

gate apparatus, servo motor, thrust and guide bearings. Cavitation resistance depends on the correct selection of runner blade geometry, accuracy of manufacture and machining quality. Cavitation erosion and associated vibration problems are detailed. A number of protective coatings were tested and results are reported. It is concluded overall that the design is correct and the pump-turbine has operated reliably, however, some design improvements to the end seals are suggested.

Information-analytical support of reliable operation of power facilities: computer program for hydraulic calculation of structures for controlling aeration of the flow on spillways

Semenkov V.M. & Saranchev V.O., *Hydrotechnical Construction*, 1996, 30/5 (234-242). In English.

A computer program is presented for calculating the hydraulic performance of structures and controlling aeration of spillway flow. Cavitation occurrence, cavitation erosion of the spillway surface and aeration of the flow are important in improving the design of a high-head spillway. The program can be used to optimize the design parameters of a system for anticavitation protection of a high-head spillway which consists of a sequence of aerators.

Predicting the reliability of runner pits of diagonal-flow and adjustable-blade turbines

Dzyubanov E.M., Dmitriev N.Yu., Klimovich V.I., Levin S.M. & Shtil'man V.B., *Hydrotechnical Construction*, 1996, 30/2 (59-68). In English.

An analysis of documents and on-site inspections at several hydrostations has revealed many causes of hydro-power equipment failure, especially related to runner pit damages. The principal causes of damage are discussed: fatigue cracking with cavitation erosion, cavitation-erosion damage resulting in cracking, and fatigue failure due to defects in metal, manufacturing and assembly. Factors influencing this damage and the reliability of the runner pit are examined.

Titanium - first choice for desalination plant heat exchangers

McCue D.M. & Peacock D.K., *Industrial Water Treatment*, 1996, 28/4 (44-52). In English.

The advantages of titanium for desalination plant heat exchangers are discussed. Problems of corrosion and erosion in heat exchanger tubes are considered. The replacement of heat exchanger internals with prefabricated all titanium modules is described. The corrosion resistance of titanium is discussed particularly to microbiologically influenced corrosion, pitting, erosion and cavitation, stress corrosion cracking, fatigue, fouling, crevice corrosion, galvanic corrosion and corrosion fatigue. The economics of corrosion prevention in different plant layouts are considered.

Flow characteristics of sage and peppermint leaves

Martinov M., Babic M. & Adamovic D., *International Agrophysics*, 1996, 10/4 (289-293). In English.

The separation of the desirable parts of a medicinal plant in air flow is a widely applied procedure. Therefore there has been established the goal to measure flow characteristics of sage (*Salvia officinalis* L.) and peppermint (*Mentha piperita* L.) leaves. Leaves were picked from stem and classified according to dimensions in four (sage) and three (peppermint) fractions. The flow characteristics defined by the air velocity of fluidization of a material layer show the possibility of separating sage leaves and stems, due to a significant difference in velocity values, 1.75 m s^{-1} maximum for leaves and 3.35 m s^{-1} for stems. Due the difference in flow characteristics the separation of different peppermint leaves fractions is also possible.

An experimental investigation of critical flow rates of subcooled water through short pipes with small diameters

Moon-Hyun Chun, Choon-Hyung Park & Jee-Won Park, *International Communications in Heat and Mass Transfer*, 1996, 23/8 (1053-1064). In English.

Critical two-phase flow rates of subcooled water through short pipes ($L < 400 \text{ mm}$) with small diameters ($D < 7.15 \text{ mm}$) have been experimentally investigated for wide ranges of subcooling ($0-199^\circ\text{C}$) and pressure ($0.5-2.0 \text{ MPa}$). Experimental results that show effects of various parameters on subcooled critical two-phase flow rates are presented in the form of graphs such as the dimensionless mass flux versus the dimensionless subcooling curve. An empirical correlation expressed in terms of a dimensionless subcooling is also obtained for subcooled two-phase flow rates through present test sections. Comparisons between the mass fluxes calculated by present correlation and a total of 679 selected experimental data points of 9 different investigators show that the agreement is fairly good except for very subcooling data obtained from small L/D (less than 10) orifices.

Heat transfer from a horizontal tube in a magnetofluidized bed

Saxena S.C. & Dewan S.S., *International Communications in Heat and Mass Transfer*, 1996, 23/5 (655-664). In English.

Heat transfer coefficient values are reported for a horizontal Nylon 24.1 mm diameter heated probe immersed in an iron shot bed of $1511 \mu\text{m}$ average diameter and exposed to an external uniform magnetic field collinear with the fluidizing air velocity. Total and local heat transfer coefficients are measured at different axial and angular positions over a range of air velocity and magnetic-field intensity values. The bed is also characterized by its hydrodynamic properties, viz., minimum fluidization and bubbling velocities and mean bed voidage.

Analysis of influence of physical parameters on vapor-liquid flow behavior up to dryout in a heat-generating porous medium

Kim S., *International Communications in Heat and Mass Transfer*, 1996, 23/8 (1097-1107). In English.

