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Computer Calculations for Multicomponent Vapor-Liquid Equilibria, J. M. Prausnitz, C. A. Eckert, R. V. Orye, and J. P. O'Connell, *Prentice-Hall, Englewood Cliffs*, New Jersey (1967). 238 pages.

This monograph should be of very great value to those interested in making multicomponent vapor-liquid equilibrium calculations for systems at low to moderate pressures. The pressure restriction is stated explicitly by the authors, and is to be heeded. Thus, this work is directed more toward chemical than to petroleum separations. Professor Prausnitz promises a second monograph devoted to high-pressure vapor-liquid equilibria, and its publication will provide the complement to the present volume.

The approach taken is thermodynamic; that is, the basic equations are completely rigorous expressions of the thermodynamic criteria of equilibrium. The thermodynamic method and the basic equations for the required fugacities are concisely presented in the first two chapters. Chapter 3 treats the calculation of fugacities of the components in the vapor phase through use of the virial equation truncated after the second term. Generalized methods for arriving at values for the second virial coefficients are included. Chapter 4 deals with the calculation of fugacities of the components in the liquid phase. Here the Wilson equation for the excess Gibbs energy is employed. Its great advantage is that it provides an expression for multicomponent liquid mixtures which requires no other constants than those determined from data for the constituent binaries. Thus no ternary or multicomponent data are needed. This is probably the best that can be hoped for; it seems most unlikely that it will prove possible in general to predict mixture behavior from pure-component data alone. Methods are included for dealing with liquid mixtures containing "non-condensable" components, that is, components whose critical temperature is less than the mixture temperature. Chapter 5 outlines the main computer programs and subroutines for multicomponent calculations, and presents sample results. Chapter 6 discusses the methods and computer programs used to determine the param-

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Dynamics of a tubular reactor with recycle: Part II. Nature of the transient state, Reilly, M. J., and R. A. Schmitz, **A.I.Ch.E. Journal 13,** No. 3, p. 519 (May, 1967).

Key Words: A. Dynamics-8, Reactor-9, Plug-Flow-0, Tubular-0, Recycle-10, Equations-10, Difference Equations-10, Liapunov's Direct Method-10, Stability-8, 9, Steady State-9, Phase Plane-10, Region of Asymptotic Stability-8, 9, Concentration-9, Temperature-9.

Abstract: The purpose of this paper is to investigate the complete transient nature of the reactor-recycle system. The methods utilize the notion of a phase plane representation of the transient outlet state. The study of the behavior in the phase plane is based first on linearized transient equations and second on numerical solution of the nonlinear transient equations for some numerical examples. Finally, results obtained by applying Liapunov's direct method to predict regions of asymptotic stability are presented and compared with those obtained by numerical solution of the transient equations.

Constant total pressure evaporation with heat reuse by a built-in engine, Cheng, Chen-yen, and Sing-wang Cheng, **A.I.Ch.E. Journal, 13,** No. 3, p. 528 (May, 1967).

Key Words: A. Evaporator-8, 10, Evaporation-8, 10, Built-In Engine-8, 10, Process-8, Nonspontaneous-0, Isobaric-0, Free Energy-10, Heat of Condensation-10, Reuse-8, 10, Heat-9, Boiling Point Depressor-10, Absorbent-10, Pressure-8, Condenser-9, Boiler-9.

Abstract: A new way of promoting a nonspontaneous process, namely, a built-in engine, is introduced, showing that a process with a large temperature coefficient of free energy change can be utilized to promote a nonspontaneous process which has a small temperature coefficient of free energy change. When such a built-in engine is incorporated into an evaporating system, heat reuse in the system can be obtained under a constant total pressure condition.

Concentrated polymer solutions: Part II. Dependence of viscosity and relaxation time on concentration and molecular weight, Williams, Michael C., **A.I.Ch.E. Journal, 13,** No. 3, p. 534 (May, 1967).

Key Words: A. Concentration-6, Molecular Weight-6, Solutions-9, Polymers-9, Viscosity-7, 8, Relaxation Time-7, 8, Friction Coefficient-7, 8, Rheology-8, Segment Distribution Function-7, Pair Correlation Function-7.

Abstract: A previously presented molecular theory for non-Newtonian viscosity in moderately concentrated polymer solutions is extended in this paper to a specific consideration of the influence of solute concentration and molecular weight on the limiting viscosity and the relaxation time.

Determination of transient plate efficiencies from operational data, Groves, D. M., N. J. Tetlow, and C. D. Holland, **A.I.Ch.E. Journal, 13,** No. 3, p. 540 (May, 1967).

Key Words: A. Plate Efficiency-8, 7, Transient-0, Temperature-6, Composition-6, Liquid Phase-9, Distillation Columns-9, Tests-10, Mixing-8.

Abstract: Methods are presented for the determination of the transient values of the vaporization efficiencies from the knowledge of various combinations of the transient values of operating variables. For the case where the temperature and the composition of the liquid phase for each plate are known, a direct solution for the vaporization efficiencies is presented. Also, a method is presented for the determination of the mixing parameters of a generalized plate model on the basis of known transient values of certain operating variables.

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Heterogeneous and homogeneous reactions in a tubular reactor, Solomon, R. L., and J. L. Hudson, **A.I.Ch.E. Journal, 13,** No. 3, p. 545 (May, 1967).

Key Words: A. Reactions-8, First-Order-0, Heterogeneous-0, Homogeneous-0, Reactor-9, Tubular-0, Isothermal-0, Laminar Flow-9, Eigenvalues-8, Eigenfunctions-8, Concentration-8, Galerkin Method-10.

