BOOKS

Energy: From Surplus to Scarcity?, K. A. D. Inglis, (Ed.), Halsted Press, New York (1974). 224 pages. $21.95.

This book comprises the proceedings of the Institute of Petroleum summer meeting held in June, 1973, at Harrowgate, Yorkshire, United Kingdom.

Broad consideration is given to the future roles of coal, petroleum, natural and synthetic gases, nuclear energy, and electricity in the changing world situation. New technologies are discussed in relation to their utility and their potential contributions, but process features and fundamentals are not elucidated.

The focus is on global and regional resources, projected growth in energy use, efficient fuels utilization, allocation and supply problems, alternate energy sources, and the possible effects of political and economic determinants. Unhappily, though no doubt correctly, the United States is credited with leading "the age of profligate use of energy" which may well be coming to an end.

The fifteen chapters, each representing an original paper, are reasonably compatible with little overlapping and, taken as a whole, provide a useful and well balanced statement of the energy problem. In view of developments since the conference, the treatment seems low key in places but is generally perceptive and realistic.

However, the chapter entitled "Towards the All Electric Economy" has somewhat the tone of an utility company television commercial. It would, one feels, have been distinctly improved if the author (1) showed greater recognition of the long-range need for avoiding energy waste, (2) contemplated a more balanced allocation of fuel resources to end uses, and (3) used conventional overall efficiency criteria. He treats electricity as a fuel and compares its use efficiency with that for the overall use of fossil fuels. This ignores the generation efficiency which in the United States is typically something less than 33%.

Some of the papers appear to regard the world as a highly flexible and adaptable unit in which any important need will be met with a prompt and adequate production and delivery response. The meeting, it will be remembered, took place before the oil embargo. However, Professor Penrose gives an excellent and pertinent analysis of political considerations in relation to the economic self interests of fossil fuel rich countries. She points out, for example, that oil production and exportation by an oil-rich, but industrially underdeveloped, country will almost certainly be managed not, primarily, to benefit the importing countries, but to optimize its own position and foster its current and future interests.

On the whole, the book is recommended as a useful and well-presented overview of the energy situation.

WENDELL W. WATERMAN
INSTITUTE OF GAS TECHNOLOGY
CHICAGO, ILLINOIS

Momentum, Heat and Mass Transfer, 2nd Edition, C. O. Bennett and J. E. Myers, McGraw-Hill, New York (1974). 810 pages. $17.85.

This text is a clearly written introduction to the transport phenomena which presents the basics of momentum, heat, and mass transfer without vector notation. The material is arranged into three sections in the now classic order of the title. The unique feature of this book is the attempt to show the student that transport phenomena and unit operations are a continuum, with the former providing the theoretical basis for the latter. To this end, design equations have been given in each section while a chapter on filtration closes the momentum transfer section, a chapter on heat exchangers completes the heat transfer section, and five unit operations chapters (continuous contacting of immiscible phases, equilibrium stage operations on immiscible phases, on miscible phases, binary distillation and multicomponent separations) wrap up the mass transfer section. The most successful marriage of transport theory and unit operations is the description of filtration, while the heat transfer unit operations chapter is less successful. Of the mass transfer unit operations chapters, only that on continuous contacting of immiscible phases (gas absorption) uses transport theory to any extent. Since extraction and distillation are conventionally treated through the equilibrium stage model and are so treated here, the authors should have deleted these applications, settled for one illustration of each type of transport, and shortened the book by 100 pages. Although Bennett and Myers have not convincingly shown how the unit operations may be analyzed through transport phenomena, perhaps the fault lies, in part, elsewhere. After working through this text a bright student could reasonably ask, "Why haven't the transport phenomena had greater impact on bread-and-butter chemical engineering?"

Those familiar with the first edition will see that the second is over 100 pages longer. Nearly 40% of this inflation is due to the addition of three appendices; the longest contains physical property and other data useful in solving the many new problems added at the end of each chapter. The chapter on high speed flow and the chapter on mass transfer with chemical reaction have been deleted. The remaining material and its treatment are essentially identical to that of the first edition with minor additions and some rationalization of material between chapters. SI units are not used; They are dismissed in five lines in Chapter 1.

MARTIN E. WEBER
DEPT. OF CHEMICAL ENGINEERING
MCGILL UNIVERSITY
MONTREAL, QUEBEC

Handbook of Process Stream Analysis, Kenneth J. Clevett, Halsted Press, New York (1973). 470 pages. $39.00.

This is the best book now available on the increasingly important subject of techniques for the continuous monitoring of process streams in the chemical and related industries. The subject matter is well organized, well illustrated, and easy to read.

There are 17 chapters, each devoted to a physical property or an analytical technique currently utilized in process stream control. These items range from viscosity of *p*H to octane number to water analysis. Each chapter contains (1) introductory comments on the general nature of the property or analysis, (2) a summary of basic principles, (3) a brief discussion of laboratory techniques, (4) descriptions of available commercial on-line analyzers, and (5) examples of specific industrial applications.

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and the computation time are given in each table.

When the initial value of $x_2(t_f)$ was held at 0.70 and ten initial values of $x_1(t_f)$ were taken from 0.15 to 0.06, the BCI method of Denn and Aris required 0.61 min. of computation time to reach $e < 0.001$ and 1.09 min. to reach $e < 0.0001$. With the BCI method of Jaspan and Coull, only 5 cases were run corresponding to $x_1(t_f) = 0.15, 0.14, 0.13, 0.12$, and 0.11. The computation times were 2.67 min. to obtain $e < 0.001$ and 3.89 min to obtain $e < 0.0001$. For the initial value of $x_1(t_f) = 0.11$ and $x_2(t_f) = 0.70$, convergence, however, was not obtained within 1000 iterations.

