Society of Petroleum Engineers

## MECHANISTIC MODELING OF GAS-LIQUID TWO-PHASE FLOW IN PIPES

OVADIA SHOHAM

# <u>Mechanistic Modeling Of Gas Liquid Two Phase Flow In</u> <u>Pipes</u>

Gioia Falcone, Geoffrey Hewitt, C. Alimonti

## **Mechanistic Modeling Of Gas Liquid Two Phase Flow In Pipes:**

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 Multiphase Production Jean Falcimaigne, Sandrine Decarre, 2008 Annotation This book presents the fundamentals of multiphase production with regard to flow simulations in multiphase pipelines multiphase pumping and multiphase metering It gives a large range of information on approaches and technologies which can be used today It is designed for engineers involved in field development but also for petroleum engineering students

One-dimensional Mechanistic Modelling of Gas-liquid Two Phase Flow in Pipes Zifan Tang, 1991 **Multiphase** Transport of Hydrocarbons in Pipes Juan J. Manzano-Ruiz, Jose G. Carballo, 2024-04-09 Multiphase Transport of Hydrocarbons in Pipes An introduction to multiphase flows in the oil and gas industry The term multiphase flow refers to the concurrent flow of oil and or gas alongside other substances or materials such as production water chemical inhibitors and solids e g sand This is a critical topic in the oil and gas industry where the presence of multiple flow phases in pipelines affects deliverability generates serious complications in predicting flow performance for system design and operation and requires specific risk mitigation actions and continuous maintenance Chemical and Mechanical Engineers interested in working in this industry will benefit from understanding the basic theories and practices required to model and operate multiphase flows through pipelines wells and other components of the production system Multiphase Transport of Hydrocarbons in Pipes meets this need with a comprehensive overview of five decades of research into multiphase flow Incorporating fundamental theories historic and cutting edge multiphase flow models and concrete examples of current and future applications This book provides a sound technical background for prospective or working engineers in need of understanding this crucial area of industry Readers will also find Fundamental principles supporting commercial software Detailed tools for estimating multiphase flow rates through flowlines wells and more Integration of conservation principles with thermodynamic and transport properties Coverage of legacy and modern simulation models This book is ideal for flow assurance engineers facilities engineers oil and gas production engineers and process engineers as well as chemical and mechanical engineering students looking to work in any of these roles **Integrated Modeling of Reservoir Fluid** Properties and Multiphase Flow in Offshore Production Systems Tobias R. Gessner, Jader R. Barbosa Jr., 2023-10-03

The book is intended for practicing engineers in the oil industry researchers and graduate students interested in designing and simulating offshore hydrocarbon production systems It approaches offshore oil production systems from an integrated perspective that combines the modeling of thermophysical properties of reservoir fluids and their flow as a multiphase mixture in wellbores flow lines and risers The first part of the book presents an internally consistent method to compute the critical parameters and acentric factor of Single Carbon Number SCN fractions of petroleum mixtures using state of the art multivariate fitting techniques. The procedure is illustrated and validated using flash and differential liberation data from actual field samples In the second part of the book mechanistic multiphase flow models are discussed in light of their ability to predict the pressure temperature and phase holdup of production fluids in wellbores flow lines and risers Multivariate fitting procedures are again applied to evaluate the sensitivity of the results with respect to closure relationship parameters such as slug body gas holdup wall shear stress and wall roughness in pipelines and production tubing Finally the modeling framework is validated using actual field data from offshore production wells **Fundamentals of Gas Lift Engineering** Ali Hernandez, 2016-02-18 Fundamentals of Gas Lift Engineering Well Design and Troubleshooting discusses the important topic of oil and gas reservoirs as they continue to naturally deplete decline and mature and how more oil and gas companies are trying to divert their investments in artificial lift methods to help prolong their assets While not much physically has changed since the invention of the King Valve in the 1940s new developments in analytical procedures computational tools and software and many related technologies have completely changed the way production engineers and well operators face the daily design and troubleshooting tasks and challenges of gas lift which can now be carried out faster and in a more accurate and productive way assuming the person is properly trained This book fulfills this training need with updates on the latest gas lift designs troubleshooting techniques and real world field case studies that can be applied to all levels of situations including offshore Making operational and troubleshooting techniques central to the discussion the book empowers the engineer new and experienced to analyze the challenge involved and make educated adjustments and conclusions in the most economical and practical way Packed with information on computer utilization inflow and outflow performance analysis and worked calculation examples made for training the book brings fresh air and innovation to a long standing essential component in a well s lifecycle Covers essential gas lift design troubleshooting and the latest developments in R D Provides real world field experience and techniques to solve both onshore and offshore challenges Offers past and present analytical and operational techniques available in an easy to read manner Features information on computer utilization inflow and outflow performance analysis and worked calculation training examples 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 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

