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Gasdynamic Aspects of Two-Phase Flow - Herbert Staedtke 2006-10-06
Here, the author, a researcher of outstanding experience in this field, summarizes and combines the recent results and findings on advanced two-phase flow modeling and numerical methods otherwise dispersed in various journals, while also providing explanations for numerical and modeling techniques previously not covered by other books. The resulting systematic and comprehensive monograph is unrivalled in its kind, serving as a reference for both researchers and engineers working in engineering as well as in environmental science.

Physics of Gas-Liquid Flows - Thomas J. Hanratty 2013-10-31
A unified theory of multiphase flows, providing tools for practical applications.

Studies on Fluid Dynamics of Gas-liquid Two-phase Flow - Saiful Azmi Md. Hanif 2009

Two Phase Flow in Gas-liquid Systems - J. A. R. Bennett 1958

Experimental and Theoretical Studies of Gas-liquid Two Phase Flow at Reduced Gravity Conditions - Antoine J. P. Janicot 1988

Novel Signal Processing Approaches for Characterization of Transient Two-phase Gas-liquid Flow - Deepak Kirpalani 2000
The flow pattern generated in pipes for two-phase gas-liquid horizontal flows can significantly affect the efficiency of chemical process equipment. Since the early 1900's, scientists and engineers have investigated various methods for characterizing the flow patterns generated for various two-phase chemical systems. A notable effort was made by Baker to quantify physical fluid properties and correlate them to observed flow patterns in pipe flow. The primary objective of this research was to develop a flow pattern recognition system, for industrial implementation, that is suitable for characterizing transient two-phase flow patterns. Since the advent of computer and system control equipment, researchers have focused on quantifying flow characteristics by analyzing pressure fluctuation because the natural tendency of multiphase flow is to pulse as the fluid phases mix while moving along the pipe length. Recent developments in digital signal processing provide new methods for characterizing

transient signals. A novel approach using wavelet transform analysis to study pressure fluctuations in two-phase flow systems has been developed in this research. Experimental development includes the design of a baseline system and a flow pattern recognition system. (Abstract shortened by UMI.).

Mechanistic Modeling of Gas-liquid Two-phase Flow in Pipes - Ovadia Shoham 2006

The objectives of this book are twofold: to provide insight and understanding of two-phase flow phenomena and to develop analytical tools for either designing two-phase flow systems or conducting research in this area. The traditional approach for two-phase flow prediction was based on the development of an empirical correlation from experimental data. This book presents the recent approach, in which mathematical mechanistic models are developed, based on the physical phenomena, to predict two-phase flow behavior. The models can be verified and refined with limited experimental data. However, as these models incorporate the physical phenomena and the important flow variables, they can be extended to different operational conditions and can enable scaleup with significant confidence.

Prediction of Gas-Liquid Two-Phase Flow Regime in Microgravity - National Aeronautics and Space Administration (NASA) 2018-07-10

An attempt is made to predict gas-liquid two-phase flow regime in a pipe in a microgravity environment through scaling analysis based on dominant physical mechanisms. Simple inlet geometry is adopted in the analysis to see the effect of inlet configuration on flow regime transitions. Comparison of the prediction with the existing experimental data shows good agreement, though more work is required to better define some physical parameters. The analysis clarifies much of the physics involved in this problem and can be applied to other configurations. Lee, Jinho and Platt, Jonathan A. Glenn Research Center RTOP 694-03-0A...

Modelling and Experimentation in Two-Phase Flow - Volfango Bertola 2014-05-04

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.

An Experimental Study of the Boundary-layer Characteristics for Two-phase (gas-liquid Spray) Flow Over a Circular Cylinder - Harold Eugene Wright 1966

Single- and Two-Phase Flow Pressure Drop and Heat Transfer in Tubes - Afshin J. Ghajar 2022-01-11

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.

