Introduction to Modern Thermodynamics

This book by Dilip Kondepudi is concerned with the subject of equilibrium and non-equilibrium thermodynamics. It develops this subject by starting with the fundamental ideas, definitions, and laws, gives the derivations of the necessary equations, and moves on to many applications. It is intended for use both as a textbook and as a reference work. In addition to the basic topics found in most books on thermodynamics, *Introduction to Modern Thermodynamics* also contains sections on systems that are not at equilibrium, small systems, fluctuations and oscillations, critical phenomena, biological systems (including some kinetics), chemical potentials in a field, the thermodynamics of radiation, and some statistical thermodynamics.

A search of Google Books (http://books.google.com/books?q=Thermodynamics) shows that hundreds of books have been written on the subject of thermodynamics. Thus, it is reasonable to ask two questions: 1) Are any more books on this subject needed? 2) Does the book under review serve as a valuable addition to the many books already published on this subject? This reviewer's answer to both questions is yes. Most importantly, thermodynamics, although an old subject, is remarkable in the number of ways that the principles can be formulated and/or explained and the various working equations derived. Also, the applications of thermodynamics span our entire science—physics, chemistry, biology, geology, meteorology, oceanography, engineering, etc. These applications, which can become very detailed, have often led to specialized monographs on the application or subject of interest. The wide scope of the subjects covered (for example, *Introduction to Modern Thermodynamics* includes a discussion on the thermodynamics of hurricanes) and the way that the author keeps the reader interested in the subject is the main strength of this book.

The terminology, notation, and units are very clear and, for the most part, consistent with IUPAC recommendations. This is particularly important given the fact that thermodynamics requires more symbols than most scientific disciplines. However, one item that is inconsistent with modern internationally accepted usage and IUPAC recommendations is the statement about the biochemical standard state and the distinction between chemical ionic reactions and overall biochemical reactions that include sums of different ionic species (see "Recommendations for Nomenclature and Tables in Biochemical Thermodynamics", *Pure and Applied Chemistry* **1994**, *66*, 1641–1666; *European Journal of Biochemistry*, **1996**, *240*, 1–14).

Introduction to Modern Thermodynamics is useful both for intermediate and advanced courses in chemical thermodynamics and as a reference book. However, if the instructor were to choose to skip several topics, it could also be used for an introductory course in thermodynamics. The necessary mathematics is introduced in such a way that a student with a background in elementary differential and integral calculus can understand it. The book is also useful as a reference source and as an introduction to several advanced topics that are not covered in most books on thermodynamics. Good examples of this are the discussions of the linear phenomenological laws and of the Onsager reciprocal relationships and their application to the Seebeck and Peltier effects. There is an excellent discussion on oscillating reactions (e.g., the Belousov–Zhabotinsky reaction). The subject of symmetry-breaking transitions and dissipative structures is one that this reviewer has not seen covered in other texts. Naturally, given the wide scope of thermodynamics, there are other topics that are not covered in depth in this book and that many readers would find helpful. Examples of such topics are electrolyte solutions, generalized binding and complex equilibrium calculations, calorimetry and experimental thermochemistry, the applications of Legendre transformations, and thermodynamic network calculations. However, considering the fact that the work is already nearly 500 pages long, one can see a reason to draw a line.

As mentioned above, the book is excellent at capturing and keeping the interest of the reader. The historical perspective and the biographical sketches of the major developers of thermodynamics are exceptionally good. The use of Mathematica codes is also helpful, although one would like to see more of them. These codes might also be included in a compact disk that could accompany the book. Also, most chapters are accompanied by an informative bibliography, which serves to guide the reader to additional sources of information.

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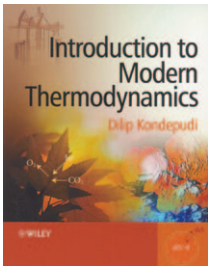

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