Heat Transfer

by Gregory Nellis and Sanford Klein
Cambridge (2009) $155.00

Reviewed by
Kemal Tuzla
Lehigh University, Bethlehem, PA 18015

This book is different from most existing heat transfer books in two ways. First, it incorporates computational tools into each chapter, so that students can learn theory and computational solution methods together. This approach allowed the authors to include more complicated problems into the book. Second, the book also contains advanced material definitely beyond the requirements of a first-level undergraduate heat transfer course.

Today, integration of computations with the lectures is an essential part of engineering education. Some of the faculty require use of computational tools to solve homework problems and submit homework electronically. Although many heat transfer books suggest using computational methods for solution of some problems, they mostly assume that student knows how to use the software. This book goes much beyond and provides examples/guidance in use of computational methods together with the theory. Some specific commands and output associated with these software packages are presented as the theory is developed. The book introduces computations progressively, starting with simple applications in the beginning chapters and moves to advanced features in later chapters. There are many example problems, in which the authors describe the computational solutions and, when possible, they compare the results with analytical ones. This gradual introduction of programming and detailed examples should encourage students to learn and speed up their use of computational tools. It is my impression that the presence of computational subjects will not slow down the rate or reduce the contents of the course. The descriptions of computational methods and related examples in this book will be a good resource and help. Popular software packages Maple, Matlab, EES, and FEHT are integrated into the computations used in the book. Educational versions of these software packages are provided at the Web site of the book.

On the analytical side, the book presents much more material than classical contents of a first-level undergraduate heat transfer book. Conduction, convection, radiation, and heat exchanger chapters contain a good amount more additional materials than standard first-level books. There is also a boiling and condensation section. These additional materials include detailed applications of mathematical solution methods using Bessel functions, Laplace transforms, separation of variables, Duhamel's theorem, and Monte Carlo methods. These additional materials definitely will be useful for practicing engineers as well as some of the undergraduates who are taking the first-level course. Furthermore, there is enough material to compose a second-level course for advanced undergraduates and graduate students.

For the future edition of the book, the authors may want to consider adding a section for gas radiation, and use more examples from bioengineering applications.

In conclusion, this is a very good heat transfer book with a lot of emphasis on use of computational methods. The authors did a very good job incorporating computations side-by-side with the theory. This is a suitable textbook for first- and second-level courses, where the instructor wants to use computational tools, as well as a reference book for practicing engineers. ❐