Two Phase Flow in Gas-liquid Systems - J. A. R. Bennett 1958

A study of two phase (gas liquid) flow in a tube bend - P. D. Hills 1973

Two-Phase Flow in Complex Systems - Salomon Levy 1999-08-02

The first comprehensive, real-world look at two-phase flow systems-from one of the world's leading authorities on the subject. From his early works in the area of heat transfer research on boundary layer flows and two-phase flows to his role as one of the lead consultants following the Three Mile Island accident, internationally renowned engineer Salomon Levy has achieved an ideal balance of theory and practice in his engineering career. In Two-Phase Flow in Complex Systems, Dr. Levy's newest book, he draws on this breadth of experience to examine these systems in the real world. Two-Phase Flow in Complex Systems offers a unique look at two-phase flow phenomena (primarily gas and liquid) in a variety of systems, from water reactors to the global climate system. Focusing on the interaction and simultaneous behavior of all the components in a system, the book's approach departs significantly from conventional texts, which emphasize modeling of separate phenomena. The book begins with the formulation of an integrated program of experiments and analytical tools, and describes experimental aspects-specifically the scaling of test facilities-essential to representing the critical elements of the behavior of complex systems. Subsequent chapters: * Discuss system computer codes for predicting system behavior during transients and accidents. * Examine flow pattern maps and flow pattern models. * Describe typical limiting phenomena known to impact the safety and cost of complex systems (including countercurrent limiting conditions and critical or choking flow). The book also illustrates how the analysis used in understanding the dynamics of a nuclear power system can be applied to the entire global climate system, including the phenomenon of global warming.

Experimental Study of Two-phase Gas-liquid Flow in a Microscale Fractal-like Branching Flow Network - Younghoon Kwak 2009

Two-phase gas-liquid flows in microscale fractal-like branching channel flow networks were experimentally studied to assess the validity of existing void fraction correlations and flow regimes based on superficial gas and liquid velocities. Void fractions were assessed using two different methods. First, void fraction data were

acquired using a High-Speed-High-Resolution (HSHR) camera and computed by area-based two-dimensional image analysis. Void fraction data were also computed using a slip ratio, defined as gas velocity over liquid velocity. Liquid velocity represents the bulk-averaged liquid velocity as determined by microscale particle image velocimetry (micro-PIV). Gas velocity was determined by averaging gas-liquid interface velocities made at the channel centerline. The fractal-like branching channel flow network has five bifurcation levels of different channel widths varying from 400 [mu]m to 100 [mu]m with a fixed channel depth of 250 [mu]m. Each downstream width decreases by 30% whereas the downstream lengths increase by 40%. The total flow length through a single path is approximately 18 mm. Filtered air and deionized water were used as the gas and liquid working fluids, respectively. Mass flow rates of air and water into each k=0 branch were varied from 0.3 g/min to 2.5 g/min and from 5.2x10−5 g/min to 1.3x10−2 g/min, respectively. These flow rates yielded superficial air and water velocities through the same branch level between 0.007 m/s and 1.8 m/s and between 0.05 m/s and 0.42 m/s, respectively. For each branching level, due to an increase in flow area, the superficial liquid and gas flow rates change. A two-phase flow regime map was generated for each level of the fractal-like branching flow network and compared to maps developed using the Taitel and Dukler (1976) model and to maps presented in Chung and Kawaji (2004). Flow regime transitions are well predicted with the Taitel and Dukler (1976) model for each branching level. Void fraction assessed using the slip ratio shows very good agreement with the homogeneous void fraction model for all branching levels. On the other hand, void fraction determined by area-based two-dimensional image analysis shows better agreement with the void fraction correlation of Zivi (1964).

Scale-Up Study of Gas-Liquid Two-Phase Flow in Downcomer - Jayanth Abishek Subramaniam 2013

Studies on void fraction and flow pattern for countercurrent gas-liquid two-phase flow - Katsuji Yamaguchi 1983

Study of Superficial Velocities Effect on Behaviour Gas-liquid Two Phase Flow in Horizontal Tube - A'imullah Abd.Halim 2009

Experimental and Modeling Studies for Gas-liquid Two-phase Flow in Slightly Inclined Pipes at Low- and High-pressure Conditions - Plat Abduvayt 2003

Experimental and Theoretical Studies of Isothermal Upward Gas-liquid Flows in Vertical Tubes - Ronaldo Coutinho Fernandes 1984

Thermo-fluid Dynamics of Two-Phase Flow - Mamoru Ishii 2006-09-28
This book has been written for graduate students, scientists and engineers who need in-depth theoretical foundations to solve two-phase problems in various technological systems. Based on extensive research experiences focused on the fundamental physics of two-phase flow, the authors present the detailed theoretical foundation of multi-phase flow thermo-fluid dynamics as they apply to a variety of scenarios, including nuclear reactor transient and accident analysis, energy systems, power generation systems and even space propulsion.

