Two Phase Flow Patterns Pressure Drop And Heat Transfer

This volume covers the modern developments in boiling heat transfer and two-phase flow, and is intended to provide industrial, government and academic researchers with state-of-the-art research findings in the area of multiphase flow and heat transfer technology. Special attention is given to technology transfer, indicating how recent significant results may be used for practical applications. The chapters give detailed technical material that will be useful to engineers and scientists who work in the field of multiphase flow and heat transfer. The authors of all chapters are members of the CMR at Rensselaer, a research centre specializing in the state-of-the-art in multiphase science.

Annular Two-Phase Flow presents the wide range of industrial applications of annular two-phase flow regimes. This book discusses the fluid dynamics and heat transfer aspects of the flow pattern. Organized into 12 chapters, this book begins with an overview of the classification of the various types of interface distribution observed in practice. This text then examines the various regimes of two-phase flow with emphasis on the regions of occurrence of the annular flow regime. Other chapters consider the single momentum and energy balances, which illustrate the differences and analogies between single- and two-phase flows. This book discusses as well the simple modes for annular flow with consideration to the calculation of the profile of shear stress in the liquid film. The final chapter deals with the techniques that are developed for the measurement of flow pattern, entrainment, and film thickness. This book is a valuable resource for chemical engineers.

Flow Patterns and Pressure Drop in Two-phase Two-liquid Flow

an investigation of holdup, pressure drop and flow pattern in a pipe at various inclinations

Studies of Two-Phase Flow Dynamics and Heat Transfer at Reduced Gravity Conditions

Transport Phenomena in Multiphase Systems

Pressure Drop and Heat Transfer in the Two-phase Flow of Freon-12

The book provides design engineers an elemental understanding of the variables that influence pressure drop and heat transfer in plain and micro-fin tubes to thermal systems using liquid single-phase flow in different industrial applications. It also provides design engineers using gas-liquid, two-phase flow in different industrial applications the necessary fundamentals of the two-phase flow variables. The author and his colleagues were the first to determine experimentally the very important relationship between inlet geometry and transition. On the basis of their results, they developed practical and easy to use correlations for the isothermal and non-isothermal friction factor (pressure drop) and heat transfer coefficient (Nusselt number) in the transition region as well as the laminar and turbulent flow regions for different inlet configurations and fin geometry. This work presented herein provides the thermal systems design engineer the necessary design tools. The author further presents a succinct review of the flow patterns, void fraction, pressure drop and non-boiling heat transfer phenomenon and recommends some of the well scrutinized modeling techniques.

The aim of the two-set series is to present a very detailed and up-to-date reference for researchers and practicing engineers in the fields of mechanical, refrigeration, chemical, nuclear and electronics engineering on the important topic of two-phase heat transfer and two-phase flow. The scope of the first set of 4 volumes presents the fundamentals of the two-phase flows and heat transfer mechanisms, and describes in detail the most important prediction methods, while the scope of the second set of 4 volumes presents numerous special topics and numerous applications, also including numerical simulation methods.Practicing engineers will find extensive coverage to applications involving: multi-microchannel evaporator cold plates for electronics cooling, boiling on enhanced tubes and tube bundles, flow pattern based methods for predicting boiling and condensation inside horizontal tubes, pressure drop methods for singularies (U-bends and contractions), boiling in multiport tubes, and boiling and condensation in plate heat exchangers. All of these chapters include the latest methods for predicting not only local heat transfer coefficients but also pressure drops.Professors and students will find this 'Encyclopedia of Two-Phase Heat Transfer and Flow' particularly exciting, as it contains authored books and thorough state-of-the-art reviews on many basic and special topics, such as numerical modeling of two-phase heat transfer and adiabatic bubbly and slug flows, the unified annular flow boiling model, flow pattern maps, condensation and boiling theories, new emerging topics, etc.

