BOOKS

Thermodynamics for Engineers, Jesse S. Doolittle, International Textbook, Scranton, Pennsylvania (1964). 2 ed., 660 pages, $9.75.

The multiplicity of thermodynamic textbooks within recent years, along with a diversity of approach that has been almost as numerous, suggests that there is no mainstream as far as the teaching of introductory thermodynamics goes. In his preface Professor Doolittle implies that by appropriate insertion of the molecular or microscopic approach and a brief description of some aspects of elementary statistical mechanics on a superstructure of engineering examples, the incipient engineer will have "a better and more complete understanding of the subject of engineering thermodynamics." This reviewer believes that there is only one kind of thermodynamics and only in the area of applications is a course in thermodynamics for engineers different from one in, say, thermodynamics for physicists or for chemists. Only by a complete grasp of the fundamentals can the practitioner be able to apply his knowledge to a novel situation.

The beginner should not be given imprecise simplifications which have to be modified at a later date when more advanced concepts are required. This requirement has nothing to do with mathematical elegance or sophistication but rather with mathematical and physical precision.

As may be gathered, this book uses a molecular approach as an adjunct to fill out the bones of the phenomenological skeleton and this certainly is admirable. However, in Chapter 4, for example, where the author explains why real gases deviate from the ideal gas laws, any sketch of a typical potential energy vs. distance between two molecules is omitted. This fundamental concept would unite several diverse concepts such as the billiard ball repulsion and attraction which affect macroscopic properties. On page 52 it is stated that, "Except for monatomic gases, the structure of a molecule differs materially from that of a sphere." This is incorrect, since even monatomic gases do not "behave as perfect elastic spheres."

An equally serious example of lack of precision occurs on page 98 where a quantity W, which is clearly greater than one, is called a probability. This quantity is actually proportional to the probability. This mistake is committed elsewhere and can only help to disassociate statistical mechanics from basic probability concepts where it belongs.

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COMMUNICATIONS TO THE EDITOR

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Liquid-liquid phase behavior of binary solutions at elevated pressures, Winnick, Jack, and J. E. Powers, **A.I.Ch.E. Journal, 12,** No. 3, p. 466 (May, 1966).

Key Words: A. Miscibility-8, 9, 7, Phase Equilibria-8, 9, 7, Phase Diagram-8, 9, 7, Isothermal-0, Liquids-9, Mixtures-9, Nonideal-0, Binary-0, Acetone-9, Carbon Disulfide-9, Pressure-6, Composition-6, Measuring-8, Predicting-8, 4, Thermodynamics-10, Calculating-10, 8, Free Energy-2, Free Energy Change of Mixing-2, 7, 8, Activity Coefficients-1, Volume Change of Mixing-1.

Abstract: Isothermal pressure elevation can cause liquid-liquid phase separation of some binary liquid mixtures. A quantitative thermodynamic analysis of this effect is made and applied to the system acetone–carbon disulfide at 0°C. on the basis of available P-V-T-X, density, and solution behavior data. Visual observations of the phase separations at pressures up to 80,000 lb./sq.in. are used to compare with the results of the analysis. There is also a discussion of criteria for qualitatively predicting which binary liquid systems will exhibit a liquid-liquid phase separation on increasing external pressure.

Axial mixing and extraction in a mechanically agitated liquid extraction tower, Bibaud, Roger E., and Robert E. Treybal, **A.I.Ch.E. Journal, 12,** No. 3, p. 472 (May, 1966).

Key Words: A. Mass Transfer-8, Separation-8, Extraction-10, 8, 9, Extractors-10, 9, Countercurrent-0, Oldshue-Rushton Column-10, 9, Liquids-1, 2, 9, *n*-Butyl Amine-1, 2, Kerosene-1, Axial Mixing-6, 9, 8, Eddy Diffusivity-6, 9, Performance-7, Rate-7, Mass Transfer Coefficients-7, Measuring-8. B. Agitation-6, Flow Rate-6, Velocity-6, Diffusion-6, Axial Mixing-7, Eddy Diffusivity-7, Columns-9, Extractors-9, Extraction-4, Separation-4, Liquids-1, 2.

Abstract: Axial mixing is measured in both phases for a countercurrent, mechanically agitated extractor of the Oldshue-Rushton design. Results in terms of an eddy axial diffusivity were correlated in terms of the variables studied. These correlations were then applied to column performance during the extraction of *n*-butyl amine from kerosene into water and the mass transfer coefficients, corrected for axial mixing, were determined. The coefficients are shown to be predictable for droplets of dispersed phase considered to be rigid spheres.

Velocity distributions and normal stresses in viscoelastic turbulent pipe flow, Astarita, Gianni, and Luigi Nicodemo, **A.I.Ch.E. Journal, 12,** No. 3, p. 478 (May, 1966).

Key Words: A. Fluid Dynamics-8, Flow-8, Turbulent Flow-8, Fluids-9, Polymers-9, Solutions-9, Viscoelastic-0, Non-Newtonian-0, Calculating-8, Measuring-8, 4, Stresses-9, Pressure-9, 1, Velocity-2, 1, 8, Velocity Distribution-2, 1, 8, Apparent-0, Momentum Balance-2, 7, 8, Momentum Average Factor-2, 7, 8, Reynolds Number-2, 6, Pitot Tubes-10, 8.

Abstract: The turbulent flow of viscoelastic fluids through circular pipes is investigated by the use of Pitot tubes. Theoretical analysis of the flow situation shows that the Pitot tube pressure readings are composed of a normal stress contribution, an integral normal stress contribution, and a kinetic contribution. The experimental data are used to calculate apparent velocities of the fluids and momentum average factors. Observed values of the relevant parameters are discussed.

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Once more, the original (incorrect) argument of James Clerk Maxwell is used to derive the Maxwell-Boltzmann velocity distribution. This has been used in numerous other textbooks and perhaps deserves to be put out to pasture after all these years.

A further criticism is the inclusion of various transport processes such as fluid flow and heat transfer. In research and design the distinction between thermodynamics and transport processes is spurious. In an introductory thermodynamics course this dichotomy is preferable.

It is necessary to judge introductory thermodynamics texts rather harshly because there are so many around and some are quite good. Although the text is well written, the impression is received that the author has not presented an original or profound treatment of introductory thermodynamics.

On another level the book is more of a success. The applications section is chock full of interesting goodies. The major emphasis is on energy conversion and thus while most of the examples may not be in chemical engineering, the chemical engineer has in interest in them. For example, the thermodvnamics of reacting mixtures is mainly concerned with burning reactions. Chapters are included on various gas cycles, turbines, refrigeration, and elementary irreversible thermodynamics with thermoelectric phenomena as examples.

Many problems are included and the student will understand most of the standard material after doing them.

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Boiling Heat Transfer and Two-Phase Flow, L. S. Tong, John Wiley and Sons, New York (1965). 242 pages, $14.00.

The author is manager of Thermal and Hydraulic Design and Development at the Atomic Power Division of the Westinghouse Electric Corporation. As such he has been involved in the heat transfer design for a number of nuclear reactors now in operation. This book evolved from evening lectures given in graduate courses taught at the Carnegie Institute of Technology over a period of three or four years.

The volume is a concise handbook which summarizes the literature in the field of boiling and two-phase flow. The four hundred references go through 1963 and include numerous domestic and foreign government reports. The