Preface

This book, like the first edition, is intended to serve undergraduate students in their introductory heat transfer course. The coverage, however, has been expanded to include an introduction to mass transfer as well. The anticipated prerequisites for the course are engineering thermodynamics, two years of calculus, and an introduction to fluid mechanics. The material can be taught to students who lack a fluid mechanics course, but at a somewhat slower pace.

Two principles have dictated the changes in this edition. One is to avoid trying to fix what is not broken. Large portions of the book, therefore, retain their outward appearance. But the second principle has been to listen in detail to what colleagues around the country have had to tell us about their use of the book. Consequently, we have given a great deal of attention throughout the text to corrections, and to the kind of small changes in the text that make the narrative easier to follow.

Two of the changes in this new edition are substantial ones. They are changes designed to meet the needs of certain faculty who have previously been unable to use the book.

- A fairly comprehensive chapter has been added on the subject of *mass transfer*. This will make the book appropriate for use in many of the existing chemical engineering courses in transport processes.
- The availability of end-of-chapter problems has been greatly expanded. There are now approximately 500 problems—enough to allow an instructor to assign new problems each time the course is taught, for many years.

Other major changes include:

- Coverage of the unique and straightforward strategy of dimensional analysis offered by this text has been simplified and strengthened.
- The numerical analysis chapter has been resectioned to make it easier to use in whole or in part.
- The boiling chapter has been updated and streamlined. It will thus maintain its singular position as the most complete discussion of heat transfer with phase change available at this level.
- The radiation chapter has undergone extensive revision and improvement.
- A complete Nomenclature section has been added.

The book reflects certain viewpoints that instructors and students alike should understand. The first is that material once learned should not be forgotten. Material in the earlier portions of the book is generally put to use in the subsequent portions. There are two exceptions to this: Chapter 11 on thermal radiation may safely be taught at any point following Chapter 3; and Chapter 12 on mass transfer draws only on the material through Chapter 9.

It is our conviction that students must develop confidence in their ability to invent methods for solving problems. Therefore, the examples in the text will not provide complete patterns for solving the end-of-chapter problems, nor will they replace the need for reading the text. Students who gain an understanding of the material should have no trouble in solving the problems. The problems vary in the demand that they lay on the student, and we hope that each instructor will select those that best challenge the students in each class.

The material has been carefully sequenced, and experience reveals that the book will best serve the students whose instructor understands the sequencing. The first three chapters form a minicourse in heat transfer that touches on all subsequent aspects of the subject. This minicourse includes the study of heat exchangers. We have consistently found that students are greatly encouraged when they encounter so solid an application of the material at this early stage. The subsequent chapters make back reference to this material and it should not be bypassed.

Neither should one bypass the introduction to dimensional analysis in Chapter 4. It is simple and compact, and it is subsequently used to great advantage.

Among the changes we rejected was that of expanding coverage on the application of Fourier series solutions to heat conduction problems. We concluded that it is a mistake to invest the time needed to do this properly in an introductory heat transfer course. Furthermore, the solutions of most problems that students can manage after a month of instruction are well known, and those they encounter in practice are likely to require digital computation.

The present edition contains more material than most universities will be able to cover in three semester-hours or four quarter-hours of instruction. Typical one-semester coverage at the University of Houston includes Chapters 1 through 9 (skipping some of the more specialized material in Chapters 5, 6, and 9), a little of Chapter 10, and over half of Chapter 11.

We have received generous counsel from many colleagues and students in this revision. The preface to the first edition lists many contributors to the first edition and its subsequent printings. I remain in the debt of these good people.

Roger Eichhorn and John H. Lienhard V, each of whom has written one chapter of the book, have provided unstinting criticism and help with the remainder of the revision. My colleagues who have used the text here: R. B. Bannerot, S. J. Kleis, C. J. Matice, R. M. Nerem, N. Shamsundar, and L. C. Witte have been most generous in their constructive commentary. So too have many colleagues from other institutions: R. F. Boehm, W. R. Gambill, H. R. Jakobs, A. Karimi, and D. J. Shlien, to name just a few. We owe a special debt of gratitude to A. F. Mills, whose writings and influence are strongly reflected in Chapter 12, and who, with R. W. Flumerfelt, provided important critical readings of the chapter.

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Finally, I am pleased to thank my wife Carol and son Andrew for their continuing moral support in this work, and Carol for her material help in reindexing the book.

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