chapter reviews semi-empirical calculations derived from modified molecular orbital theories, pseudopotentials, and the atoms in molecules approximation, and concludes with consideration of some simple models and correlations between potentials. The author frequently cites comparisons of calculated values with experimental results.

The completion of so exhaustive a two-volume study is truly a monumental achievement. Goodisman has cited some 1300 papers including at the end of each chapter a list of papers published too late to be included in the main manuscript. For each of these the reader is directed to the section of the chapter to which the content of the paper is most relevant. The author claims that a knowledge of quantum mechanics equal to that which would be obtained from a one-semester course is sufficient for users of this work. He directs the student reader to standard texts for clarifying details. It appears likely that considerable use of such reference material would be needed by students with only one semester of quantum mechanics, but more advanced students should find the work to be quite lucid.

The only substantial disappointment that comes from reading the work is that the expectation of success generated by early statements in the text ["... quantum chemists can now produce reliable interaction potentials for diatomic systems in their ground states," (preface) and " ... the derivation of the potential $U(R)$ from calculated energies for a series of values of R ... is considered, as well as the correction of the results of Hartree-Fock calculations to give accurate potential curves." (volume one, page 4)] is not fulfilled by the actual results given. In volume two, page 263 one finds: "It appears that one can perform approximate Hartree-Fock calculations leading to $U(R)$ for any diatomic system desired. The resulting potential constants and other features, however, will generally be reliable only qualitatively, unless one has an idea of (a) the expansion error ... and (b) the correlation error ... These questions can be answered when one has available similar calculations on a set of related molecules, for which exact Hartree-Fock and exact results are known." This information of course, is generally not available. Later (page 285) he writes "One would like to have a set of rules for constructing configurations which could easily be implemented for a variety of new systems, and which yields a potential curve in which one can be confident. It does not appear from the preceeding discussion that theoretical analysis suffices to derive such a method." Although the material offered falls short of one's hopes, it remains an outstanding review of the state of the art up to the date of publication.

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Symmetry and its Applications in Science

A. D. Boardman, D. E. O'Connor, P. A. Young
305 pp. Halsted, New York, 1973. $14.95

This book by A. D. Boardman, D. E. O'Connor, and P. A. Young is a welcome addition to the literature on the application of group-theoretical principles to physics and chemistry. The authors have produced a well planned introductory text, which aims primarily to provide the reader with an understanding of how the simple but very powerful concepts of group theory can provide great insight into complex problems, both on the microscopic and macroscopic levels without the necessity of attempting rigorous solutions.

The book is written at an elementary level and should appeal to an undergraduate audience or indeed to any scientist who has felt the need to become familiar with the increasingly popular nomenclature of group theory in the realm of atomic, molecular and solid-state physics and chemistry. Although there are many existing books on group theory and its applications; most of them are encumbered by varying degrees of rigorous mathematical background and abstract group concepts that, although of great value to the serious student of the formal theory, have perhaps scared away that great body of scientists who would prefer to use the theory as a tool (or at least learn its language), but have looked in vain for a simple textbook that would enable them to acquire this facility in a limited time and without significant previous knowledge. The present book appears to fill this void admirably. Avoiding rigorous proofs, it introduces the essential concepts and relationships of basic group theory and the manner in which they may be used to extract the maximum amount of information from the inherent symmetry properties of physical phenomena. The later chapters contain many applications such as crystal symmetry, tensors, energy bands in solids, atomic orbitals, molecular orbitals, selection rules, normal modes and vibrational spectra.

To a large extent the several chapters on the various applications can be read independently, each chapter supplying its own preamble of background material. In addition, each chapter contains a handful of well chosen problems that enable the reader to assess his grasp of the material (and his ability to use the knowledge acquired) at frequent intervals. The solutions are supplied together with the detailed working at the end of the book.

MALCOLM E. LINES
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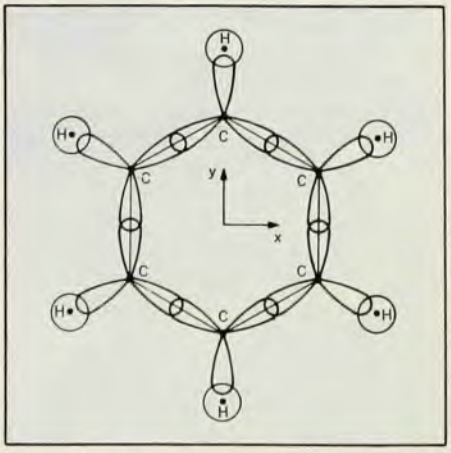

Symmetry abounds in benzene ring where sigma bonding occurs in the x–y plane.

