INFORMATION RETRIEVAL

Forced convection mass transfer: Part IV. Increased mass transfer in an aqueous medium caused by detached cylindrical turbulence promoters in a rectangular channel, Watson, J. S., and David G. Thomas, **AIChE Journal, 13,** No. 4, p. 676 (July, 1967).

Key Words: A. Mass Transfer-9, 8, 7, Ferro-Ferri Cyanide-9, 1, Channel Flow-9, Cylinders-9, 6, Promoters-9, 6, Turbulence-9, 6, Convection-8, 7, Electrochemical-10, Velocity-6, Spacing-6, Laminar-0, Transition-0.

Abstract: Enhanced rates of mass transfer in aqueous systems were studied with an electrochemical technique. Detached turbulence promoters (cylinders supported away from the surface) were shown to cause increases in mass transfer in aqueous systems in a manner similar to that observed in gaseous systems. As in air studies, peaks in the local rate of mass transfer were observed directly beneath the cylinders and a wake effect was observed downstream from the cylinders.

A method of finding simultaneously the values of the heat transfer coefficient, the dispersion coefficient, and the thermal conductivity of the packing in a packed bed of spheres: Part I. Mathematical analysis, Turner, G. A., **AIChE Journal, 13,** No. 4, p. 678 (July, 1967).

Key Words: A. Heat Transfer Coefficient-8, 6, Dispersion Coefficient-8, 6, Thermal Conductivity-8, 6, Packing-9, Packed Bed-9, Spheres-9, Temperature-6, Frequency Response-7, Amplitude -7, 10, Phase Angle-7, 10.

Abstract: The response of a packed bed to a sine wave of temperature in a stream of fluid through it will depend upon the amount of dispersion in the fluid, the resistance to transfer between fluid and solid, and the thermal properties of the solid. A method is presented that allows the effects of these three phenomena on the amplitude and phase angle to be unravelled and hence all their magnitudes to be computed simultaneously. It thus presents a way of determining these three quantities in situations where they were previously obtainable either with great uncertainty or not at all.

Generalized solution of the Tomotika stability analysis for a cylindrical jet, Meister, Bernard J., and George F. Scheele, **AIChE Journal, 13,** No. 4, p. 682 (July,1967).

Key Words: A. Stability-8, Jet-9, Cylindrical-0, Liquids-9, Immiscible-0, Newtonian-0, Tomotika Analysis-10, Drop Size-4, Jet Length-4, Ohnesorge Number-6, Disturbances-7, Wavelength-7, Growth Rate-7.

Abstract: The stability of cylindrical jets in immiscible liquid systems was analyzed by using the low velocity theory of Tomotika. Correlations applicable to all Newtonian liquid-liquid systems are presented for predicting the growth rate and wavelength of the most unstable disturbance.

Limiting relation for the eddy diffusivity close to a wall, Son, Jaime S., and Thomas J. Hanratty, **AIChE Journal, 13,** No. 4, p. 689 (July, 1967).

Key Words: A. Eddy Diffusivity-8, Diffusivity-8, Wall-9, Mass Transfer-8, Pipe-9, Annulus-9, Concentration Profile-8, Shear Stress-8, Flow-9, Turbulent-0.

Abstract: The results of studies on fully developed turbulent flows show that for flow in a pipe or in an annulus the eddy diffusivity for mass close to the wall is described by the following relation:

$$\frac{\epsilon}{\nu} = 0.00032y^{+4}$$

This result is derived from measurements of the effects of the Reynolds number, of the length of the mass transfer section, and of the Schmidt number on the rate of mass transfer.

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gons, etc.); the cell size, direction of fluid flow, and velocity of flow at steady state; or the quantitative effect of the convection on heat transfer and mass transfer rates.

Dynamics of Microbial Cell Populations is presented by H. M. Tsuchiya, A. G. Fredrickson, and R. Aris of the University of Minnesota. It is a comprehensive review of mathematical models for the growth of single cells and cell populations. Some of the models are new; others have been published but are not known generally to bioengineers. Included are batch and flow systems, synchronous and cyclical growth, phase lag, and other topics. Strong reliance on probability theory is evident. Experimental data in the review are scant, and the authors are concerned as to whether the models are realistic. The chapter concludes that someone should carry out experiments to test the predictions.

Samuel Sideman, Israel Institute of Technology, Haifa, Israel, is the author of *Direct Contact Heat Transfer Between Immiscible Liquids.* Theoretical and empirical equations giving the Nusselt number for a drop surrounded by an immiscible liquid are tabulated: sixteen equations for the rigid drop model, and twenty-eight equations for the circulating drop model. Heat transfer studies in vertical liquid-liquid spray columns and in horizontal cocurrent direct-contact exchangers are summarized. A brief section is devoted to the evaporation of drops and the condensation of bubbles surrounded by immiscible liquids. No derivations are given.

Fluid flow and particle behavior in the Reynolds number range of about 0.01 to 10 are discussed by Howard Brenner, written while he was at New York University. *Hydrodynamic Resistance of Particles at Small Reynolds Numbers* surveys over three hundred references. Primarily it is a vast mathematical treatment listing nearly four hundred equations. This advanced treatise grew from the earlier, simpler book co-authored with J. Happel. Much new recent material is given, most of it original with Brenner. Some topics included are screwlike motion, rotating particles, wall effects, nonspherical particles, and interactions between particles.

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Fluid Mechanics, Arthur G. Hansen, Wiley, New York (1967). 531 pages, $9.95.

