"Mechanism of the Oxo Reaction." They have sorted the various aspects of the complex history of hydroformylation chemistry admirably. Most of the useful tools of homogeneous catalysis are demonstrated, from molecular orbital theory to empirical kinetics to stereochemistry. The value of the stoichiometric reaction in the overall understanding of the catalytic *oxo* process is well documented. This paper nicely precedes the study of F. Paulik's review of "Recent Developments in Hydroformylation Catalysis." The combination of these two papers provides a thorough consideration of most aspects of homogeneous catalysis within the framework of a single system of process chemistry. Paulik discusses not only the most recent catalyst systems but also the effect of various process variables on the reaction system performance. His paper is concluded by briefly describing the performance of modified homogeneous catalysts which are mounted on porous solid supports.

The paper by R. J. Kokes entitled "Some Aspects of Catalysis: The P. H. Emmet Award Address" provides an excellent discussion of much of his own work in the hydrogenation of ethylene, the isomerization of olefins, and the oxidation of hydrocarbons. This is good recommended reading for anyone interested in heterogeneous catalysis. After reading Koke's paper the review of "Electron Localization and Oxygen Transfer Reactions of Zinc Oxide" by P. Roussel and S. J. Teichner provides a very effective transition from primary concern with the surface reaction to increased attention to the manner of surface involvement in the reaction. Many of the techniques described in these two papers are similar, and for students this reinforcement is helpful. Along similar lines the "Study of Kinetic Structure Using Marked Atoms" by John Happel develops the utility of isotopic tracer techniques along with the stoichiometric number concept of Horiuti in analyzing complex catalytic reaction systems. He reviews theory and experiments and then discusses the application of these tools to the ammonia synthesis, sulfur dioxide oxidation, carbon monoxide oxidation, and the dehydrogenation-hydrogenation of C_4 hydrocarbons.

Surface and support properties are considered in two papers. The first is by R. J. Cvetanovic and Y. Amenomiya, "A Temperature Programmed Desorption Technique for Investigation of Practical Catalysts." This experimental method, the apparatus and procedure, and the results for some typical systems are described. The authors anticipate that one of the principal uses of this technique will be in obtaining information on the energetic heterogeneity of catalytic surfaces. The second paper in this area is "X-ray Scattering Techniques in the Study of Amorphous Catalysts" by P. Ratnasamy and A. J. Leonard. They discuss the radial electron distribution method and the interpretation of results in application to various catalyst supports.

In conclusion, the reader can turn to the very timely discussion of Frank Dwyer on "Catalysis for Control of Automotive Emissions." He reviews in a most convincing manner the current status in each of the various aspects of this problem. Where answers are currently unavailable he points this out. He considers the requirements and difficulties in each area and concludes that there "seem to be no published claims for catalysts that will survive 50,000 miles of use when the 1975 Federal standards are used as the criteria." Recalling our fictitious graduate student in his catalysis seminar, this conclusion should send him back to the laboratory with real problems to solve and much better prepared to tackle them for having invested the energy required to study this volume of Catalysis Reviews.

CHARLES H. BARRON
SCHOOL OF ENGINEERING
AND APPLIED SCIENCE
UNIVERSITY OF VIRGINIA
CHARLOTTESVILLE, VIRGINIA 22901

Industrial Crystallisation from Solutions, Jaroslav Nyvlt. Transl. by Paul Feltham, Butterworth & Co., Ltd., London (1971). 189 pages. $28.70.

This slim book first published in Czechoslovakia in 1967 has been extensively revised for this first English edition. It should prove interesting and useful to the chemical engineer and others who have to deal with the practical problems of crystallization from solution.

The author has tried to provide a ready reference and handbook to the practical aspects of industrial crystallization and has done a good job in the attempt.

Arranged in only two chapters, it covers Theoretical Foundations of Crystallization and Design Calculations for Crystallizer Installation.

While this may seem short for a book, each chapter is divided into numerous subdivisions. Chapter 1, while not as detailed as material to be found in other monographs, gives a good background in crystallization. Some of the topics covered are phase equilibria, material and thermal balances, equilibrium diagrams, correlation methods for solubilities in multicomponent systems, kinetics of crystal growth, kinetics of crystallization, kinetics of nucleation, crystal habit, product purity, and product size distribution. Chapter 2 switches to the more practical aspects of crystallization covering various types and designs of crystallizers that are to be found in industrial practice. These cover stirred-batch and -continuous crystallizers, series stirred, classifying and parallel-flow crystallizers, among others. Also covered are some types which are not normally found in U.S. industry.

Numerous examples, tables, and hints throughout add to the book's usefulness. Background equations are given along with a clear explanation without trying to go into detailed theory on each subject. References are given for those wishing a more theoretical discussion of the subjects.

Indeed, an outstanding feature is the profusion of references given throughout the book. Each subdivision has its own reference list of from 2 to 265 entries, and there also is an additional list of over 400 entries in regard to crystallization of various compounds listed in the appendix. A large number of these entries are 1968 or later, up to and including 1971.

While other well-known monographs exist on crystallization (Mullin, 1961; Van Hook, 1961; Bamforth, 1965), this book does not compete with but rather complements them. It was not intended to be an all-inclusive work and should not be considered as such. The author has done a very good job from the chemical engineering standpoint, and this book should find its place on the shelf of all those who are engaged in this field.

