

(Continued from page 290)

pressures, viscosity, etc. of hydrogen, helium, nitrogen, and oxygen and with other miscellaneous data.

Many of the techniques are well illustrated with drawings, and the theory necessary for the design of equipment is adequately treated by equations. There is a good collection of references to literature at the end of each chapter.

All serious workers in the field of cryogenics will find this a very useful book which they will wish to add to their libraries.

B. F. DODGE
YALE UNIVERSITY

Photochemistry in the Liquid and Solid States, L. J. Heidt, R. S. Livingston, E. Rabinowitch, and Farrington Daniels, editors, John Wiley and Sons, New York, New York. 174 pages.

The twenty-four papers in this volume were presented at a symposium held in September, 1957, arranged by the Subcommittee of the National Academy of Science—National Research Council on the photochemical storage of energy. From a reading of the papers and introductory and concluding remarks by members of the subcommittee there emerges an excellent overall view of present thought and research in this area.

Criteria for suitable photochemical reactions and possible techniques for photochemical storage of energy are reviewed first by members of the subcommittee. The papers, many of them as progress

reports rather than more definitive results, point up the factors discussed in the introduction. The concluding remarks emphasize the difficulties involved in finding a feasible solution to some of the problems. It is recognized that these difficulties are formidable and that there appear to be no easy answers to many of them.

Present knowledge is inadequate to predict the extent to which the energy supplies of the future will depend on photochemical storage of energy or the methods which are most likely to prove practicable for such storage. The search for answers and ideas is nonetheless exciting and challenging, an attitude which this short volume conveys very well.

CHARLES A. WALKER
YALE UNIVERSITY

Fluids Mechanics, Richard H. F. Pao, John Wiley and Sons, New York, New York. 502 pages.

This textbook is a successful attempt to present to the engineering student (normally in his third or fourth year) an introduction to several portions of the subject of fluid mechanics. The book is of broad scope, embracing as it does the behavior of ideal fluids and viscous fluids, incompressible and compressible fluids, flow in closed conduits and open conduits, and flow about immersed bodies. The attempt to introduce so many topics without the use of mathematics beyond ordinary differential equations and some slight knowledge of partial differential equations poses difficulties. The author succeeds in

Key Words: Heat Transfer-8, Mass Transfer-8, Rates-8, Transport-8, Fluid Flow-8, Turbulence-9, Fluids-9, Gases-9, Air-9, Evaporation-9, Octane-9, Hydrocarbons-9, Spheres-10, Balls-10, Porosity-, Physical Properties-, Properties (Characteristics)-, Numbers-10, Nusselt-.

Abstract: An investigation of macroscopic and local thermal and material transport from a silver and a porous sphere, each 1.0 in. in diameter, for various flow conditions is conducted. For the porous sphere the evaporation of *n*-octane into a turbulent air stream was studied. The results indicate that the macroscopic Nusselt number is substantially larger for combined transport than for thermal transport alone.

Reference: Venezian, Emilio, Manuel J. Crespo, and B. H. Sage, *A.I.Ch.E. Journal*, **8**, No. 3, p. 383 (July, 1962).

Key Words: Absorption-8, Mass Transfer-8, Reactions-8, Rates-8, Flow-9, Fluid Flow-9, Laminar Flow-9, Turbulence-9, Columns (Process)-10, Disk-, Ammonia-1, Acetic Acid-1, Acids (Carboxylic)-1, Unsteady State-9, Liquid Phase-9, Reactions-9, Coefficients-9, Predicting-9, Estimating-9, Twot Film Theory-10, Unsteady State-10, Theory-10.

Abstract: Absorption accompanied by a rapid, second order, irreversible reaction has been studied in a "disc" column for both laminar and turbulent flow. The chemical system used involved the absorption of ammonia by acetic acid. Results confirm the predictions of the "two-film" and "unsteady state" theories for this class of two phase reactions.

Reference: Dhillon, Sharanjit S., and R. H. Perry, *A.I.Ch.E. Journal*, **8**, No. 3, p. 389 (July, 1962).