Computational Methods in Multiphase Flow VIII P. Vorobieff, C.A. Brebbia, J.L. Munoz-Cobo, 2015-04-20 This book presents the latest research in one of the most challenging yet most universally applicable areas of technology Multiphase flows are found in all areas of technology at all length scales and flow regimes involving compressible or incompressible linear or nonlinear fluids The range of related problems of interest is vast including astrophysics biology geophysics atmospheric process and many areas of engineering The solution of the equations that describe such complex problems often requires a combination of advanced computational and experimental methods For example any models developed must be validated through the application of expensive and difficult experimental techniques Numerous problems in the area thus remain as yet unsolved including modelling nonlinear fluids modelling and tracking interfaces dealing with multiple length scales characterising phase structures and treating drop break up and coalescence The papers contained in the book were presented at the eighth in a well established series of biennial conferences that began in 2001 They represent close interaction between numerical modellers and other researchers working to gradually resolve the many outstanding issues in understanding of multiphase flow The papers in the book cover such topics as Multiphase Flow Simulation Bubble and Drop Dynamics Interface Behaviour Experimental Measurements Energy Applications Compressible Flows Flow in Porous Media Turbulent Flow Image Processing Heat Transfer Atomization Hydromagnetics Plasma Fluidised Beds Cavitation

Encyclopedia Of Two-phase Heat Transfer And Flow I: Fundamentals And Methods (A 4-volume Set) John R Thome, 2015-08-14 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 Encyclopediaa 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 transser and adiabatic bubbly and slug flows the unified annular flow boiling model flow pattern maps condensation and boiling theories new emerging Multiphase Flow Handbook, Second Edition Efstathios Michaelides, Clayton T. Crowe, John D. Schwarzkopf, 2016-10-26 The Multiphase Flow Handbook Second Edition is a thoroughly updated and reorganized revision of the late Clayton Crowe's work and provides a detailed look at the basic concepts and the wide range of applications in this important area of thermal fluids engineering Revised by the new editors Efstathios E Stathis Michaelides and John D Schwarzkopf the new Second Edition begins with two chapters covering fundamental concepts and methods that pertain to all the types and applications of multiphase flow The remaining chapters cover the applications and engineering systems that are relevant to all the types of multiphase flow and heat transfer The twenty one chapters and several sections of the book include the basic science as well as the contemporary engineering and technological applications of multiphase flow in a comprehensive way that is easy to follow and be understood The editors created a common set of nomenclature that is used throughout the book allowing readers to easily compare fundamental theory with currently developing concepts and applications With contributed chapters from sixty two leading experts around the world the Multiphase Flow Handbook Second Edition is an essential reference for all researchers academics and engineers working with complex thermal and fluid Multiphase Flow Metering Gioia Falcone, Geoffrey Hewitt, C. Alimonti, 2009-11-16 Over the last two decades the systems development evaluation and use of MFM systems has been a major focus for the Oil Gas industry worldwide Since the early 1990 s when the first commercial meters started to appear there have been around 2 000 field applications of MFM for field allocation production optimisation and well testing So far many alternative metering systems have been developed but none of them can be referred to as generally applicable or universally accurate Both established and novel technologies suitable to measure the flow rates of gas oil and water in a three phase flow are reviewed and assessed within this book Those technologies already implemented in the various commercial meters are evaluated in terms of operational and economical advantages or shortcomings from an operator point of view The lessons learned about the practical reliability accuracy and use of the available technology is discussed The book suggests where the research to develop the next generation of MFM devices will be focused in order to meet the as yet unsolved problems The book provides a critical and independent review of the current status and future trends of MFM supported by the authors strong background on multiphase flow and by practical examples These are based on the authors direct experience on MFM gained over many years of research in connection with both operators and service companies As there are currently no books on the subject of Multiphase Flow Metering for the Oil Gas industry this book will fill in the gap and provide a theoretical and practical reference for professionals academics and students Written by leading scholars and industry experts of international standing Includes strong coverage of the theoretical background yet also provides practical examples and current developments Provides