W. E. WILLINGHAM
AUTOMATION INDUSTRIES, INC.
VITRO ENGINEERING DIVISION
RICHLAND, WASHINGTON

Detergency: Theory and Test Methods, W. G. Cutler and R. C. Davis, (eds.), Marcel Dekker, New York (1972). 451 pages. $28.50.

Is detergency significant to the chemical engineer? Of course his clothing, dishes, automobile, hair (if any) and skin are washed more or less frequently. Probably, however, he concerns himself less over these than about

(Continued on page 1285)

TO THE EDITOR:
ON COMPARISON OF OPTIMIZATION METHODS

In a recent communication Jaspan and Coull (1972) presented a comparison of optimization methods in establishing the optimal control of a tubular reactor whose behavior is given by two nonlinear ordinary differential equations.

In view of the significant improvement to control vector iteration (CVI) methods for the optimization of chemical engineering systems as proposed by Rao and Luus (1972), we would like to supplement some of the statements made by Jaspan and Coull (1972) with reference to the system reported by them.

Jaspan and Coull stated that the initially guessed control policies as given by Fine and Bankoff (1967) and Lee (1968) are the only two initial control policies that will give convergence to the optimum when CVI method is applied. Using the proposed algorithm of Rao and Luus, a constant temperature initial control policy

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

$$250 \leq K \leq 380$$

is found to be successful to give convergence to the optimum. While using the initial control policy of Lee, the algorithm of Rao and Luus gives convergence to the optimum $x_2\ (t_f) = 0.6801$ in 8 iterations and 1.3 seconds of computation time using IBM 370/165 computer (integration time step = 0.1). The method is thus more efficient when compared to the BCI, GBCI, and Horn's method (Jaspan and Coull, 1972.). The significance of the method of Rao and Luus (1972) lies in the systematic approach to determine the stepping parameter ϵ with respect to the system characteristics. For this system, the stepping parameter so determined is found to be in the range of 10^2 to 10^4. With such a systematic way of obtaining ϵ, we should further state that the choice of stepping parameter is no longer an art.

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ALBERT C. C. TSANG AND REIN LUUS
DEPARTMENT OF CHEMICAL ENGINEERING
UNIVERSITY OF TORONTO
TORONTO, CANADA

TO THE EDITOR:

On reading Professor McGee's editorial in the November 1971 issue I was impressed by his statement that the *Journal*'s contents "are not calculated to excite anybody." The reason for being impressed was that such a statement seemed to be an appropriate criticism for a publication like, say, Playboy, but it appeared to me as rather irrelevant as applied to the *Journal*. I read the *Journal* when I want to learn something basic about chemical engineering, I do something else when I want to get excited.

Yet this seems to be a very personal attitude, since Dr. Christensen (Jan. 1972, p. 256) advocates "stimulating articles," and Dr. Chase (May, 1972, p. 669) also seems to desire a Playboy-type *Journal*, and yearns for more photographs—perhaps a central folder on crystallinity of polyethylene would just be ideal.

I wonder whether these are the standards by which the *Journal*'s contents should be judged. McGee's statement that the predominant attitude of practicing engineers toward the *Journal* is "one of overwhelming disinterest" is a serious one, and, if true, the reasons of such a situation should be investigated. If the material published on the *Journal* is irrelevant to chemical engineering, the Institute should revise its standards for accepting papers.

If on the other hand, practicing engineers fail to see the relevance of, for example, research in heat transfer (a subject McGee seems to dismiss) or on cryobiological preservation (a subject preferred by McGee), then the Institute should revise its standards of acceptability of individuals to the profession.

GIANNI ASTARITA
UNIVERSITY OF NAPLES
NAPLES, ITALY

BOOKS (continued from page 1282)

the sticky valves in his sports car or the fouled heat-exchange surfaces that raise his plant operating costs.

The latter hard surface detergency aspects and the related topics of emulsions and foams are *not* included in the present book (although chapters on Dishwashing and Cleaning of Metals are to appear in a second volume). Essentially, the ten authors of the present volume discuss the attachment, removal, and redeposition of soils upon organic fibers and fabrics, and the very numerous methods which have been used in studies of these processes. W. C. Powe adds an informative chapter on the origin and composition of laundry soils.

The theories of particulate soil adherence and removal in terms of the van der Waals and electrical double-layer forces are presented in a straightforward fashion by H. Lange (actually an abridgment by the editors of an earlier publication). Hans Schott of Temple University contributes two chapters on the removal of particulate and organic soils. These briefly consider Zisman's extensive work on wettability of surfaces, the rolling-up of oily deposits, and the various surface interactions of soil, fiber, fabric and surfactants. He includes a wealth of theory and observations from 200 references. I feel that a wrap-up section by Schott summarizing this material would have strengthened the book considerably.

Overall, the book's treatment of its subjects is simple and reasonably up-to-date with references up to 1970. Illustrations vary in quality from excellent to mere photos of boxes with knobs. Editing appears to have been done quickly, in that chapters on test methods and equipment overlap in coverage, and several errors and unclear statements remain.

The information and bibliographic references in the book should help engineers who are involved with fiber technology and with laundry problems. For the rest of us, it is a humbling reminder that surfactants and fiber surfaces are still difficult to characterize, that the process of cleansing is far from simple, that the judging of its effectiveness involves most of the difficulties of appearance-measurement, and that even the simulation of the dirt is controversial. As Davis aptly says, "One of the chief needs of detergency research now is to find a realistic soil upon which all laboratories can agree and seek a common ground."

F. L. HOWARD
KAISER ALUMINUM & CHEMICAL CORP.
WENDOVER, UTAH 84083