INFORMATION RETRIEVAL*

Diffusion in pulsating flow in a distensible conduit, Fagela-Alabastro, Estrella B., and J. D. Hellums, **AIChE Journal, 15,** No. 6, p. 803 (November, 1969).

Key Words: A. Mass Transfer-7, 8, Interphase-0, Flux-7, 8, Diffusion-7, 8, Flow-9, Laminar-0, Pulsating-0, Tube-6, 9, Distensible-0, Expandable-0, Pressure-6, Wave-6, Frequency-6.

Abstract: An earlier study on interphase mass transfer in pulsating laminar flow has been extended to the case of a distensible tube. The physical situation studied corresponds to developed flow in a long tube with a traveling pressure wave of small amplitude impressed on the steady flow. The tube wall is free to expand radially. Asymptotic solutions are developed for large and small values of the frequency parameter. The interphase flux is much greater in distensible conduits than in the corresponding case in rigid conduits.

A comparison between rheological data for polymer melts and the Spriggs four-constant viscoelastic model, Denson, C. D., W. M. Prest, Jr., and J. M. O'Reilly, **AIChE Journal,** 15, No. 6, p. 809 (November, 1969).

Key Words: A. Rheology-8, Physical Properties-8, Polymers-9, Polymer Melts-9, Spriggs Model-10, Viscosity-8, Elasticity-8, Mathematical Model-10, Weissenberg Rheogoniometer-10.

Abstract: An experimental and analytical study was made to determine how well the material functions derived from the Spriggs four-constant viscoelastic model could describe the rheological properties of polymer melts. Viscosity and elasticity of selected polymer melts were experimentally determined in the rotational and oscillatory modes by using a Weissenberg rheogoniometer. It was found that the model provides a good description of the rheological data for polymer melts and that some of the model parameters depend upon the molecular characteristics of the polymer.

Flow properties of suspensions with high solids concentration, Gay, E. C., P. A. Nelson, and W. P. Armstrong, **AIChE Journal, 15,** No. 6, p. 815 (November, 1969).

Key Words: A. Flow-7, 8, Suspensions-9, Physical Properties-6, Viscosity-6, Density-6, Size-6, Particles-9, Solids-9, Liquids-9, Pressure Drop-6, Design-4, Pipelines-2, Nickel-9, Alumina-9, Copper-9, Glass-9, Sodium-5, Xylene-5, Glycerine-5.

Abstract: Equations were developed for evaluating the laminar flow behavior of high solids suspensions from the physical properties of the liquid and solid components. A technique was developed for calculating suspension flow rates as a function of pressure drop. The technique is applicable to the design of pipelines.

A numerical solution for the single-screw extrusion of a polymer melt, Dyer, David F., **AIChE Journal, 15,** No. 6, p. 823 (November, 1969).

Key Words: A. Extrusion-8, 9, Polymers-9, Melts-9, Non-Newtonian-0, Screw-10, Mathematical Model-8, Navier-Stokes Equations-10, Numerical Analysis-10, Prediction-10, Vorticity-2, Stream-Function-2, Velocity-2, Swirl-9, Energy-2, Internal-0, Viscosity-2, Rate-2, Shear-9.

Abstract: A general numerical-analysis procedure is presented for the screw extrusion of a non-Newtonian material. The full Navier-Stokes energy and continuity equations are used in the numerical procedure. The procedure allows the prediction of vorticity over any cross section of a groove containing plastic. Calculations for the mass extrusion rate and power consumption (shear rate) for the screw extruder are also given.

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Thermal Physics, Edward A. Desloge, Holt Rinehart and Winston, New York (1968). 363 pages.