Physical Fluid Dynamics

P. D. McCormack, L. Crane
487 pp. Academic, New York, 1973. $17.50

It sometimes seems as though all of the scores of fluid mechanics books except that by Landau and Lifshitz were written primarily for applied mathematicians and/or engineers, so the appearance of this one, *Physical Fluid Dynamics*, is an event of interest to readers of PHYSICS TODAY.

The bad news is that this book is in many ways less "physical" than many others on the subject. Evidently the first adjective of the title was justified in the minds of the authors by presence of a chapter on the hydrodynamics of superfluids, a topic researched more by "physicists" than by "applied mathematicians" or "engineers." The inclusion of this subject is the principal good news. But there is more bad news: the book has more than its fair share of misprints, errors, misleading omissions, and generally slipshod exposition.

The shortcomings can be categorized as follows:

- misprints and undefined symbols,

- figures drawn so casually that they are qualitatively wrong,
- restricted results without mention of the restrictions,
- erroneous statements and results and
- omission of topics basic to fluid mechanics. The third and fifth types are most frequent but there exists more erroneous statements and results than are acceptable in a textbook in this didactically well travelled field.

To omit examples would, of course, be unfair to the authors. One of the errors is the occasional omission from the vorticity dynamic equation of its (physically) most interesting term, the one that represents vorticity amplification by vortex line growth. On page 243 this effect is apparently suppressed by the mere act of transforming to Cartesian coordinates! Another error is the claim that "the basic mechanism for transition from a laminar flow to a random-type turbulent flow has been explained." In fact it is not explained at all; apparently the authors are unaware of the difference between laminar instability and transition to turbulence.

Perhaps the most common restriction that is often used in this book without mention is the "barotropic" one, that is, that density be a unique function of pressure. It is explicitly brought out only in the one section where the more general case is finally discussed—well along in the book.

Two welcome chapters are those on particle fluid dynamics (essentially suspensions) and hydrodynamics of superfluids, the latter especially, because of the scarcity of introductory surveys in that area. It is not obvious, however that their presence compensates for the shortcomings in the presentations of the classical fluid mechanics material.

STANLEY CORRSIN
The Johns Hopkins University
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European Technology, The Politics of Collaboration

Roger Williams
214 pp. Halsted, New York, 1973.
$13.00

The topic of this book is an exasperating one. Most of us would like to consider Western Europe as a cultural, economic and political unit rather than a collection of sovereign states preserving their own parochial interests. Past and recent history, however, point toward the latter alternative.

We are disappointed by the apparent lack of European collaboration on the political, technical and scientific level

apart from a few outstanding examples to the contrary in the scientific field, such as CERN (European Center for Nuclear Research), EMBO (European Molecular Biology Organization) and to some extent ESRO (European Space Research Organization). The lack of success of EURATOM, the air bus, the European Institute of Technology and of many other attempted as well as non-attempted efforts of collaboration are only too well known and deplored. The reactions of European governments to the recent oil crisis have further strengthened these feelings.

However, things are perhaps not quite as bad as they seem on the surface. There exist successful collaborative efforts that are less in the public eye, because they are not government initiated. They come from the many multinational companies in Europe who have in fact introduced a certain measure of international collaboration. A few examples are Philips in electronics, Brown Boveri in the steel industry, ITT in communication, Nestlé in food industry. In many cases, as for example, in the field of computers and electronics, this collaboration was instigated by the participation of US firms. Also one should not overlook that the much maligned oil companies succeeded in preventing crippling oil shortages in Holland and Denmark, when the Arabs imposed a special embargo upon those two countries.

The book under review deals with many aspects, private and governmental, of European cooperation and with the problem of competition with the United States in science and technology. The famous "technology gap" is discussed at length. The most succinct explanation of this gap is found in a quotation of H. G. B. Casimir:

> "Abolish the Federal Government of the US. Divide the country into its several states and make sure each has a mildly different system of taxation, a different currency, different banking and insurance laws, and different customs regulations. Regroup American minorities into as many distinct language areas as possible and in any case not less than 15, and try to make sure that whenever possible there is at least one competing minority language requiring dual language schools. Oh yes, you will need 40 and 50 distinct patent systems. Do this and the technology gap between the US and Europe will fill up rapidly."

This gap also is sometimes overestimated. In various respects, especially where high science-based technology is less important, Europe is in fact more advanced than the US; this is the case in railroad development, tire production (the radial steel-belted tire is a European invention), hydroelectric power stations, and—strange as it seems—nuclear breeder reactors.

Unfortunately Roger Williams's book is not very useful for somebody who is not knowledgeable in these questions. It is written for the initiated, with too few clear summaries, with too many quotations, and very much from the British vantage point. The author refers to many projects by their code names—CESAR, MESH, CIFAS, TNPG—without saying what they signify and in those cases where he does say it, he gives a commercial and not a technical description of the projects, although the author supposedly was