Abstract: Irreversible, first-order, simultaneous heterogeneous and homogeneous reactions in an isothermal tubular reactor under laminar flow conditions are studied. Accurate values of the eigenvalues, eigenfunctions, and radial concentration profiles are found for the dilute system. Criteria are given as to when the homogeneous reaction may be neglected with respect to the heterogeneous reaction and vice versa. It is found that for a certain range of rate parameters well-known limiting solutions apply. Outside this range the new solutions must be used.

External flows of viscoelastic materials: fluid property restrictions on the use of velocity-sensitive probes, Metzner, A. B., and Gianni Astarita, **A.I.Ch.E. Journal, 13,** No. 3, p. 550 (May, 1967).

Key Words: A. Flow-8, 7, Fluids-9, Viscoelastic-0, Non-Newtonian-0, Deborah Number-6, Boundary Layer-7, Velocity-9, Velocity Profiles-9, Measurement-8, 9, Accuracy-8, Pitot Tubes-10, Hot-Wire Anemometry-10, Polymers-9, Heat Transfer-9, 7, Stagnation Point-9.

Abstract: The more pronounced macroscopic features of flows of viscoelastic materials around submerged objects are considered in the light of restrictions imposed on the flow by the Deborah number. It is seen that one major effect is to thicken the boundary layer appreciably in the region of the leading edge or stagnation point of the object in the fluid. The influence of this and other effects on the use of probes for determination of point values of the velocity of viscoelastic fluids is considered in some detail.

Equilibrium stage calculations, Tierney, John W., and Joseph A. Bruno, **A.I.Ch.E. Journal, 13,** No. 3, p. 556 (May, 1967).

Key Words: A. Calculations-8, Temperature-6, 8, Flow Rate-6, 8, Material Balance-7, 8, 9, Compositions-9, Stages-9, Plates-9, Enthalpy Balance-7, 8, Equations-10, Newton-Raphson Method-10, Equilibrium-9, Two-Phase System-9, Multicomponent-0, Columns-10, Distillation-10, Extraction-10, Stripping-10, Digital Computers-10, Matrices-10.

Abstract: Iterative methods for the determination of stage temperatures and interstage flow rates in the equilibrium stage problem are discussed, and the use of the Newton-Raphson method for solution of the systems of simultaneous equations is proposed.

Local and macroscopic transport from a 1.5-in. cylinder in a turbulent air stream, Galloway, T. R., and B. H. Sage, **A.I.Ch.E. Journal, 13,** No. 3, p. 563 (May, 1967).

Key Words: A. Heat Transfer Coefficients-8, 7, Local-0, Macroscopic-0, Cylinder-9, Copper-9, Air-9, Turbulence-6, Reynolds Number-6, Flow-6, Experimental-0, Frossling Number-10.

Abstract: This paper presents results concerning the effect of free-stream turbulence on the local transport from a cylinder. The local and macroscopic thermal transfer coefficients were experimentally investigated for a 1.5-in. copper cylinder located in a transverse flowing turbulent air stream.

Forced and natural convective mass transfer in multicomponent gaseous mixtures, Carlton, Herbert E., and Joseph H. Oxley, **A.I.Ch.E. Journal, 13,** p. 571 (May, 1967).

Key Words: A. Mass Transfer-8, 7, Mixtures-9, Gases-9, Diffusion-8, 7, Diffusivity-8, 7, Transport Properties-8, 7, Convection-7, Composition-6, Flow-6, Reynolds Number-6, Chilton-Colburn Analogy-10, Stefan-Maxwell Equation-10, Iron Carbonyl-1, Iron-2, Nickel Carbonyl-1, Nickel-2, Tungsten Hexafluoride-1, Tungsten-2.

Abstract: The use of the Chilton-Colburn analogy to obtain an effective film thickness over which the Stefan-Maxwell equations can be integrated was confirmed for binary mixtures and found applicable for ternary, quaternary, and presumably higher order mixtures under conditions of nonequimolal counterdiffusion in a differential convective flow system.

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eters which must be supplied as input for the multicomponent programs. The remainder of the book (about two-thirds) is devoted to two appendices. The first gives detailed descriptions of the computer programs, printouts, nomenclature, etc., and the second provides numerical parameters for a variety of components and binary mixtures.

Although multicomponent vapor-liquid equilibrium problems are, in principle, solved once the required number of thermodynamic and stoichiometric equations are written down, the necessary multiple trial-and-error calculations are practical only if carried out by computer. Thus it is highly appropriate for this monograph to treat the thermodynamics of vapor-liquid equilibrium from a sophisticated point of view and at the same time to provide computer programs for the numerical solution of practical problems.

The authors recognize that their work can be modified, extended, and improved. They have, however, provided a very complete and substantial framework upon which to build, and they themselves, if past work is any indication, are likely to be primary architects in any remodeling.

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ERRATUM

Corrections to "A New Gas-Gas Equilibria Prediction Method" by Richard Kaplan (*1*):

The author recently has acquired a copy of Kreglewski's (*2*) original article and finds that the separation into two gas phases was stated to be more probable the greater the difference between the D values of the components, not the D^2 values as was reported by Tsiklis and Maslennikova (*3*) and restated in Kaplan's communication. The prediction method retains its validity, however, since comparisons are made only between binary systems having one component in common; thus the predictions are unaffected whether D or D^2 values are considered.

Also, minus signs were omitted from the final two expressions for E in the corrected van der Waals approach.

NOTATION

D = solubility parameter at the critical point
E = energy of vaporization

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