An overview of the author's presentation of thermodynamic fundamentals is clearly expressed in the preface of his text: "The title **Thermal Physics,** rather than the more customary title *Thermodynamics,* has been chosen for two reasons: first to emphasize the fact that the book has been written from the point of view of a physicist rather than that of a chemist or an engineer, and second because much of thermal physics is concerned with static rather than dynamic states of matter." "I have directed my attention primarily to the macroscopic aspects of thermal physics, but, in an attempt to avoid isolating the subject from the rest of physics, I have formulated the basic principles in terms of a set of postulates that are closely related to the microscopic approach, rather than in terms of the more immediately expeimental laws of thermodynamics. . . ."

This book, ". . . designed as a text for a one-quarter, one-semester, or two-quarter course at the junior or senior level", is comprised of seven major parts of 288 pages arrange in 34 chapters. One appendix consists of a review of the calculus of many variables. Herein topics such as Jacobians, Legendre transformation, homogeneous functions, etc., are nicely presented. On the other hand, only a sparse collection of thermodynamic properties—specific heat data for gases, liquids, and solids, standard state formation properties, and phase diagrams for water—is given in another appendix. Finally, the text concludes with a generous bibliography of classic and current thermodynamics texts, as well as answers to many of the problems.

In part one, the basic concepts of thermodynamics are presented in nine chapters. Essentially, these basic concepts are stated in four postulates: The first pertains to the internal energy; the second is a statement of the state principle for simple one component systems. The third postulate decrees the existence of entropy—as an extensive property—as well as an entropy-maximum criterion for equilibrium. The fourth and last postulate is a form of the third law of thermodynamics. Before each postulate is stated formally, an attempt is made to motivate the postulate by physical, mostly microscopic discussions. However, the author's claims notwithstanding, the postulates are not consistently well motivated.

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INFORMATION RETRIEVAL

(Continued from page 948)

Some general equations for reverse osmosis process design, Ohya, Haruhiko, and S. Sourirajan, **AIChE Journal, 15,** No. 6, p. 829 (November, 1969).

Key Words: A. Design-8, Processes-2, Batch-Wise-0, Flow-9, Reverse Osmosis-8, 10, Membranes-10, Cellulose Acetate-10, Concentration-6, 7, Solution-9, Product-9, Volume-7, Velocity-7, Separation-7, Desalination-4, Time-6.

Abstract: A generalized approach to reverse osmosis process design is presented for solution-membrane-operating systems characterized by dimensionless parameters defined in terms of the pure water permeability constant, solute transport parameter, mass transfer coefficient on the high pressure side of the membrane, and the properties of the solution. Analytical expressions are derived, in terms of dimensionless quantities, for the change of volume of solution, concentration of the bulk solution and that of the concentrated boundary solution on the high pressure side of the membrane, the change in the permeating velocity of solvent water through the membrane, solute separation, and the other related quantities, at any instance, as a function of concentration of the product solution on the atmospheric pressure side of the membrane, or time from the start of the operation for reverse osmosis systems.

Static pressure and velocity profiles in swirling incompressible tube flow, King, M. K., R. R. Rothfus, and R. I. Kermode, **AIChE Journal, 15,** No. 6, p. 837 (November, 1969).

Key Words: A. Swirling Flow-8, Pressure Profiles-8, Velocity Profiles-8, Reversing Flow-8, Incompressible-0, Large L/D-10, Axisymmetric-0, Turbulent-0, Navier-Stokes-10, Dimensional Analysis-10, Vortex-7.

Abstract: The phenomenon of reversing axial flow in swirling incompressible flow through a tube has been investigated experimentally. The study was carried out in a 2 in. I.D. test section of plexiglass tubing 10 ft. in length. The swirl was introduced by injection of the total fluid stream through two symmetric tangential inlets perpendicular to the tube. Measurements have been made with specially constructed stagnation and static pressure probes.

Velocity and pressure profiles obtained for tests conducted at four Reynold's Numbers in one fixed geometrical configuration are presented and discussed in general terms. Swirl decay rate is characterized in a plot of weighted tangential velocity/inlet velocity ratio vs. distance along the test section from the inlets. A model presented by a previous investigator to explain the flow reversal phenomenon is discussed in the light of present work. Finally the data is used in an order-of-magnitude analysis to reduce the turbulent Navier-Stokes Equation describing the flow to simpler (though still indeterminate) form.