practical reference for professionals students and academics **Integral Methods in Science and Engineering Christian** Constanda, Paul Harris, 2019-07-18 This contributed volume contains a collection of articles on state of the art developments on the construction of theoretical integral techniques and their application to specific problems in science and engineering The chapters in this book are based on talks given at the Fifteenth International Conference on Integral Methods in Science and Engineering held July 16 20 2018 at the University of Brighton UK and are written by internationally recognized researchers The topics addressed are wide ranging and include Asymptotic analysis Boundary domain integral equations Viscoplastic fluid flow Stationary waves Interior Neumann shape optimization Self configuring neural networks This collection will be of interest to researchers in applied mathematics physics and mechanical and electrical engineering as well as graduate students in these disciplines and other professionals for whom integration is an essential tool Behavior of Pipelines for Marine Applications Ioannis K. Chatjigeorgiou, 2023-03-18 The dynamic behavior of pipelines describes the time varying continuous response of these structures under extreme effects that are generated by the surrounding environment waves and sea currents and motions imposed by the host floating facility This book describes all known impacts that affect the behavior and operation of a pipeline conveying an inner flow for underwater applications Known Impacts are those phenomena that are considered important according to practice and experience Underwater pipelines are typical unique structures that are attached to unique floating facilities. The design and utilization of underwater pipelines depend strongly on the installation site and the intended application s particulars It is possible that future technology demands will require us to cope with additional challenges that will be considered important for the design and operation of underwater pipelines leading inevitably to the enhancement of the known challenges **Experimental and** Theoretical Advances in Fluid Dynamics Jaime Klapp, Anne Cros, Oscar Velasco Fuentes, Catalina Stern, Mario Alberto Rodriguez Meza, 2011-09-23 The book is comprised of lectures and selected contributions presented at the Enzo Levi and XVI Annual Meeting of the Fluid Dynamic Division of the Mexican Physical Society in 2010 It is aimed at fourth year undergraduate and graduate students as well as scientists in the fields of physics engineering and chemistry with an interest in fluid dynamics from the experimental and theoretical point of view The lectures are introductory and avoid the use of complicated mathematics The other selected contributions are also geared to fourth year undergraduate and graduate students The fluid dynamics applications include multiphase flow convection diffusion heat transfer rheology granular material viscous flow porous media flow geophysics and astrophysics. The material contained in the book includes recent advances in experimental and theoretical fluid dynamics and will be of great use to those involved in either teaching and or Advances in Fluid Mechanics IX Matiur Rahman, C. A. Brebbia, 2012 This book discusses the basic formulations research of fluid mechanics and their computer modelling as well as the relationship between experimental and analytical results Containing papers from the Ninth International Conference on Advances in Fluid Mechanics this book discusses the basic

formulations of fluid mechanics and their computer modelling as well as the relationship between experimental and analytical results Scientists engineers and other professionals interested in the latest developments in theoretical and computational fluid mechanics will find the book a useful addition to the literature. The book covers a wide range of topics with emphasis on new applications and research currently in progress including Computational Methods in Fluid Mechanics Environmental Fluid Mechanics Experimental Versus Simulation Methods Multiphase Flow Hydraulics and Hydrodynamics Heat and Mass Transfer Industrial Applications Wave Studies Biofluids Fluid Structure Interaction 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 guite 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 Practical Design of Ships and Other Floating Structures Tetsuo Okada, Katsuyuki Suzuki, Yasumi Kawamura, 2020-10-03 This book gathers the peer reviewed proceedings of the 14th International Symposium PRADS 2019 held in Yokohama Japan in September 2019 It brings together naval architects engineers academic researchers and professionals who are involved in ships and other floating structures to share the latest research advances in the field The contents cover a broad range of topics including design synthesis for ships and floating systems production hydrodynamics and structures and materials Reflecting the latest advances the book will be of interest to researchers and practitioners alike

