Book Review

Heat Exchanger Design Handbook, Edited by E. U. Schlünder, K. J. Bell, D. Chisholm, G. F. Hewitt, F. W. Schmidt, D. B. Spalding, J. Taborek, A. Žukauskas, and V. Gnielinski, Hemisphere Publishing Corporation, New York, 1983, 2080 pp., list price $600.00.

This handbook fills a long-standing gap in the field of thermal engineering—a comprehensive manual for the design of heat exchangers. It represents the culmination of a decade of organization and preparation by an editorial board comprised of representatives from universities, government research laboratories, and industrial organizations. The aim was to bring the pertinent heat transfer and fluid flow data and correlations, thermal and mechanical design principles, and physical property data available in the open literature together into a comprehensive information base for the design of heat exchangers. In a well-coordinated effort, the handbook was created from the contributions of a large number of specialists representing both academic and industrial experience.

The handbook is divided into five parts, each a separate volume. In Part 1, entitled "Heat Exchanger Theory," the various types of heat exchangers are described and a presentation of the theoretical basis for their thermal design is given. Numerical solution procedures for fluid flow and heat transfer are reviewed for application to situations where "ordinary" solutions deviate significantly from the real process. The volume concludes with the presentation of the correction factors F and θ for cross-flow geometries relative to true counter-flow in equation and graphical form.

Part 2, "Fluid Mechanics and Heat Transfer," discusses the methods recommended for predicting pressure drops and heat and mass transfer coefficients for the wide variety of geometries encountered in heat exchangers. The section begins with a review of the fundamentals of heat and mass transfer. This is followed by a summary of single and multiphase fluid flow. Then, the many heat transfer processes are discussed: steady-state and transient heat conduction, single phase natural and forced convection, condensation of both pure vapors and vapor mixtures, evaporation of single and multicomponent liquids, heat transfer in packed and fluidized beds, and thermal radiation from surfaces and participating gases.

Part 3 deals with "Thermal and Hydraulic Design of Heat Exchangers." This is probably the most important section, not only for practitioner but for researchers as well. The practitioner will find well-documented methods for "hand" calculation of many common heat exchanger types. Researchers will see how their work relates to thermal and/or hydraulic design and may spark some interest in keeping ease of application in mind in the development of future correlations. Types of heat exchangers addressed in the design methods are: double-pipe, shell-and-tube, plate, air-cooled, and compact heat exchangers and also condensers, evaporators, reboilers, heat pipes, furnaces, cooling towers, dryers, and agitated vessels.

"Mechanical Design of Heat Exchangers" is the topic of Part 4. The basic fundamental principles of stress and strain are introduced. The analysis of mechanically and thermally induced stresses in the various heat exchanger components is presented. The mechanical design and construction of shell-and-tube heat exchangers and their accessories are reviewed, followed by a discussion and comparison of the various design codes, e.g. ASME, TEMA, etc. The mechanical design procedures for other types of heat exchangers follow in less detail. A guide to the selection of materials and a summary of phenomenon-induced damage to heat exchangers are presented. Finally, flow-induced vibration and the costing of heat exchangers are discussed.

Part 5 of the handbook is "Physical Properties." The definitions and analytical methods for predicting the pertinent physical properties and their dependency on temperature and pressure are presented. The physical properties are then tabulated for many common substances. Appropriate methods for interpolation of the data have been thoughtfully included, although estimates of the probable accuracy of the properties are lacking. For toluene the values of the enthalpies for the saturated liquid and vapor phases have been inadvertently reversed. It is suggested that the editors consider extending the saturated fluid property data below 1.0 bar pressure since such values are often needed when estimating physical properties for wide boiling range mixture systems.

In summary, the handbook is an excellent addition to the technical literature and will provide a much needed guide for training the next generation of heat exchanger designers.

John R. Thome
Michigan State University, East Lansing, Mich.