Determination and Characteristics of the Transition to Two-phase Slug Flow in Small Channels

A Survery of Literature

Prediction of Flow Patterns and Pressure Gradient in Inclined Two-phase Flow Systems

Boiling and Condensation

Boiling Heat Transfer

Transport phenomena are the physical forces and processes by which energy and mass are moved into, out of, and throughout a system. Systems that are changing from one state (phase) to another, such as liquid to gas, are said to be "multiphase." This advanced text, for the first time, teaches the fundamentals of transport phenomena, including the relevant thermodynamics and kinetics, in the context of multiphase systems. Students will find this an accessible guide to the understanding of an often dauntingly complex subject, with ample worked-out examples taken from real-life engineering problems and helpful end-of-chapter problems to help reinforce abstract concepts. *Develops and understanding of the thermal and physical behavior of multiphase systems *Reviews underlying thermodynamics, including thermal equilibria and stability, thermodynamics of surfaces *Covers all types of phase changes, including melting and solidification, sublimation and vapor deposition, boiling, condensation, and evaporation *Ample end-of-chapter problems *Solutions Manual

This volume presents state-of-the-art of reviews in the field of multiphase flow. In focusses on nonlinear aspects of multiphase flow networks as well as visualization experiments. The first chapter presents nonlinear aspects or deterministic chaos issues in the systems of multi-phase reactors. The second chapter reviews two-phase flow dynamics in combination with complex network theory. The third chapter discusses evaporation mechanism in the wick of copper heat pipes. The last chapter investigates numerically the flow dynamics and heat and mass transfer in the laminar and turbulent boundary layer on the flat vertical plate.

Two phase flow in small diameters line-flow patterns pressure drop

Two-phase Flow Patterns and Frictional Pressure Gradients in a Small Rectangular Channel

Two-phase, gas-liquid cocurrent flow

Annular Two-Phase Flow

Handbook of Phase Change

* Third edition of a well-known and well established text both in industry and for teaching * Fully up-to-date and includes extra problems This book is an aid to heat exchanger design written primarily for design and development engineers in the chemical process, power generation, and refrigeration industries. It provides a comprehensive reference on two-phase flows, boiling, and condensation. The text covers all the latest advances like flows over tube bundles and two-phase heat transfer regarding refrigerants and petrochemicals. Another feature of this third edition is many new problems at chapter ends to enhance its use as a teaching text for graduate and post-graduate courses on two-phase flow and heat transfer. - ;This book is written for practising engineers as a comprehensive reference on two-phase flows, boiling, and condensation. It deals with methods for estimating two-phase flow pressure drops and heat transfer rates. It is a well-known reference book in its third edition and is also used as a text for advanced university courses. Both authors write from practical experience as both are professional engineers. - Provides a comprehensive coverage of the basic phenomena. It contains twenty-five chapters which cover different aspects of boiling and condensation. First the specific topic or phenomenon is described, followed by a brief survey of previous work, a phenomenological model based on current understanding, and finally a set of recommended design equa

Flow Patterns, Pressure Drops and Other Related Topics of Two-Phase Gas-Liquid Flow in Microgravity

Frontiers and Progress in Multiphase Flow I

The Prediction of Flow Patterns, Liquid Holdup and Pressure Losses Occurring During Continuous Two-phase Flow in Horizontal Pipelines

Flow Patterns of Two-phase Flow

Heat Transfer and Pressure Drop During Two-phase Two-component Flow in a Horizontal Tube

Heat exchangers with minichannel and microchannel flow passages are becoming increasingly popular due to their ability to remove large heat fluxes under single-phase and two-phase applications. Heat Transfer and Fluid Flow in Minichannels and Microchannels methodically covers gas, liquid, and electrokinetic flows, as well as flow boiling and condensation, in minichannel and microchannel applications. Examining biomedical applications as well, the book is an ideal reference for anyone involved in the design processes of microchannel flow passages in a heat exchanger. Each chapter is accompanied by a real-life case study New edition of the first book that solely deals with heat and fluid flow in minichannels and microchannels Presents findings that are directly useful to designers; researchers can use the information in developing new models or identifying research needs