This is an introductory fluid mechanics text, at a level suitable for third-year engineering students. It provides

INFORMATION RETRIEVAL

Mass transfer from large single bubbles at high Reynolds numbers, Nate, Takayuki, and D. M. Himmelblau, **AIChE Journal, 13,** No. 4, p. 697 (July, 1967).

Key Words: A. Mass Transfer-8, 7, Diffusion-8, 7, Absorption-8, 7, Bubbles-9, Carbon Dioxide-9, Water-5, Mass Transfer Coefficient-8, 7, Flow Rate-6, Reynolds Number-6.

Abstract: Measurements of interphase transfer of carbon dioxide into single bubbles at average film Reynolds numbers of 40 to 300 were made.

Diffusion coefficients of hydrogen and helium in water, Ferrell, R. T., and D. M. Himmelblau, **AIChE Journal, 13,** No. 4, p. 702 (July, 1967).

Key Words: A. Diffusivity-8, 7, Diffusion Coefficient-8, 7, Mass Transfer-8, Hydrogen-9, Helium-9, Water-5, Transport Properties-8, Temperature-6, Absolute Rate Theory-10.

Abstract: Measurements of laminar dispersion in a capillary were used to determine the molecular diffusion coefficients of hydrogen and helium dissolved in water over the temperature range of 10° to 55°C. A statistical analysis of the experimental diffusion coefficients indicated that they could be related to the absolute temperature by a semiempirical correlation. The relation was based on the absolute reaction rate model of liquids.

A new apparatus for liquid phase thermal diffusion, Von Halle, Edward, and S. H. Jury, **AIChE Journal, 13,** No. 4, p. 709 (July, 1967).

Key Words: A. Thermal Diffusion-8, 7, Composition-7, Column-10, Horizontal-0, Forgotten Effect-6, Remixing-6, Efficiency-7, Temperature-6. B. Separation-8, Water-1, 2, Ethyl Alcohol-1, 2, Column-10, Horizontal-10.

Abstract: A horizontal thermal diffusion column is described in which the inefficiencies caused by the forgotten effect and parasitic remixing are avoided. Experimental results obtained on the separation of water-ethyl alcohol mixtures are presented.

The phase and volumetric relations in the helium-*n*-butane system: Part II. Second virial coefficients for helium-*n*-butane mixtures, Jones, Allen E., and Webster B. Kay, **AIChE Journal, 13,** No. 4, p. 720 (July, 1967).

Key Words: A. Second Virial Coefficients-8, *n*-Butane-9, Helium-9, Gas-Gas Equilibrium-8, Phase Equilibrium-8, Binary System-9, Compressibility-10, Isothermal-0.

Abstract: The second virial coefficients of pure *n*-butane and of two mixtures of helium and *n*-butane were determined from isothermal compressibility measurements. The occurrence of the gas-gas equilibrium observed in the helium-*n*-butane system can be qualitatively ascribed to the large differences in the molecular sizes and energies of the two components.

The phase and volumetric relations in the helium-*n*-butane system: Part I. Phase and volumetric behavior of mixtures of low helium concentration, Jones, Allan E., and Webster B. Kay, **AIChE Journal, 13,** No. 4, p. 717 (July, 1967).

Key Words: A. P-V-T Relationships-8, Helium-9, *n*-Butane-9, Gas-Gas Equilibrium-8, Phase Equilibrium-8, Binary System-9, Critical Temperature-8, Critical Pressure-8, Critical Volume-8, Critical Constants-8, Isothermal Retrograde Condensation-8.

Abstract: The P-V-T-x phase relations of helium-*n*-butane system were measured in the region of low helium content. The system exhibits the gas-gas equilibrium. The term gas-gas equilibrium is applied because the critical temperatures of the mixtures are higher than the critical temperature of either component.

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a survey of the physical concepts, experimental findings, and elementary theory of the subject. The topics covered include hydrostatics, integral conservation equations (macroscopic balances), differential conservation equations, and empirical methods of flow analysis, all for pure fluids. There are numerous examples, as well as review questions and problems at the end of each chapter.

The novelty claimed for the text is the provision of conservation equations for deformable control volumes (systems) with accelerating reference frames. These techniques have actually been demonstrated in other fluid mechanics texts; however the formal presentation given by Hansen will encourage their use.

The reviewer could find no mention of the mechanical energy balance. This important equation is included only in special forms obtained from the total energy balance, or from the Euler equation of inviscid flow. Thus, the student is not made aware of the availability of two separate and independent energy balances, both of which are needed to solve the majority of nonisothermal design problems.

The first section of the book contains a number of errors, such as the statement that stress is a vector (page 10), the use of inexact differential signs in differentiating state functions (page 30), the inappropriate use of a classical-mechanical expression for C_p/C_v (page 34), and the suggestion that the internal energy becomes a path function in the presence of electric fields, magnetic fields, or surface energy effects (page 28). In subsequent printings these errors will undoubtedly be corrected.

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Geometric Programming, Duffin, R. J., Peterson, E. L., and Zener, C., John Wiley, New York (1967). 278 pages.

So closely is the technique of *Geometric Programming* associated with the names of Duffin, Peterson, and Zener that had the authors not coined such an apt title, there is a fair chance that it would be called the DPZ method (or something equivalent). In view of this, it comes not at all as a surprise that this team has written a fine book on the subject.

The treatment starts from scratch so far as geometric programming is concerned, but does assume an acquaintance on the part of the reader with the arguments associated with linear (matrix) algebra, Lagrange functions, and linear programming. In fact a good review of the latter is presented in Chap-