In the present work the influence of various physical characteristics on the two-phase flow behavior in a self-heated porous medium has been studied using a numerical model, that is, the effects of heat generation, rate of porosity, of particle size, and of system pressure on the dryout process. To analyze the effect of these characteristics, the variation of both liquid volumetric fraction and liquid axial velocity is evaluated at the steady state or

at the onset of a first boiled-out region. The analysis of computational results indicate that a qualitative tendency exists between the characteristics such as heat generation rate, porosity, effective particle diameter and the temporal development of the liquid volumetric fraction field up to dryout.

Two phase thermalhydraulic code used for fast transient calculations

Prah M., Feretic D. & Grgic D., *International Journal for Engineering Modelling*, 1996, 9/1-4 (21-26). In English.

The thermalhydraulic model was developed as a base for a fast running computer code for the purpose of a nuclear power plant primary system simulation. The model is based on the drift flux theory and integrated momentum equation. It is a nonhomogeneous four-equation model of a two-phase flow. On the basis of the developed theoretical model, the computer code in FORTRAN 77 for PC 386/486 compatible computers was prepared. The results of simulation are quite good and the accuracy of the program for selected test cases is comparable to the accuracy of RELAP5/mod2 computer code with CPU time reduction.

The analysis of nonlinear internal wave induced by arbitrary pressure distribution in a stratified flow

Chin-Hwa Kong & Chieh-Yao Chang, *International Journal for Engineering Modelling*, 1996, 9/1-4 (11-20). In English.

Nonlinear internal waves induced by arbitrary pressure loads in a stratified flow are treated, and the analytical solutions are given. The analytical solutions are supplied by applying Rayleigh and Lamb methods to linear waves on the free surface with infinite depth. It is shown that for a stratified-flow category, a number of differences are influenced by interfacial Froude numbers between the two methods. These variances derived from the Froude numbers are interpreted physically. The purpose of this study is to analyze the effects of the nonlinearity, to compare the different results derived from different pressure distribution functions by the above two analytical methods and to develop the appropriate model which is capable of solving the similar problem under any other conditions.

Numerical prediction of two-phase flow in bubble columns

Boisson N. & Malin M.R., *International Journal for Numerical Methods in Fluids*, 1996, 23/12 (1289-1310). In English.

A numerical model is described for the prediction of turbulent continuum equations for two-phase gas-liquid flows in bubble columns. The mathematical formulation is based on the solution of each phase. The two-phase model incorporates interfacial models of momentum transfer to account for the effects of virtual mass, lift, drag and pressure discontinuities at the gas-liquid interface. Turbulence is represented by means of a two-equation $k-\epsilon$ model modified to account for bubble-induced turbulence production.

A multiphase mixture model for multiphase, multicomponent transport in capillary porous media - I. Model development

Wang C.Y. & Cheng P., *International Journal of Heat and Mass Transfer*, 1996, 39/17 (3607-3618). In English.

A new model for multiphase, multicomponent transport in capillary porous media is developed, in which the multiple phases are considered as constituents of a multiphase mixture. This multiphase mixture model consists only of the conservation equations for the multiphase mixture and is derived from the classic multiphase flow formulation without making any approximations. In addition, algebraic relations are found which can be used to back out the individual phase flow fields from the mixture velocity in a post-processing fashion.

New low-Reynolds-number $k-\epsilon$ model including damping effect due to buoyancy in a stratified flow field

Murakami S., Kato S., Chikamoto T., Laurence D. & Blay D., *International Journal of Heat and Mass Transfer*, 1996, 39/16 (3483-3496). In English.

A new $k-\epsilon$ model which includes damping effect on vertical turbulent transport due to thermal stratification is proposed. The proposed model was tested by application to two kinds of two-dimensional thermally stratified flow fields. One is a high-Reynolds-number open channel flow, and the other is a low-Reynolds-number flow-field within an enclosure. The new model also includes low-Reynolds-number treatment which is effective not only in the vicinity of the wall, but also apart from the wall.

A model for slurry rheology

Shi F.N. & Napier-Munn T.J., *International Journal of Mineral Processing*, 1996, 47/1-2 (103-123). In English.

A semi-empirical model has been developed to predict slurry rheology from easily-measured slurry properties. The model demonstrates the complex influence of these properties on rheology, and also permits rheological information to be predicted in cases where it cannot be measured. It is intended for use with slurries commonly encountered in mineral processing. The model has been applied to 127 sets of Debex viscometer measurements of a variety of slurries totalling more than 1200 data points, with good agreement between the predicted and the measured data. The separate effects of solids volume fraction and particle size on slurry rheological nature, simulated using the model and turbulence-corrected by the TC curve procedure, are demonstrated graphically. The influence of various factors of slurry rheology is discussed, and it is shown that a single slurry can exhibit many different rheological natures, depending only on the concentration and size distribution of the solids.

Measuring the rheology of slurries using an on-line viscometer

Shi F.N. & Napier-Munn T.J., *International Journal of Mineral Processing*, 1996, 47/3-4 (153-176). In English.

This paper presents a new procedure for obtaining a full shear rate-shear stress flow curve for unstable slurries using the single bobbin Debex on-line viscometer. It is based on the use of a calibration algorithm which incorporates a correction for turbulent flow in the measurement vessel. It is shown that torqueoc efficient data from a variety of Newtonian fluids and non-Newtonian slurries fall on a single curve, and it is suggested that this calibration curve (the 'TC curve') is characteristic for a particular instrument configuration. In principle, it can