Scale-up criteria for stirred tank reactors, Evangelista, J. J., Stanley Katz, and Reuel Shinnar, **AIChE Journal, 15,** No. 6, p. 843 (November, 1969).

Key Words: A. Design-8, Scale Up-8, Reactors-2, Stirred Tank Reactors-2, Time-6, Mixing-6, 9, Reaction Rate-7, Mathematical Model-10, Autothermic Reactions-4, Polymerization-4, Crystallization-4.

Abstract: A method is derived for the design of stirred tank reactors for homogeneous reactions. A simple mixing model is used to compute the effects of finite mixing time on complex chemical reactions. Methods are derived to compute the average outlet concentration for complex systems such as autothermic reactions, polymerization, crystallization, etc.

The dynamic modeling, stability, and control of a continuous stirred tank chemical reactor, Ramirez, W. Fred, and Brian A. Turner, **AIChE Journal, 15,** No. 6, p. 853 (November, 1969).

Key Words: A. Dynamics-8, 9, Control-8, 9, Continuous Stirred Tank Reactor-9, Reactor-9, Stability-8, 9, Mathematical Model-8, Hydrogen Peroxide-1, 2, Sodium Hydroxide-10, Catalyst-10, Water-2.

Abstract: The purpose of this investigation was to study both experimentally and theoretically the dynamics and control of a continuous stirred tank reactor. The reaction studied was first order and homogeneously catalyzed. The reactant, hydrogen peroxide, and the catalyst, sodium hydroxide, were fed into the reactor, while the product, water, and the unreacted peroxide were continuously removed.

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In theory, the logical development should be completely contained in the definitions, postulates, and theorems (plus corollaries). But this is not the case; especially, several crucial definitions are absent from the formal structure (for example, property, state, work). Furthermore, when one looks to the informal discussions, to fill these voids, it is usually found to be complicated if not impossible to do so without introducing circularity.

Also, although in theory the definitions and postulates selected by an author are his prerogative, one goal of the selection should be an extensive practical domain for the theory. The reviewers believe that Desloge's choice of postulates and definitions overly constrain the domain of his approach. And, more importantly, the broader domain is often hidden from the reader's view. One example is the exclusion of negative absolute temperatures, an omission necessitated by the author's definitions of *system* and/or *equilibrium.* More serious—though more excusable, at this stage in the historical development of thermodynamics—is the failure to cover the domain of nonequilibrium states (except for the traditional steady states).

In summary, the presentation of fundamentals in part one of the text often seems to lack coherence, and could leave the student with misconceptions. However, this is not rare in thermodynamics texts, and the mode for presenting the fundamentals might well be considered, especially today, a matter of taste. Some of our criticisms may reflect a preference for alternative modes. For the succeeding parts of the book, our specific comments are more favorable.

Part two of the text, entitled *Methods of Thermodynamics,* is a four chapter sequence of 30 pages devoted to thermodynamic potentials, complete and incomplete functions of state, and the methodology of computing properties from experimentally derived complementary functions of state. Some consequences of the basic principles of thermodynamics are covered in part three. These include criteria and stability of equilibrium, phase transitions (latent heat, Clapeyron equation), and a very brief treatment of power-producing and absorbing systems. Here the reviewers find the discussion of availability too shallow. No mention of availability transports is

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INFORMATION RETRIEVAL

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The kinetics of condensation polymerization, Secor, R. M., **AIChE Journal, 15,** No. 6, p. 861 (November, 1969).

Key Words: A. Desorption-8, Kinetics-8, Diffusion-6, Finite-Differences-10, Mass Transfer-8, Penetration Theory-8, 10, Condensation-8, 9, Polymerization-7, 8, 9, Reaction Rate-7, 8, Mathematical Model-10.