Numerical and Experimental Studies of Gas/liquid Two-phase Flow in a

Turbocharger - Jun Yao 2010

Two-Phase Flow, Boiling, and Condensation - S. Mostafa Ghiaasiaan 2017-01-11
Providing a comprehensive introduction to the fundamentals and applications of flow and heat transfer in conventional and miniature systems, this fully enhanced and updated edition covers all the topics essential for graduate courses on two-phase flow, boiling, and condensation. Beginning with a concise review of single-phase flow fundamentals and interfacial phenomena, detailed and clear discussion is provided on a range of topics, including two-phase hydrodynamics and flow regimes, mathematical modeling of gas-liquid two-phase flows, pool and flow boiling, flow and boiling in mini and microchannels, external and internal-flow condensation with and without noncondensables, condensation in small flow passages, and two-phase choked flow. Numerous solved examples and end-of-chapter problems that include many common design problems likely to be encountered by students, make this an essential text for graduate students. With up-to-date detail on the most recent research trends and practical applications, it is also an ideal reference for professionals and researchers in mechanical, nuclear, and chemical engineering.

A Particle Image Velocimetry Study of Bubbly Gas-liquid Two-phase Flow - Xiaoyun Tu 2004

Non-boiling Heat Transfer in Horizontal and Near Horizontal Upward Inclined Gas-liquid Two Phase Flow - Srinaga Bharath Chandra Kalapatapu 2014
Heat transfer in non-boiling gas-liquid two phase flow finds its practical application in chemical and petroleum industries. So far, majority of the research dedicated to study heat transfer in non-boiling two phase flow is limited to horizontal and vertical pipe orientations with very little attention given to the study of this phenomenon in inclined systems. To contribute and further enhance the general understanding of heat transfer in non-boiling two phase flow, the main focus of this work is to experimentally measure local and average convective heat transfer coefficients for different flow patterns in horizontal and near horizontal upward inclined two phase flow. In total, 368 experiments are carried out in a 12.5 mm I.D. schedule 10S stainless steel pipe at 0, +5, +10 and +20 degrees pipe orientations using air-water as fluid combination. For each pipe orientation, the superficial gas and liquid Reynolds number is varied from 200 to 19,000 and 2000 to 18,000, respectively and the measured values of the averaged heat transfer coefficient were found to be in a range of 1300 W/m2K to 8000 W/m2K. The two phase heat transfer coefficients are compared among the above mentioned orientations. It is found that the two phase heat transfer coefficient increases from 0° to +5° and +10° and then decreases at +20°. Also, correlations in the literature were tested and the best performing correlations have been discussed in the experimental study. Correlation using the concept of Reynolds analogy was developed by modification of the existing correlation in the literature leading towards the better understanding of the relationship of heat transfer phenomenon with the pressure drop.

Two-Phase Flow Research Using the DC-9/Kc-135 Apparatus - National Aeronautics and Space Adm Nasa 2018-10-18

Low-gravity gas-liquid flow research can be conducted aboard the NASA Lewis Research Center DC-9 or the Johnson Space Center KC-135. Air and water solutions serve as the test liquids in cylindrical test sections with constant or variable inner diameters of approximately 2.54 cm and lengths of up to 3.0 m. Superficial velocities range from 0.1 to 1.1 m/sec for liquids and from 0.1 to 25 m/sec for air. Flow rate, differential pressure, void fraction, film thickness, wall shear stress, and acceleration data are measured and recorded at data rates of up to 1000 Hz throughout the 20-sec duration of the experiment. Flow is visualized with a high-speed video system. In addition, the apparatus has a heat-transfer capability whereby sensible heat is transferred between the test-section wall and a subcooled liquid phase so that the heat-transfer characteristics of gas-liquid two-phase flows can be determined. McQuillen, John B. and Neumann, Eric S. and Shoemaker, J. Michael Glenn Research Center RTOP 963-20-00