Two-phase pressure drop was measured in a small horizontal rectangular channel (hydraulic diameter = 5.44 mm). The two-phase fluid was an air/water mixture at atmospheric pressure tested over a mass flux range of 50 to 2000 kg/m[sup 2][center dot]s. Two-phase flow patterns were identified and an objective method was found for determining the flow pattern transition from bubble or plug flow to slug flow. The method is based on an RMS pressure measurement. In particular, it is shown that the transition is accompanied by a clear and abrupt increase in the RMS pressure when plotted as a function of mass quality. Use of the RMS pressure as a two-phase flow pattern transition indicator is shown to have advantages over pressure-versus-time trace evaluations reported in the literature. The transition is substantiated by a clear local change in slope in the curve of two-phase pressure drop plotted as a function of either Martinelli parameter or mass quality. For high mass fluxes, the change in slope is distinguished by a local peak. Some degree of substantiation was found in previous work for both of the results (the RMS pressure change and the local pressure drop change) at the transition to slug flow.

Study of Two-phase Flow Patterns and Frictional Pressure Drop in Helical and Spiral Coils

Two-phase Gas-liquid Flow in Pipes with Different Orientations

Boiling Heat Transfer And Two-Phase Flow

Flow Patterns in High Pressure Two-phase Flow

Two-phase Flow Patterns and Frictional Pressure Gradients in a Small, Horizontal, Rectangular Channel

Abstract.

Completely updated, this graduate text describes the current state of boiling heat transfer and two-phase flow, in terms through which students can attain a consistent understanding. Prediction of real or potential boiling heat transfer behaviour, both in steady and transient states, is covered to aid engineering design of reliable and effective systems.

Two-phase Flow in Pipelines and Heat Exchangers

Measurement of Two Phase Flow Parameters

Application of Chaos Theory in Identification of Two-phase Flow Patterns and Transitions in a Small, Horizontal, Rectangular Channel

Heat Transfer and Fluid Flow in Minichannels and Microchannels

Convective Boiling and Condensation

This book provides design engineers using gas-liquid two-phase flow in different industrial applications the necessary fundamental understanding of the two-phase flow variables. Two-phase flow literature reports a plethora of correlations for determination of flow patterns, void fraction, two- phase pressure drop and non-boiling heat transfer correlations. However, the validity of a majority of these correlations is restricted over a narrow range of two -phase flow conditions. Consequently, it is quite a challenging task for the end user to select an appropriate correlation/model for the type of two-phase flow under consideration. Selection of a correct correlation also requires some fundamental understanding of the two-phase flow physics and the underlying principles/assumptions/limitations associated with these correlations. Thus, it is of significant interest for a design engineer to have knowledge of the flow patterns and their transitions and their influence on two-phase flow variables. To address some of these issues and facilitate selection of appropriate two-phase flow models, this volume presents a succinct review of the flow patterns, void fraction, pressure drop and non-boiling heat transfer phenomenon and recommend some of the well scrutinized modeling techniques.

This is an up-to-date review of recent advances in the study of two-phase flows, with focus on gas-liquid flows, liquid-liquid flows, and particle transport in turbulent flows. The book is divided into several chapters, which after introducing basic concepts lead the reader through a more complex treatment of the subjects. The reader will find an extensive review of both the older and the more recent literature, with abundance of formulas, correlations, graphs and tables. A comprehensive (though non exhaustive) list of bibliographic references is provided at the end of each chapter. The volume is especially indicated for researchers who would like to carry out experimental, theoretical or computational work on two-phase flows, as well as for professionals who wish to learn more about this topic.

