**A theoretical analysis of some interrelationships and mechanisms of heat and mass transfer in dispersions,** Gal-Or, Benjamin, and Vernon Walatka, **AIChE Journal, 13,** No. 4, p. 650 (July, 1967).

**Key Words:** A. Heat Transfer-8, 7, Mass Transfer-8, 7, Dispersions-9, Holdup-6, Residence Time-6, Surface Active Agents-6, Viscosity-6, Particle Size-6.

**Abstract:** Some of the main interrelationships that govern heat and mass transfer in dispersions are considered. Qualitative and quantitative analyses of the effects of holdup, average residence time, surface active agents, viscosity, and average particle size on transfer rates are made.

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**On a tracer method for evaluating catalytic kinetic data,** Kuo, James C. W., and James Wei, **AIChE Journal, 13,** No. 4, p. 657 (July, 1967).

**Key Words:** A. Reaction Kinetics-8, Kinetics-8, Catalytic Reactions-9, Heterogeneous-0, Radioactive Tracers-10, Monomolecular Reactions-9, Isothermal-0, Divergence Theorem-10, Diffusivity-8, Reactant-9, Catalyst-9.

**Abstract:** This paper presents theoretical studies of a method of using a radioactive tracer technique to evaluate the kinetic data of heterogeneous catalytic reactions that are coupled with a Knudsen type of pore diffusion. By superimposing a transient radioactive tracer response over the steady state concentration profile in the catalyst particle, one can establish an implicit relation between the total amount of radioactive components diffused out of the particle and the kinetic data of the reaction system.

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**A correlation for pressure drop in two-phase cocurrent flow in packed beds,** Sweeney, D. E., **AIChE Journal, 13,** No. 4, p. 663 (July, 1967).

**Key Words:** A. Pressure Drop-8, 7, Flow-9, Two-Phase-0, Cocurrent-0, Packed Beds-9, Single Phase-10, Gas Phase-5, Liquid Phase-5, Density-6, Viscosity-6, Velocity-6.

**Abstract:** A correlation has been developed from considerations of single-phase flow behavior to predict pressure drop across packed beds for two-phase cocurrent flow. The correlation does not require one of the assumptions made in previous correlations. The only empiricism involved in the use of this correlation is that required in correlating single-phase pressure drops through packed beds.

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**Transition and film boiling from horizontal strips,** Kesselring, R. C., P. H. Rosche, and S. G. Bankoff, **AIChE Journal, 13,** No. 4, p. 669 (July, 1967).

**Key Words:** A. Heat Flux-8, 7, Fluctuations-8, Temperature-8, 9, Surface-8, Transition Boiling-8, 9, Film Boiling-8, 9, Freon 113-9, Strips-9, 10, Stainless Steel-9, Horizontal-0, Width-6.

**Abstract:** Measurements of heat flux and surface temperature fluctuations are reported for transition and film boiling of Freon 113 from flattened horizontal stainless steel tubes. The strip width is found to have a definite effect upon the heat flux in the film boiling regime.

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dence upon the impeller speed should be expected.

The summary of all the different blending equations requires a great deal of perserverance and experience to be useful. One of the conclusions, that the power per unit volume required for blending increases with the square of the tank diameter, is not experienced in practice.

Chapter 5 on heat transfer is very complete. It still leaves the reader with many choices for exponents and constants.

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**Advances in Chemical Engineering,** Vol. 6, Thomas B. Drew, John W. Hoopes, Jr., and Theodore Vermeulen, Ed., Academic Press, New York (1966). 455 pages, $17.50.

A well-written treatment of *Diffusion-Controlled Bubble Growth* is presented by S. G. Bankoff of Northwestern University. Specifically excluded are cavitation bubbles and bubbles formed by gas injection through submerged orifices. Included are bubbles formed during boiling of pure or two-component liquids, gas bubbles formed by dissolution from supersaturated liquid solutions, and bubbles formed during electrolysis. The mathematical treatments are thorough and up-to-date. A good selection of experimental data is given. The author concludes that the theory for the growth of isolated bubbles is well established; important future advances must come in the experimental area.

"The convective flow which occurs spontaneously in evaporating liquids is one of the most spectacular performances that nature has hidden from our view." Thus begins *Evaporative Convection,* written by John C. Berg, Andreas Acrivos, and Michel Boudart while at the University of California in Berkeley. This review is a case study beginning with the theoretical work of Marangoni (1870) and the experiments of Thomson (1882) and Benard (1900). Natural convection driven by both density differences and surface tension differences is considered. The fluid layers are thin enough for the depth to be important. A good selection of photographs illustrates the various circulation patterns, and the specialized optical techniques are described. The mathematical derivations are summarized. The main problem today is to handle mathematically the nonlinear aspects of the differential equations. Until then it is not possible to state what structure exists at steady state (squares, hexa-

**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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*(Continued from page 627)*

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