Direct Numerical Simulations of Gas–Liquid Multiphase Flows - Grétar Tryggvason 2011-03-10

Accurately predicting the behaviour of multiphase flows is a problem of immense industrial and scientific interest. Modern computers can now study the dynamics in great detail and these simulations yield unprecedented insight. This book provides a comprehensive introduction to direct numerical simulations of multiphase flows for researchers and graduate students. After a brief overview of the context and history the authors review the governing equations. A particular emphasis is placed on the 'one-fluid' formulation where a single set of equations is used to describe the entire flow field and interface terms are included as singularity distributions. Several applications are discussed, showing how direct numerical simulations have helped researchers advance both our understanding and our ability to make predictions. The final chapter gives an overview of recent studies of flows with relatively complex physics, such as mass transfer and chemical reactions, solidification and boiling, and includes extensive references to current work.

Measuring Techniques in Gas-Liquid Two-Phase Flows - J.M. Delhaye 2012-12-06

A IUTAM symposium on "Measuring Techniques in Gas-Liquid Two Phase Flows" was held on July 5-8, 1983 in Nancy, France. This topic in cluded instrumentation for steam-water and liquid-vapor flows but strictly excluded measuring techniques for gas or liquid flows with solid particles. The top priority in the paper selection was given to presentations of new methods which had been substantiated by theoretical modeling, calibration tests and comparison tests with other techniques. Examples of experimental resul ts obtained with the proposed instrumentation had to be displayed. However the interpretation of these results in terms of two-phase flow or heat transfer modeling did not fall wi thin the scope of the meeting. Thirty four papers were presented during the Symposium and 79 participants coming from Canada, European countries, Japan and the United States attended the sessions. They represented not only Universities but also state agencies and private companies. After the meeting each paper was peer-reviewed by at least three referees. The Editors of this Procee dings Volume are pleased to extend their deep gratitude to the following reviewers: J.L. Achard, R.J. Adrian, B.

Azzopardi, J.A. Boure, G. Costigan, M. Courtaud, A.E. Dukler, F. Durst, J.R. Fincke, G. Gouesbet, P. Griffith, T.J. Hanratty, A. Hawighorst, T.R. Heidrick, G. Hetsroni, Y.Y. Hsu, M.

An Overview of Heat Transfer Phenomena - Salim Newaz Kazi 2012-10-31

In the wake of energy crisis due to rapid growth of industries, urbanization, transportation, and human habit, the efficient transfer of heat could play a vital role in energy saving. Industries, household requirements, offices, transportation are all dependent on heat exchanging equipment. Considering these, the present book has incorporated different sections related to general aspects of heat transfer phenomena, convective heat transfer mode, boiling and condensation, heat transfer to two phase flow and heat transfer augmentation by different means.

Two-phase Flow and Heat Transfer - D. Butterworth 1979

Two-Phase Gas-Liquid Flow in Pipes with Different Orientations - Afshin J. Ghajar 2020-03-14

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.

An Experimental Study of Two-phase Flow in Inclined Pipes - Howard Dale Beggs 1987

Integrated Chemical Processes in Liquid Multiphase Systems - Matthias Kraume 2022-06-21

The essential principles of green chemistry are the use of renewable raw materials, highly efficient catalysts and green solvents linked with energy efficiency and process optimization in real-time. Experts from different fields show, how to examine all levels from the molecular elementary steps up to the design and operation of an entire plant for developing novel and efficient production processes.

Two-Phase Flow - Cl Kleinstreuer 2003-05-23

This graduate text provides a unified treatment of the fundamental principles of two-phase flow and shows how to apply the principles to a variety of homogeneous mixture as well as separated liquid-liquid, gas-solid, liquid-solid, and gas-liquid flow problems, which may be steady or transient, laminar or turbulent. Each chapter contains several sample

problems, which illustrate the outlined theory and provide approaches to find simplified analytic descriptions of complex two-phase flow phenomena. This well-balanced introductory text will be suitable for advanced seniors and graduate students in mechanical, chemical, biomedical, nuclear, environmental and aerospace engineering, as well as in applied mathematics and the physical sciences. It will be a valuable reference for practicing engineers and scientists. A solutions manual is available to qualified instructors.

