done before the method may be generally applied to pure components. We have shown that such an effort should have a reasonable chance of success.

NOTATION

f_i = fugacity of pure component i, atm
G_i = Gibbs energy of 1 mole of liquid component i, kcal/mole
G_i^o = Gibbs energy of 1 mole of component i in its standard state, kcal/mole
G_m = Gibbs energy of 1 mole of liquid mixture, kcal/mole
G_m^o = Gibbs energy of 1 mole of mixture in its standard state, kcal/mole
G^E = excess Gibbs energy of 1 mole of mixture, kcal/mole
g_k = Gibbs energy of 1 mole of group k, kcal/mole
g_k^o = Gibbs energy of 1 mole of group k in its standard state, kcal/mole
g^E = excess Gibbs energy of 1 mole of groups, kcal/mole
g_i^E = excess Gibbs energy of 1 mole of groups at the composition corresponding to pure component i kcal/mole
P_i^{sat} = vapor pressure of component i, atm
R = gas constant, kcal/mole °K
T = temperature, °K
x_i = mole fraction of component i
X_k = group fraction of group k
$X_k^{(i)}$ = group fraction of group k in pure component i
Γ_k = residual activity coefficient of group k
$\Gamma_k^{(i)}$ = residual activity coefficient of group k at composition $X_k^{(i)}$
$\nu^{(i)}$ = total number of UNIFAC groups in component i
$\nu_k^{(i)}$ = number of UNIFAC groups of type k in component i

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BOOKS

Transport in Porous Catalysts, by R. Jackson, Chemical Engineering Monographs Vol. 4, Elsevier Scientific Publishing Co., New York, 1977. (197 pages, $29.80).

Very infrequently there appears a concise carefully written and comprehensible monograph with sufficient rigor that it soon becomes a standard reference and guideline for the student, the researcher and the practitioner. Professor Jackson has accomplished such a feat in this monograph which brings together material from the technical literature of the past hundred years or so and gives a connected account of transport in porous media relative to modeling catalyst pellets. It is ideally suited for a first graduate-level course in chemical reaction engineering. Furthermore, practicing engineers will find it refreshing to read and thoroughly informative.

Professor Jackson develops the theory of diffusive transport for ideal gas mixtures in porous catalysts in a general form rather than limiting the treatment to simple binary systems which so often have been used to approximate the real situation. In addition, he considers transport in pores having intermediate sizes wherein pore diameters and molecular mean free paths are comparable in magnitude. He aptly calls it the "awkward" range because the prediction of transport behavior for that situation, which frequently occurs in practice, is by no means trivial and often has been a source of confusion.

Professor Jackson is particularly helpful in exposing erroneous conclusions that one, quite unwittingly, may reach. He very skillfully keeps the reader informed about the physical meanings of the formulations which are developed.

This constant and valuable comparison between formulation and reality is in fact one of the major strengths of the monograph.

The reader gains an accurate perspective about the limitations of current transport models and the fact that no flux relations exist with a completely sound theoretical basis, since all involve empiricism to some extent. Professor Jackson thoroughly discusses the existing two classes of models which approximate the porous particle either as a network of interconnected capillaries or as an assembly of stationary obstacles dispersed in the gas on a molecular scale ("dusty gas"). He demonstrates that the predictions of the capillary and dusty gas models are in agreement although their bases of formulation are quite different. He also discusses the strategy of experiments for testing models, illustrates some of the pitfalls of superficial interpretation of the results, and describes one or two of the more noteworthy investigations in some detail. Historical continuity is provided by referring to the 19th century contributions of Clerk Maxwell and Thomas Graham.

Both classes of models lead to equations which are implicit in the fluxes, and Professor Jackson examines in detail limiting forms of explicit solutions for the fluxes for reaction mixtures of realistic complexity. He considers steady and unsteady behavior as well as stability in catalyst pellets.

To avoid giving the impression that the monograph is flawless, this reviewer feels that a separate section defining the author's notation would have been appropriate.

In conclusion, one who has preconceived apprehensions about the subject matter will be relieved when reading the monograph as if Professor Jackson were an experienced navigator on a ship in troubled waters. The monograph is superbly crafted, authoritative and thought-provoking. It represents a truly substantive contribution in the area of transport in porous catalysts and is certainly worthy of becoming a work of enduring excellence.