Abstract: The final stages of condensation polymerization are characterized by a rapid rise in molecular weight as the condensation product is formed and diffuses out of the polymer. The process occurring is one of desorption accompanied by a chemical reaction. The penetration theory equations for a generalized condensation polymerization reaction have been solved, and some solutions are presented. The penetration theory solution, obtained by finite-difference computations, is compared with an analytical solution for the special case of no diffusional resistance.

Single-phase flow through porous media, Slattery, John C., **AIChE Journal, 15,** No. 6, p. 866 (November, 1969).

Key Words: A. Anisotropic-0, Darcy's Law-8, Isotropic-0, Noll-0, Nonoriented-0, Oriented-0, Permeability-10, Porous Media-8, Simple Fluid-10, Viscoelastic-0, Volume-Averaging-8.

Abstract: The local volume average of the equation of motion is taken for an incompressible fluid flowing through a porous structure under conditions such that inertial effects may be neglected. The result has two terms beyond a pressure gradient. For a Newtonian fluid with a constant viscosity, the divergence of the local volume-averaged extra stress tensor is proportional to the Laplacian of the averaged velocity vector.

Combined forced and free convective diffusion in vertical semipermeable parallel plate ducts, Ramanadhan, Krishnan, and William N. Gill, **AIChE Journal, 15,** No. 6, p. 872 (November, 1969).

Key Words: A. Purification-7, 8, 9, Desalination-7, 8, 9, Water-1, 2, Brine-1, Salt-1, 9, Reverse Osmosis-8, 10, Mathematical Analysis-8, Polarization-6, 9, Membrane-10, Mass Transfer-8, Diffusion-8, Series Expansion-10, Free Convection-0, 8, Forced Convection-0, 8, Vertical Conduits-9.

Abstract: The effect of natural convection on polarization and flow patterns in liquid phase convective diffusion in a vertical duct with semipermeable membrane walls has been investigated theoretically. It is found that at low flow rates, gravitational fields can play a significant role in distorting the velocity profiles, and thereby they affect the transition from laminar to turbulent flow. Natural convection also significantly affects mass transfer rates and therefore the extent of polarization at low flow rates. Results are presented for both momentum and mass transfer in upward and downward flows for different wall Peclet numbers. The hydrodynamic stability of the system also has been investigated, and critical values of the buoyancy parameters are reported. Also, these results enable one to estimate when natural convection may create errors in membrane testing systems.

The analysis and results are of practical interest in reverse osmosis and other membrane separation processes. The more productive the system, the more likely it will be that buoyancy effects are important.

Laminar-nonlaminar transition for non-Newtonian flow in annuli, McEachern, Donald W., **AIChE Journal, 15,** No. 6, p. 885 (November, 1969).

Key Words: A. Flow-8, Fluid Flow-8, Estimating-8, Predicting-8, Transition-8, Laminar-0, Turbulent-0, Hanks' Stability Criterion-9, Validity-9, 8, Liquids-9, Non-Newtonian-0, Viscous-0, Viscoelastic-0, Polymer-Solutions-9, 4, Flow Rate-6, Pressure Drop-7, Annulus-9, Conduits-9, Annular-0, Concentric-0.

Abstract: Experimental results on the laminar-nonlaminar transition of polymer solutions in axial, isothermal flow in annuli are presented. These data on transition in annuli are compared with predictions made by using Hanks' transition criterion where only viscous effects are considered and where viscous effects are considered and elastic effects accounted for approximately. Predictions were sufficiently accurate to demonstrate technique is applicable.

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found. And, hence, it is not possible to compare the effectiveness of real processes with their ideal (say reversible) counterparts. At least for the engineer, such comparisons are one of the most important applications of thermodynamics.