Engineering Fluid Dynamics 2019-2020 Bjørn H. Hjertager, 2021-02-25 This book contains the successful submissions to a Special Issue of Energies entitled Engineering Fluid Dynamics 2019 2020 The topic of engineering fluid dynamics includes both experimental and computational studies Of special interest were submissions from the fields of mechanical chemical marine safety and energy engineering We welcomed original research articles and review articles After one and a half years 59 papers were submitted and 31 were accepted for publication The average processing time was about 41 days The authors had the following geographical distribution China 15 Korea 7 Japan 3 Norway 2 Sweden 2 Vietnam 2 Australia 1 Denmark 1 Germany 1 Mexico 1 Poland 1 Saudi Arabia 1 USA 1 Serbia 1 Papers covered a wide range of topics including

analysis of free surface waves bridge girders gear boxes hills radiation heat transfer spillways turbulent flames pipe flow open channels jets combustion chambers welding sprinkler slug flow turbines thermoelectric power generation airfoils bed formation fires in tunnels shell and tube heat exchangers and pumps **Emerging Advances in Petrophysics** Jianchao Cai, Shuyu Sun, Ali Habibi, Zhien Zhang, 2019-04-18 Due to the influence of pore throat size distribution pore connectivity and microscale fractures the transport distribution and residual saturation of fluids in porous media are difficult to characterize Petrophysical methods in natural porous media have attracted great attention in a variety of fields especially in the oil and gas industry A wide range of research studies have been conducted on the characterization of porous media covers and multiphase flow therein Reliable approaches for characterizing microstructure and multiphase flow in porous media are crucial in many fields including the characterization of residual water or oil in hydrocarbon reservoirs and the long term storage of supercritical CO2 in geological formations This book gathers together 15 recent works to emphasize fundamental innovations in the field and novel applications of petrophysics in unconventional reservoirs including experimental studies numerical modeling fractal approach and multiphase flow modeling simulations. The relevant stakeholders of this book are authorities and service companies working in the petroleum subsurface water resources air and water pollution environmental and biomaterial sectors Encyclopedia Of Two-phase Heat Transfer And Flow Iv: Modeling Methodologies, Boiling Of Co<sub>2</sub>, And Micro-two-phase Cooling (A 4-volume Set) John R Thome, 2018-05-15 Set IV is a new addition to the previous Sets I II and III It contains 23 invited chapters from international specialists on the topics of numerical modeling of pulsating heat pipes and of slug flows with evaporation lattice Boltzmann modeling of pool boiling fundamentals of boiling in microchannels and microfin tubes CO2 and nanofluids testing and modeling of micro two phase cooling systems for electronics and various special topics flow separation in microfluidics two phase sensors wetting of anisotropic surfaces ultra compact heat exchangers etc The invited authors are leading university researchers and well known engineers from leading corporate research laboratories ABB IBM Nokia Bell Labs Numerous must read chapters are also included here for the two phase community Set IV constitutes a must have engineering and research reference together with previous Sets I II and III for thermal engineering researchers and practitioners

Whispering the Strategies of Language: An Emotional Quest through **Mechanistic Modeling Of Gas Liquid Two Phase**Flow In Pipes

In a digitally-driven earth where monitors reign great and quick connection drowns out the subtleties of language, the profound strategies and psychological nuances concealed within words frequently go unheard. Yet, situated within the pages of **Mechanistic Modeling Of Gas Liquid Two Phase Flow In Pipes** a interesting literary value blinking with raw emotions, lies an extraordinary journey waiting to be undertaken. Composed by an experienced wordsmith, this marvelous opus encourages visitors on an introspective journey, delicately unraveling the veiled truths and profound impact resonating within the material of each and every word. Within the emotional depths with this moving evaluation, we shall embark upon a honest exploration of the book is core subjects, dissect their charming publishing style, and fail to the powerful resonance it evokes heavy within the recesses of readers hearts.

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