Key Words: Extraction-9, Separation-9, Mass Transfer-9, Concentrations-9, Thermodynamics-8, Equilibrium-8, Liquid Phase-8, Mixtures-8, Solutions (Mixtures)-8, Profiles-8, Ideal-, Activities-8, Gradients-8, Theories-10, Penetration-, Columns (Process)-10, Packed-, Extractors-10.

Abstract: Concentration profiles have been computed for an idealized extraction in a packed extraction column involving a three-component system. The results are presented for various mass transfer coefficient ratios. A modified activity gradient, derived for both molecular diffusion and penetration theory conditions, is used in place of the usual concentration driving potential. Explanations are offered for the calculated behavior of the raffinate and extract phases.

Reference: Hennico, Alphonse, and Theodore Vermeullen, *A.I.Ch.E. Journal*, **8**, No. 3, p. 394 (July, 1962).

Key Words: Adsorption-8, Methane-1, Propane-1, *n*-Butane-1, *n*-Pentane-1, *n*-Hexane-1, Methanethiol-1, Ethanethiol-1, Propanethiol-1, Carbonyl Sulfide-1, Carbon Disulfide-1, Activated Carbon-10, Temperature-6, Pressure-6, Capacity-7, Correlation-8, Isotherm-9, Free Energy-10.

Abstract: Adsorption isotherms of methane, propane, *n*-butane, *n*-petane, *n*-hexane, methanethiol, ethanethiol, propanethiol, carbonyl sulfide, carbon disulfide, and hydrogen sulfide on activated carbon have been determined gravimetrically from -23° to 100°C. at pressures up to 1 atm. Correlation of the isotherms by a published method based on adsorption free energy considerations yielded two curves, one for the hydrocarbons, the other for the sulfur-containing compounds.

Reference: Grant, R. J., Milton Manes, and S. B. Smith, *A.I.Ch.E. Journal*, **8**, No. 3, p. 403 (July, 1962).

Key Words: A. Disturbance-1, Perturbation1-, Step-Change-1, Transient Response-2, Rate-Change-6, Transient Response-8, Distillation-8, Column-8, Control-9, Analogue Computer-10.

Abstract: Experimental transient response data are presented for a five-tray, 2-ft. diameter, bubble-cap distillation column when a step increase in liquid rate or a step decrease in vapor rate to the column was made. The column was allowed to proceed from an original total reflux condition to a new, final, steady state condition during which time the changes in composition of the tray liquids were measured. The experimental results compare well with those predicted by perturbation types of equations solved on an analogue computer.

Reference: Baber, M. F., and J. A. Gerster, *A.I.Ch.E. Journal*, **8**, No. 3, p. 407 (July, 1962).

overcoming these difficulties and in presenting a unified treatment of the subjects which should be understandable to the audience to which the book is addressed.

Among the strong points of this book are the illustrative examples which are included to show how the concepts are used and a large number of well-conceived problems at the end of each chapter. The space utilized for these materials sometimes leads to too-brief text material, particularly in making clear the physical situation which is under consideration.

The author's use of the symbol of partial differentiation in such equations as $\partial p = - \partial z$ (page 8) and $\phi = \int 2x \partial x$ (page 62) is an improper one which might confuse students. It would have been preferable to note first that the partial derivation involved can in fact be treated as ordinary derivatives for each particular case for reasons arising from the physical situation or from the nature of the mathematical operation being performed.

CHARLES A. WALKER
YALE UNIVERSITY

Computer Program Abstracts

Readers of the *A.I.Ch.E. Journal* who are interested in programing for machine computation of chemical engineering problems will find in each issue of *Chemical Engineering Progress* abstracts of programs submitted by companies in the chemical process industries. Collected by the Machine Computation Committee of the A.I.Ch.E., these programs will be published as manuals where sufficient interest is indicated. The following abstracts have appeared this year:

CEP (May, 1962) p. 80

Solution of Ordinary Differential Equations (094)

Transient Two-Dimensional Temperature Distributions in Slabs, Cylinders, or Spheres with Complex Modes of Heat Exchange and Generation (093)

CEP (June, 1962) p. 80

Canonical Analysis (096)

Principal Component and Factor Analysis (097)