If, as we believe, part one is the major weakness of this text, then we also believe the last four parts to be its strength, notably part five. Following part four—a brief but adequate treatment of the ideal gas, the van der Waals equation, including phase transformation, a short discussion of liquids and solids, and radiation—the author gives a nice treatment of multicomponent systems. He begins by expanding his four basic postulates to include the increased numbers of independent variables. He continues with chemical reactions. Here the reader will find a good treatment of standard states, heat of reaction, and reaction-equilibrium equations, including activities and the so-called law of mass action. The author couples this nicely to ideal and real gas mixtures, thereby expressing the law of mass action for both ideal and real multicomponent reacting mixtures. The presentation of gaseous reaction equilibrium is concluded with a discussion of the equilibrium constant and its temperature dependence. We believe the treatment will obviate a potential source of difficulty for the student.

The author treats the thermodynamics of solutions rather briefly. In the main he restricts analysis to dilute solutions only, for which freezing point depression and boiling point elevation are examined.

Part six is a brief coverage of a few special topics such as elastic filaments and magnetic and dielectric systems. The body of the text ends with considerations of the thermodynamics of the steady state. Entropy production, the phenomenological equations, and the Onsager theorem are treated, lead-

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ERRATA

In the paper *Dimensional Considerations in Viscoelastic Flows*, by John C. Slattery [**14**, p. 516 (1968)], Equations (15) and (16) should read as follows:

$$(\mathbf{T} + p\mathbf{I})^* = \sum_{q=1}^{n} (N_{Wi})^q$$

$$\mathbf{G}_q{}^*(\mathbf{A}_1{}^*, \mathbf{A}_2{}^*, \ldots, \mathbf{A}_n{}^*) + 0(N_{Wi}^{n+1}) \quad (15)$$

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ing to a brief presentation of thermoelectric and thermomagnetic effects.

In this text we do not find a new or better logical presentation of thermodynamics. On the contrary, much is borrowed, and in the process of reformulation and simplification the foundation is sometimes distorted and weakened. We believe the student will find it difficult to separate motivation and "it can be shown . . ." statements from the postulates. Once the reader gets beyond part one, he should feel comfortable with the remainder, and, in fact, be pleased with much of the author's presentation. Nevertheless, for the teacher inclined toward this mode of presentation, we must recommend the predecessor. Callen's *Thermodynamics*, which, as the author acknowledges, serves as the pattern for the present book.

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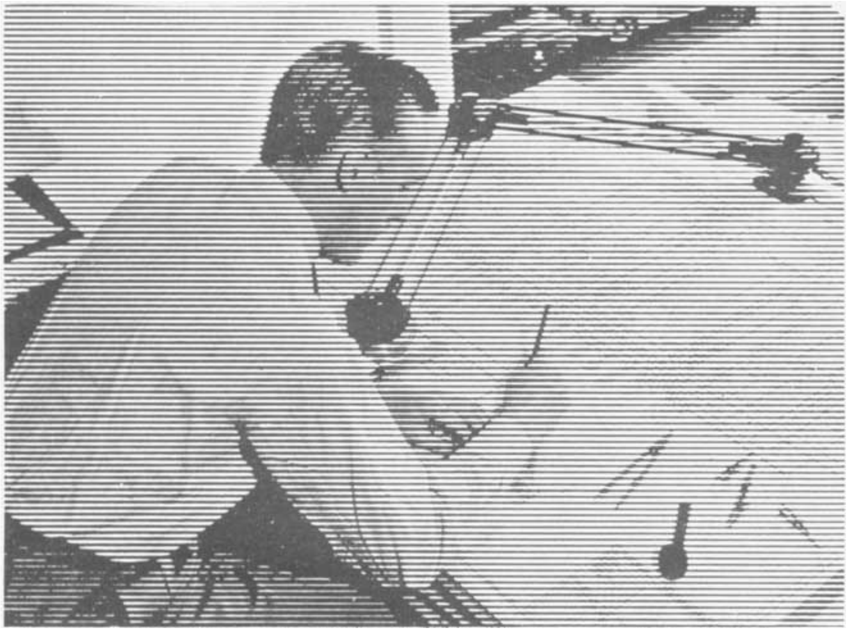

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