Interfacial Shear and Flow Patterns in Co-current Two Phase Flow

Two-phase Flow and Pressure Drop in Flow Passages of Compact Heat Exchangers

Two-Phase Gas-Liquid Flow in Pipes with Different Orientations

Studies of Two-phase Flow Patterns, Pressure Drop and Interfacial Level Gradient Effects in a Large Diameter Horizontal Pipeline

Two-phase flow experiments were performed with air/water mixtures in a small rectangular channel measuring 9.52 x 1.59 mm (aspects ratio equal to 6), for applications to compact heat exchangers. Pressure drop and flow pattern definition data were obtained over a large range of mass qualities (0.0002 to 1), and in the case of flow pattern data, a large range of mass fluxes (50 to 2,000 kg/m2s). A flow pattern map, based on visual observations and photographs of the flow patterns, is presented and compared with a map developed for a rectangular channel of the same aspect ratio but with dimensions twice those of the test channel, and with a map developed for a circular tube with the same hydraulic diameter of 3 mm. Pressure drop data are presented as a function of both mass quality and Martinelli parameter and are compared with state-of-the-art correlations and a modified Chisholm correlation. 13 refs.

The ability to predict gas-liquid flow patterns is crucial to the design and operation of two-phase flow systems in the microgravity environment. Flow pattern maps have been developed in this study which show the occurrence of flow patterns as a function of gas and liquid superficial velocities as well as tube diameter, liquid viscosity and surface tension. The results have demonstrated that the location of the bubble-slug transition is affected by the tube diameter for air-water systems and by surface tension, suggesting that turbulence-induced bubble fluctuations and coalescence mechanisms play a role in this transition. The location of the slug-annular transition on the flow pattern maps is largely unaffected by tube diameter, liquid viscosity or surface tension in the ranges tested. Void fraction-based transition criteria were developed which separate the flow patterns on the flow pattern maps with reasonable accuracy. Weber number transition criteria also show promise but further work is needed to improve these models. For annular gas-liquid flows of air-water and air- 50 percent glycerine under reduced gravity conditions, the pressure gradient agrees fairly well with a version of the Lockhart-Martinelli correlation but the measured film thickness deviates from published correlations at lower Reynolds numbers. Nusselt numbers, based on a film thickness obtained from standard normal-gravity correlations, follow the relation, Nu = A Re(sup n) Pr(exp 1/3), but more experimental data in a reduced gravity environment are needed to increase the confidence in the estimated constants, A and n. In the slug flow regime, experimental pressure gradient does not correlate well with either the Lockhart-Martinelli or a homogeneous formulation, but does correlate nicely with a formulation based on a two-phase Reynolds number. Comparison with ground-based correlations implies that the heat transfer coefficients are lower at reduced gravity than at normal gravity under the same ...

Two-phase Pressure Drops

Experimental Study of Two Phase Flow Patterns Occuring in a Well During Pressure Control Operations

Prediction of Flow Patterns, Pressure Drop, and Liquid Holdup in Vertical Upward Two-phase Flow

Modelling and Experimentation in Two-Phase Flow

The prediction of flow patterns, liquid holdup and pressure losses occurring during continuous two-phase flow in horizontal pipelines

Various measurement tools of chaos theory were applied to analyze two-phase pressure signals with the objective to identify and interpret flow pattern transitions for two-phase flows in a small, horizontal rectangular channel. These measurement tools included power spectral density function, autocorrelation function, pseudo-phase-plane trajectory, Lyapunov exponents, and fractal dimensions. It was demonstrated that the randomlike pressure fluctuations characteristic of two-phase flow in small rectangular channels are chaotic in nature. As such, they are governed by a high-order deterministic system. The correlation dimension is potentially a new approach for identification of certain two-phase flow patterns and transitions.

Flow Patterns and Pressure Drop in Horizontal Two-phase Pipe Flow

Modern Developments and Advances

A Visual Study of Water in a Uniformly Heated 4-rod Bundle (LWBR Development Program)

Single- and Two-Phase Flow Pressure Drop and Heat Transfer in Tubes

A Comparison Between Two Horizontal Orientations