in Chaps. 18 and 20, we have highlighted the three main assumptions in the development, so that later researchers can remove or improve on them: 1) an anisotropic Stokes law, containing three empirical constants, for the hydrodynamic force; 2) an assumption describing anisotropic Brownian motion; and 3) a mild-curvature approximation.

We have not discussed in any detail the Doi-Edwards (DE) development inasmuch as there are still many questions which we do not feel competent to answer:

1) Are the "tubes" and "sliplinks" essential to the theory? Do they move affinely?

2) Does the polymer chain exchange momentum and energy with the tubes and sliplinks, and if so, how?

3) How does the friction coefficient enter the theory, and what kind of modified Stokes law is implied in their model (none is explicitly stated and no physical mechanism is offered)?

4) Are the "Maxwell demons" really needed in obtaining the stress tensor expression, and is it physically defensible to use these Maxwell demons to require that the tension in the polymer chains be identical to the chain tension at equilibrium regardless of the flow field?

5) The formula "from rubber elasticity" is used for the stress tensor expression. But, is this really appropriate for reptating chains with loose ends?

6) Have the same physical assumptions been made and has the same molecular model been used in the two main parts of the kinetic theory—that is, in the stress tensor expression and in the equation for the configurational distribution function?

7) What is the physical justification for the DE treatment of polydisperse systems?

Doi and Edwards have published no comparisons between their theory and experimental rheological properties; we have made extensive comparisons for both CB and DE and found that the DE theory gives unrealistic results for viscosity, normal stresses, elongational viscosity, molecular weight dependence of the study shear compliance, and rod climbing. Attempted refinements of the DE theory have led to some improvements in the comparisons with experiment, but the seven questions above still remain unanswered in the modified theories.

Professor Marrucci's criticism of our Eq. 19.2-5 is not pertinent inasmuch as there is no stated equivalent of Eq. 19.2-5 in the DE theory. In this equation, we are forced to introduce an assumption because of lack of knowledge about the momentum distribution function. This assumption is our way of introducing anisotropic Brownian motion. It is perhaps unfortunate that we associated the word "reptation" with this equation; it seems to us, however, that our assumption is related to the DE restriction of the fluctuating motion of the chain to within a tube (actually they restrict the motion to be one-dimensional, as on a wire).

We want to emphasize that the DE and CB theories are totally different as to viewpoint and structure. The CB theory is a part of a larger formal development, in which systematic reductions are performed from the full-phase space to lower-order spaces. It is made clear where, how, and why various assumptions are introduced. The DE theory, on the other hand, is a development specifically designed for polymer melts, not clearly related to the theories for polymer solutions. It is a semiintuitive development, with lots of pictures of polymer molecules wiggling in "tubes" and through "sliplinks," which seems to have a great deal of appeal to some polymer chemists. Their theory is a collage of ideas taken from the theory of stochastic processes, rubber elasticity, and scaling theory; it apparently contains inconsistencies that we have not been able to resolve. Because of the differences between the DE and CB developments as to philosophy and structure, they should not be considered as "competing" theories. We want to make it clear, however, that we have great respect for the trail-blazing publications of Doi and Edwards and that we admire very much some of the excellent physical intuition and mathematical work in their papers, particularly their solution of the differential equation for the single-link distribution function.

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Further Comments by G. Marrucci:

As the authors say, the Doi-Edwards and Curtiss-Bird theories are totally different as to viewpoint and structure. That the CB theory is a part of a larger formal development, i.e., of the full phase-space theory, is more apparent than real, however. In fact, the CB theory is but a single-chain theory where a very strange mean-field is used: one which takes the Brownian motion of the chain beads to be anisotropic at equilibrium! No such inconsistency is found in the DE theory.

On the other hand, are there different inconsistencies, perhaps more serious ones, in the DE theory? By using the rhetorical form of questions, the authors imply that there are many. I hold an opposite view (irrelevant as this may be), but of course this is not the place to go into a long and perhaps fruitless discussion. One point requires further comment, however.

When the authors mention having compared both CB and DE predictions against experiments and having found that the DE theory gives unrealistic results for several rheological quantities, they appear to overlook an aspect which is certainly relevant to the comparison, i.e., the number of adjustable parameters that the theory incorporates. It is true that the DE theory, especially in its original formulation, does not always compare favorably with experiments, but various refinements and/or extensions have improved on this (as the authors acknowledge) without adding to the number of unknown parameters, but rather by accounting for physical effects which had been initially left out. Unfortunately, the book does not adequately portray the continuing, and fruitful, effort towards understanding the complex behavior of dense polymeric systems, originating from the fundamental work of Doi and Edwards on both flexible and rigid rod-like polymers: a process which is still very lively today. Conversely, the book emphasizes a general phase-space theory, the fruits of which are yet to be seen.

Effective Writing for Engineers, Managers, Scientists

By H. J. Tichy with Sylvia Fourdrinier, 2nd Ed., John Wiley & Sons, 1988.

A second edition of Tichy on *Effective Writing,* thoroughly revised, augmented, and updated is welcome indeed. It is probably the most complete and readable book available on writing for professionals.

