# Book Review

**Thermal Energy Storage and Regeneration.** By Frank W. Schmidt and A. John Willmott. Hemisphere Publishing Corporation, Washington, D.C. (1981). 352 pp. $35.50.

This book deals exclusively with the storage and regeneration of heat in a stationary material. The authors have done a fine job of compiling the work reported primarily by them and their coworkers. Thus this book enables one to get intermediate steps that were, for obvious reasons, not included in their journal articles. This advantage should, however, be weighed against the lack of presentation of significant work done by others.

The intended audience of this book is not stated; hence, the reviewer has considered it both as a textbook and/or a reference work. If it were intended to serve as a textbook for senior or first-year graduate level teaching, then the lack of problems is a major shortcoming. Furthermore, the authors have ignored references to specialized textbooks in fields such as the "simplex method" or the numerical analysis that would be required to follow some of the materials included in this book. Additionally, the reader would need to study alternatives other than those discussed by the authors. If this book were to be a reference book, then more general formulations should have been included first.

This book has three main sections. The first part (Chaps. 1 through 4) deals with the heat storage by "single blow." The material presented here includes rather detailed computed results that are not available in the authors' journal articles. These should be helpful in their applications to simplified problems. For complicated problems, however, these detailed tabulations will be of limited use. Contrary to the statement made in the Preface, these chapters lack discussions on the computational aspects.

The subject of thermal regenerators is presented in the second part (Chaps. 5 through 10). Understandably, the level of presentation is not uniform. For example, the intermediate steps needed to derive the nondimensional forms of the basic equations (Eqs. 5.7 and 5.8) are not given, although these form the backbone of Chaps. 5 through 10. In another place, details for obtaining Eqs. 6.16 and 6.17 are noted. Furthermore, the reviewer could not obtain Eqs. 5.7 and 5.8 from their dimensional equations (Eqs. 5.1 and 5.2) unless the thermal capacity of the gas resident in the regenerator is neglected. This is a valid assumption (as also used in Chaps. 2, 3, and 4), and it is so assumed, on and off, in Chaps. 6 through 10. This leads to some confusion that could have been avoided.

Some sketchy discussion on the numerical/computational techniques is presented in the second part. Regrettably, this part is not as well accomplished. Only the trapezoidal rule, more commonly known by numerical analysts as Simpson's rule, is detailed. Either this discussion should have been minimized or other well-known integration methods should also have been included. A reference to any one of several good numerical analysis books would certainly have served the purpose here. The discussion about FORTRAN programming does not seem justified—even the most elementary programmers know that it does not allow zero subscripts.

The third part of the book includes one chapter each on heat storage exchangers, packed beds, design optimization, and heat transfer and pressure drop correlations. All of these chapters are rather brief but interesting and worthwhile. Some of the results reproduced in Chaps. 11 and 12 are certainly instructive. The chapter on design optimization is welcome. It is important to bring together the conflicting demands that are imposed on the design of the system. The technique used in optimization is the standard simplex method with which the students of operation research are well familiar. The authors have chosen, here again, to detail their own results instead of taking a more general approach. The material included is instructive, but the readers would have to consult another book to understand the simplex method. In the last chapter, the authors have noted some of the useful correlations for pressure drops and heat transfers, but the material included is far from complete. It is appropriate, for example, to include the Moody chart (1944), but subsequent analytical expressions for the friction factor in rough pipes should also have been included.

In summary, the authors have done a fine job of compiling published journal articles, largely their own, in book form. Many worked-out examples are included to demonstrate the basic concepts. This book lacks problems, however. The overall outline is good, but there is a lack of uniformity in the level of coverage. The readers will have to keep an open mind and use other related textbooks, particularly in the areas of linear programming and numerical analysis. Perhaps the authors could eliminate some of the major shortcomings noted here in a subsequent edition, if any.

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*About the Reviewer: Ashok K. Agrawal has been engaged in nuclear reactor, particularly breeder reactor, safety for more than 14 years. His academic training included an MSc in physics from the Banaras Hindu University, India, and an ScD in nuclear engineering from the Massachusetts Institute of Technology. He has authored a large number of technical papers in the general area of thermohydraulics and computations. Dr. Agrawal developed the liquid-metal fast breeder reactor thermohydraulic simulation code (SSC) after joining Brookhaven National Laboratory in 1974.*