In Tables 3 and 4 the computational results of the CVI method based on the method of Rao and Luus (1972) are given. Also, Horn's method as proposed by Jaspan and Coull (1971) was run for comparison. As can be seen, the CVI method is considerably faster. It should be noted also that for the CVI method isothermal initial trajectories were used

$$u^{(0)}(t) = K \quad 0 \leq t < 10 \qquad (3)$$

whereas for Horn's method

$$u^{(0)}(0) = K \qquad (4)$$

so that the CVI method is placed at a disadvantage.

A modification is proposed for the Horn's method. Instead of using $\epsilon = 0.05$ initially, it is proposed to use $\epsilon = 1.0$ and then to halve ϵ whenever overstepping occurs. This modification greatly improves the method to make it comparable to CVI method for convergence to $x_2(t_f) > 0.6792$ and better for convergence to $x_2(t_f) > 0.6800$.

It is, however, important to note that even with the presently proposed modification to Horn's method, the CVI method is still faster with the choice of $K = 340$ and $x_2(t_f) > 0.6800$. This refutes the statement of Jaspan and Coull (1974) that Horn's method must be the fastest method in unconstrained problems.

The letter of Tsang and Luus (1972) and the present letter have not been intended to appraise the work of Jaspan and Coull but to defend the position of CVI methods in the face of unjustified claims of Jaspan and Coull. Although Tables 1 to 4 do not give a complete picture, it is nevertheless clear that we should not be too hasty in dispatching the CVI methods.

The tables also show that the claim of Tsang and Luus (1972) that the CVI method is superior to the BCI, GBCI, and Horn's method (as formulated by Jaspan and Coull) for this particular example is not rash at all. In fact, the CVI method is about 10 times faster than the BCI method and about 3 times faster than the latter method, not to mention the extra effort required for the procedures of Jaspan and Coull to obtain the initial values for ϵ and the initial range for $x_1(t_f)$ and $x_2(t_f)$ to ensure stability. It should also be noted that Horn's method is not a boundary condition iteration method.

Denn, M. M., and R. Aris, "Green's Functions and Optimal Systems. Necessary Conditions and an Iterative Technique," *Ind. Eng. Chem. Fundamentals*, **4**, 7 (1965).

Jaspan, R. K., and J. Coull, "Trajectory Optimization Techniques in Chemical Reaction Engineering: 1. Boundary Condition Iteration Method," *AIChE J.*, **17**, 111 (1971).

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Rao, S. N., and R. Luus, "Evaluation and Improvement of Control Vector Interation Procedures for Optimal Control," *Can. J. Chem. Eng.*, **50**, 777 (1972).

Tsang, A. C. C. and R. Luus, "On Comparison of Optimization Methods," *AIChE J.*, **18**, 1285 (1972).

REIN LUUS
DEPT. OF CHEMICAL ENGINEERING
UNIVERSITY OF TORONTO
TORONTO, ONTARIO M5S 1A4

BOOKS *(continued from page 1037)*

The book is illustrated with good line drawings and with photographs. A few of the photographs are not of the first quality. Bibliographic listings are somewhat skimpy, possibly because the author leaned heavily on instrument manufacturer's literature for much of his basic information. A convenient summary of all the on-line analyzers described in the book is presented in a table preceding the index. The table contains these items: (1) manufacture, (2) quantitative capability, (3) power supply requirements, (4) physical dimensions, (5) weight, and (6) electrical safety classification. A list of the addresses of selected instrument manufacturers in the United States, the United Kingdom, and Europe is also included.

Any reader familiar with a particular kind of analyzer will doubtlessly find some gaps in the coverage provided by Clevett. This is inevitable in a field which is developing at so fast a rate. Nonetheless, this book is the best presentation of the current state of the art on instruments for process stream analysis.

The readership to which this work is directed includes practicing chemical engineers involved in plant design or operation, laboratory analysts, and instrument engineers in almost any field of food, chemical, or petroleum manufacture. Advanced undergraduates or professional engineers in these fields will find this handbook a valuable source of information.

WILLIAM S. TAMPLIN
RESEARCH AND DEVELOPMENT
UNION CARBIDE CORPORATION
SOUTH CHARLESTON,
WEST VIRGINIA 25303

New Developments in Gas Chromatography, Howard Purnell, (Ed.), John Wiley, New York (1973). 408 pages. $9.95.

This book is Vol. 11 in the *Advances in Analytical Chemistry and Instrumentation* series edited by C. N. Reilley and R. W. Murray and contains seven articles describing developments in the forensic applications of gas chromatography, applications of digital computers to GC; applications of gas chromatography to production-scale separations, and GC studies of reaction kinetics, solvent phase changes, chemical complex formation, and the structure of polymers.

The articles are well written and noteworthy in that, unlike too many other *Advances* compendia, the articles have sufficient breadth and background to make their material accessible to research workers who are not specialists in each field. In addition, the articles present overviews of fields of application rather than a catalog of the contents of the long bibliographies that are an essential part of this type of book.

The review of chemical reactor applications of GC is particularly timely, as is the section on forensic applications of GC. The section on production scale gas chromatography presents suggested criteria for choosing GC over more conventional industrial separation techniques but lacks any discussion of gas chromatography processes such as hypersorption, and others which have reached commercial scale. The article also fails to note that a major commercial source of production-scale GC columns, referred to frequently, is no longer available.

The book is recommended strongly as a useful reference.

M. V. SUSSMAN
AND R. N. S. RATHORE
DEPARTMENT OF CHEMICAL ENGINEERING
TUFTS UNIVERSITY
MEDFORD, MASSACHUSETTS