to be likened, in the words of Lewis and Randall, to a great medieval cathedral. On the other hand, the subtlety of some of the ideas and concepts and the difficulties in reducing practical contexts to forms amenable to thermodynamic analysis usually require that students have two or more formal exposures to the subject before they are reasonably comfortable in solv-