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Dynamics of Polymeric Liquids: Volume I Fluid Dynamics, R. Byron Bird, Robert C. Armstrong, Ole Hassager, John Wiley and Sons (1977), New York, $29.95, ISBN-0-471-07375-X, pages: xv (intro) + 470 (text) + 89 (appendices).

For several years now, people have asked the question, "Is there to be a new edition of 'Transport Phenomena'?" This is not such a revision. We have heard of and some of us have seen this book in various forms during its preparation. This final version answers those questions we may have posed. Professors Bird, Armstrong, and Hassager have continued the tradition of excellence abumbrated in "Molecular Theory of Gases and Liquids" by Hirschfelder, Curtus, and Bird and later shown in "Transport Phenomena" by Bird, Stewart, and Lightfoot. These have become classics in the scientific literature. Little in the new work suggests that this tradition will be discontinued. As the puzzle in the Preface suggests, "Labitur et labetur in omne volubilis aevum".*

This first volume in the pair discussing "Dynamics of Polymeric Liquids" is largely based on the continuum mechanics of polymeric fluids. The authors' objective, it appears, is to introduce the use of "co-rotational models" for viscoelastic fluids so that a better correspondence can be made with the results of kinetic theory developed and presented in Volume II.

The book serves a broader purpose, however, but the road one travels through the volume is not an easy one. It begins with a rapid review of the mechanics of Newtonian liquids at a level reasonably accessible to the reader. It is understood that one would not begin the book without some preparation in fluid mechanics beyond the usual undergraduate level. The appendix on vectors and tensors is particularly useful in interpreting the notation used in both volumes and should serve as a measure of the students' ability to proceed.

The introductory chapter on polymers begins rather naively, but content and presentation rise rapidly to the level of one's expectation. Although my mother taught me to disdain books with lots of pictures, I feel that the many illustrations of the unique behavior of these "funny fluids", polymers, serve as ample motivation to proceed and obtain "an enhanced appreciation of a very difficult subject."

The book begins in earnest with Chapter 4. Although, in the interest of space, the authors discuss only a subset of the techniques for the measurement of material properties, the salient features of other important techniques are presented in the form of examples and problems. One useful experimental technique, the eccentric parallel plate viscometer, is covered using only three problems in the text and likely merits somewhat more attention.

Chapter 5 is a logical extension of the first chapter using the "Generalized Newtonian Model", recognizing that, in most polymer shear flows, such a simplification usually suffices to give an adequate description of the phenomena. Both chapters 1 and 5 should be integrated into a first-year graduate fluid mechanics course and do serve as valuable reference material.

By the time the reader begins a thorough discussion of a linear viscoelastic fluid, the story is half-over. However, the logical structure of the book is such that, although the road becomes rockier, the reader has become more resilient. The material in the first six chapters can be readily assimilated by the student (with some work, of course). The last three chapters are much more difficult. One leaves the well-travelled and familiar terrain of shear flows and enters into discussion of material behavior and representation in more complex, but important flow fields.

The authors' approach is to develop an understanding of co-rotational reference frames and rheological models (Chapters 7 and 8) before closing with an excellent parallel discussion of co-deformational models in Chapter 9.

Co-rotational models, proposed in the late Victorian era of mechanics, were largely ignored for the next fifty or sixty years, but as Professor Bird and his coworkers have shown most ably, they have great merit in their use. Justification, however, is best made in relation to molecular theories . . . subject matter for Volume II

Much of the text is written in the fashion of "Transport Phenomena", since a significant fraction of the material is presented in the guise of examples and problems. Indeed, to learn the material, one must do the problems. The book presents 176 problems and 46 exercises. Most are of modest difficulty, but many are more than challenging. It was somewhat disconcerting to find one problem in the book (1C.6), something which took several months of a professional career to formulate and solve. Here it so clearly stated that I question why I tried such a trivial problem in the first place.

To anyone who has seen the scholarship and organization of a lecture by the senior author, Professor Bird, it comes as no surprise that this volume is a model of excellence in exposition and clarity. It has been adopted already for use in many graduate courses and although it deals with polymeric fluids will find broad use by active researchers, engineers, and students of fluid mechanics. We congratulate and thank the authors for their most arduous, but successful work towards understanding the mechanics of polymeric fluids.

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* Keep on trucking . . . (a loose translation).