Its charm lies in its sensible, yet authoritative, approach to writing as a human process. Tichy, out of long experience as a teacher and consultant, offers writers help on getting started, drafting, and revising for specific purposes as well as on supervising the writing of others; she sees writing as a demanding task, not subject to the quick fix, but one amenable to time and patience.

New to this edition is Tichy's instruction on the "flow method," which requires a block of time to write a first draft, time uninterrupted, not only by external interference such as the telephone, but also by one's own impulses to stop to check facts or rules of grammar. Revision can then be fitted into briefer segments of time: "fifteen minutes when a meeting starts late, . . . a half hour now and then in the laboratory while . . . waiting for results."

Tichy offers sound advice on work habits and methods of organizing as well as lucid explanations of grammar and syntax. Typical of Tichy's pragmatism is her view that if your hold on grammar is shaky, deal first with the problems that trouble you rather than reading through material you already know. Whereas most manuals on writing relegate grammar and syntax to a perfunctory review, Tichy offers thoughtful explanations of English usage, taking into account such changes as the need to avoid sexist language. She also tackles issues where disagreement abounds (such as the use of the plural *their* to refer back to the singular *everyone*). She examines such shibboleths as "never split an infinitive," "never end a sentence with a preposition," "never start a sentence with but," "write as you speak" with tact in the service of understanding. In areas where there are no simple answers, Tichy gives the information we need to reach our own conclusions.

Tichy exemplifies her exhortation that above all, the needs of the reader must be considered. She thoroughly discusses the occasions for writing that occur on the job: letters of condolence, complaint and contract, as well as letters of recommendation and application, minutes, style guides, news releases, reports, and resumes. A revised table of contents makes it easy to find material in this edition. Also, this edition adds a chapter on punctuation.

This is a self-help book in the best sense, for it offers thorough explanations of principles in combination with the sensible perspective we need to apply those principles. In fact, Tichy's tone is rather like that of a knowledgeable colleague down the hall you can turn to for help with the sticky points in a piece of writing. Like that colleague, Tichy may sometimes tell you more than you want to hear, but the beauty of a book is that you can pick it up and put it down as you choose. Tichy is well worth many a visit. In fact, if I had to recommend only one guide to writing, I would choose this one.

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Thin Liquid Films: Fundamentals and Applications

I. B. Ivanov, Ed., Marcel Dekker, Inc., New York, 1988, 1160 pp., $195.00.

Some years ago, Professor Ivanov took the unusual step of gathering together the prospective contributors to this book in his native Bulgaria, with the aim of establishing a unified approach to the task of writing about the multifaceted subject of thin liquid films. The result is highly successful. Rarely have I seen an edited collection of chapters written by many different authors (23 in this case), give such a comprehensive and coherent account of a diverse topic such as this.

It is not a textbook. The level of presentation is sophisticated; each chapter covers its topic in some depth, and none of them is designed for light reading. The book is aimed at the researcher (a term which includes the advanced graduate student, of course) who wants to learn more about liquid films. It is concerned primarily with films between fluid phases, such as those occurring in foams, emulsions, or biological membranes. Readers could browse through the entire tome to get an overall view of the subject, and that view would be authoritative and comprehensive. Or they could study one or more of the fifteen chapters, ranging in length from 40 to 130 pages, to get a very thorough grounding in particular aspects of liquid films. It would take some determination to read the book carefully from cover to cover.

The progression of the chapters follows a logical plan. First come two which introduce the thermodynamics of thin films, both presented clearly and carefully. The first, by de Feijter, considers planar films; the second (Ivanov and Kralchevsky) covers the more difficult but more practically important case of curved films. In these chapters the important concept of disjoining pressure is introduced, then in the following four chapters come detailed accounts of the various contributions to it. Rickayzen and Richmond set out the statistical mechanics of inhomogeneous liquids and discuss the structural component of disjoining pressure or "solvation force" between two solid walls. Nir and Vassilieff give a very good account of van der Waals interactions, covering both the theory and experimental determinations in some detail. Electrostatic forces are covered by Grimson, Richmond, and Vassilieff, and Tadros completes the picture with a chapter on steric interactions.

Once armed with a knowledge of these equilibrium interactions, we proceed to a consideration of dynamic effects. The crucial question of coagulation or coalescence depends on the thinning and possible rupture of liquid films. Ivanov and Dimitrov concentrate on the first aspect, in a very thorough and satisfying chapter on thin film drainage. The second, hydrodynamic stability, is addressed by Maldarelli and Jain, in what is probably the book's most difficult chapter. Joosten describes the use of light scattering as a probe of both surface tension and interaction forces across liquid films.

That completes the "Fundamentals" of the book's subtitle. The "Applications" follow in the form of descriptions of particular types of liquid films, starting with a chapter by Hartland on coalescence, which has a far more down-to-earth flavor. At the outset he reminds us of the complexity of film drainage and rupture in real froths and foams, then presents various phenomenological models which can be used to describe their behavior. He concludes with a useful prescription for selecting the appropriate model. Kruglyakov follows with a comparison of free films, foam films, and emulsion films. Malhotra and Wasan give a rather dry survey of the literature on interfacial rheology, and Perez, Proust, and Ter-Minassian-Saraga discuss liquid crystal