BOOKS

Classical Thermodynamics of Non-Electrolyte Solutions, H. C. Van Ness, Pergamon Press, New York (1964).

This short (166 pages) monograph is a relatively systematic treatment of the classical thermodynamics of vapor and liquid solutions of nonelectrolytes. The subject, as developed, follows essentially the same approach used in most of the standard texts on thermodynamics for chemical engineers. The differences lie in the thoroughness with which the author has developed solution thermodynamics and the strong emphasis on correlation of experimental data.

The author states, quite correctly, that most textbooks tend to slight the subject of solution thermodynamics. This is particularly unfortunate since this reviewer's own teaching experience indicates that the subject of solution thermodynamics probably contains the concepts which are hardest for students to understand. For this reason, this monograph would probably be of considerable help to both graduate and undergraduate students of thermodynamics.

The emphasis throughout this book is in obtaining equations which can be of use in determining the properties of solutions. To this end, the author has had to sacrifice some of the usual mathematical development of thermodynamic properties in favor of giving a fairly complete survey of the area of solution themodynamics. This is as it should be, since if an exact thermodynamic theory had been developed in this small book, there would have been little room for anything else. For example, the author's chapter on thermodynamic fundamentals was obviously intended as a review of material which is treated in far better fashion in many other books, and not as a self-contained package.

Once the author gets to the subject of solution thermodynamics, he is considerably more thorough. A considerable amount of effort is expended in the development of mathematical relationships between thermodynamic properties in solution, and a considerable amount of time is spent on the use of the virial equation of state in their actual calculation. The author also devotes a good deal of effort in explaining how to correlate experimental data though, in this reviewer's opinion, entirely too much time is spent on graphical procedures for such a short book. Perhaps a better balance would have been achieved if the author had mentioned numerical procedures which can

(*Continued on page 177*)

(*Continued from page 1*)

(*Continued from page 174*)

axial direction x.

It is often desirable to calculate the temperature distribution in a complex structure formed by joining members having good thermal conductivity. Frequently, such a structure will resemble a system of fins connected in series. In order to take advantage of this similarity, analytical expressions have been derived and are given below for two, three, and four fins in series. Each fin

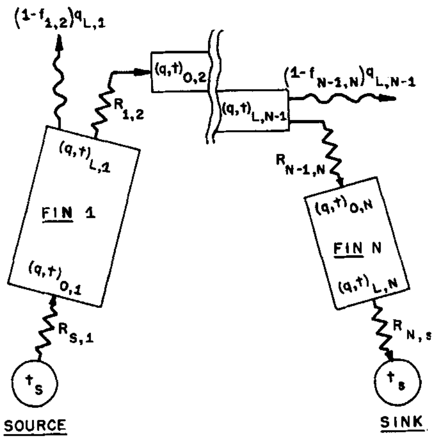

Fig. 1. Illustration of nomenclature.

may have its own surface conditions, axial conductance, and internal heat generation. In addition, there can be thermal resistances and/or heat losses between fins.

The nomenclature used is illustrated in Figure 1. There, fin N is located in opposition to fin 1 to emphasize that even heat transfer between unconnected fins may be included, if a little ingenuity is exercised. (In this regard, the section on Plate Fin with Different Conditions at Each Surface is relevant.) Thus, useful solutions can be found for a large variety of problems which would normally justify the use of extensive computational equipment.

BASIC EQUATIONS

As shown by Jakob (*1*), the temperature distribution in a fin may be expressed as

$$\theta = Me^{-mx} + Ne^{mx} + [q'''/(km^2)] \tag{1}$$

(*Continued on page 178*)

(*Continued from page 2*)

certainly be more exact than the graphical procedures described. In fact, the failure of the author to describe numerical procedures is the main fault in this book.

In general, I would say that this book is a valuable addition to the library of any student of thermodynamics mainly because of the thoroughness with which it treats the classical theories of solutions. Because it is so cursory in its treatment of fundamentals, it must be recommended as a supplement to a standard text, rather than as a replacement. Its value to researchers in the field is more limited because it is simply too short to treat modern advances with the thoroughness they deserve.

Irving F. Miller
Polytechnic Institute of Brooklyn

Equilibrium Thermodynamics, J. Coull and E. B. Stuart, Wiley, New York (1964). 469 pages.

The presentation of classical thermodynamics given by the authors differs from the normal presentation in three respects. First, to quote the authors, "Our method of presentation of material is based on the spiral technique wherein the various topics are presented early in the book and are developed in depth as the student progresses." Second, "Detailed references to equipment have been largely omitted, for we feel that the engineering application of equilibrium thermodynamics should be at an analytical level. We have brought in details of application not in equipment, but in the determination of thermodynamic properties and equilibrium analysis." Third, the authors have included a chapter on the third law, which contains a brief discussion of microscopic considerations, and an introductory chapter on nonequilibrium thermodynamics.

These last two points are certainly noteworthy. It is refreshing to encounter a complete chapter (Chapter 6, 35 pages) entitled "The Evaluation of the Thermodynamic Properties from Fundamental Data." The authors clearly inform the reader of the purpose of the chapter, and of the desirability of making such calculations. This section is well illustrated with examples and includes the standard methods of calculation from P-V-T data, and also a discussion of generalized properties. Although the presentations of microscopic considerations and nonequilibrium thermodynamics are admittedly brief, the former is sufficient to lead the reader into the consideration of group-contribution methods, and both sections should serve to whet the appetite of the reader and lead him to pursue these topics further.

Although the method of presentation is obviously based upon the authors' experence in teaching, it is in the use of the *spiral technique* of presentation that the reviewer believes the student will encounter a problem. While the idea is appealing to one already familiar with thermodynamics, the use of this technique may well represent a sizeable hurdle for the beginning student, particularly in the initial portion of the book where possible difficulties are most noticeable. To illustrate this point, it is worth listing the topics presented in Chapter 1 (42 pages): traditional introductory material such as the definition of a system, the surroundings, heat, work, etc.; the definition of internal energy and a statement of the first law for a closed system; a definition of entropy (as an extensive property associated with thermal energy) and a brief statement of the second law; the definition of enthalpy, the Gibbs function, and the Helmholtz free energy, their general differential equations, and the Maxwell relations derived therefrom; the definitions of a property and of partial molar properties; the criteria of equilibrium and of a spontaneous process; the concept of lost work; the relation of entropy to probability; and an introduction to irreversible thermodynamics. While each of these topics is fully developed in subsequent chapters, at the end of this chapter the reader is overwhelmed.

The authors then continue with the same technique in Chapter 2 in which the relationships for various types of processes are presented for closed systems (in general and for ideal gases) before the first law is covered in detail in Chapter 3. It would seem that this portion of the book would be particularly difficult for a beginning student, leaving him lost, rather than with the intended clear sense of the purpose of the book.

Also to be noted is the statement on the jacket of the book that it "supplies the needs of the core curriculum undergraduate course in classical thermodynamics." While the book is well suited to a course for chemical engineering students, it does not actually supply the needs of a core course; indeed, the treatment of the first law should be supplemented in any case. In discussing the first law the authors present the equations for closed systems, steady-flow open systems, and nonsteady open systems, but the treatment of the latter is extremely brief. Actually, there are

(*Continued on page 179*)