Gas-Liquid Two-Phase Flow in an Ejector Induced Downflow Bubble Column - Ajay Mandal 2010-11

Fine dispersion of gas into liquid is one of the most important criteria for momentum, mass and energy transfer between the phases. It not only provides an intense mixing but also creates increased interfacial area and high mass transfer coefficient. A comprehensive study have been done on the gas holdup, pressure drop and energy dissipation during the gas-liquid two-phase flow in an ejector induced downflow bubble column. Experimental results were analyzed by previously established models. Correlations were also developed to predict the gas entrainment, gas holdup, two-phase friction factor and frictional loss coefficients in terms of physical, dynamic variables and the system parameters. Studies have also been made to measure the interfacial area and mass transfer coefficient of the present system using chemical method. It has been found that interfacial area and mass transfer coefficients are strong functions of superficial gas velocity.

Numerical Simulation of Multiphase Reactors with Continuous Liquid Phase - Chao Yang 2014-09-04

Numerical simulation of multiphase reactors with continuous liquid phase provides current research and findings in multiphase problems, which will assist researchers and engineers to advance this field. This is an ideal reference book for readers who are interested in design and scale-up of multiphase reactors and crystallizers, and using mathematical model and numerical simulation as tools. Yang and Mao’s book focuses on modeling and numerical applications directly in the chemical, petrochemical, and hydrometallurgical industries, rather than theories of multiphase flow. The content will help you to solve reacting flow problems and/or system design/optimization problems. The fundamentals and principles of flow and mass transfer in multiphase reactors with continuous liquid phase are covered, which will aid the reader’s understanding of multiphase reaction engineering. Provides practical applications for using multiphase stirred tanks, reactors, and microreactors, with detailed explanation of investigation methods. Presents the most recent research efforts in this highly active field on multiphase reactors and crystallizers. Covers mathematical models, numerical methods and experimental techniques for multiphase flow and mass transfer in reactors and crystallizers.

Study of Gas-liquid Two-phase Flow Pattern Transitions in Horizontal Pipe, Annulus and Nuclear Fuel Type Rod Bundle Flow Systems [microform] - Sylvester Ifanyi Osamusali 1989

An Index to the Two-phase Gas-liquid Flow Literature - S. William Gouse 1966

Gas-Liquid Two-Phase Flow in the Pipe Or Channel - Maksim Pakhomov 2022-03-24

The main goal of this Special Issue

was to contribute to, highlight and discuss topics related to various aspects of two-phase gas-liquid flows, which can be used both in fundamental sciences and practical applications, and we believe that this main goal was successfully achieved. This Special Issue received studies from Russia, China, Thailand, ROC-Taiwan, Saudi Arabia, and Pakistan. We were very grateful to see that all the papers presented findings characterized as unconventional, innovative, and methodologically new. We hope that the readers of the journal Water can enjoy and learn about the experimental and numerical study of two-phase flows from the published material, and share these results with the scientific community, policymakers and stakeholders. Last but not least, we would like to thank Ms. Aroa Wang, Assistant Editor at MDPI, for her dedication and willingness to publish this Special Issue. She is a major supporter of the Special Issues, and we are indebted to her.

Two-Phase Flow, Boiling, and Condensation - S. Mostafa Ghiaasiaan 2007-10-22

This text is an introduction to gas-liquid two-phase flow, boiling and condensation for graduate students, professionals, and researchers in mechanical, nuclear, and chemical engineering. The book provides a balanced coverage of two-phase flow and phase change fundamentals, well-established art and science dealing with conventional systems, and the rapidly developing areas of microchannel flow and heat transfer. It is based on the author's more than 15 years of teaching experience. Instructors teaching multiphase flow have had to rely on a multitude of books and reference materials. This book remedies that problem by covering all the topics essential for a graduate course. Important areas include: two-phase flow model conservation equations and their numerical solution; condensation with and without noncondensables; and two-phase flow, boiling, and condensation in mini and microchannels.