ACCESS MULTIPHASE FLOW AND FLUIDIZATION CONTINUUM AND KINETIC THEORY DESCRIPTIONS

Multiphase Flow and Fluidization

Useful as a reference for engineers in industry and as an advanced level text for graduate engineering students, Multiphase Flow and Fluidization takes the reader beyond the theoretical to demonstrate how multiphase flow equations can be used to provide applied, practical, predictive solutions to industrial fluidization problems. Written to help advance progress in the emerging science of multiphase flow, this book begins with the development of the conservation laws and moves on through kinetic theory, clarifying many physical concepts (such as particulate viscosity and solids pressure) and introducing the new dependent variable--the volume fraction of the dispersed phase. Exercises at the end of each chapterare provided for further study and lead into applications not covered in the text itself. Treats fluidization as a branch of transport phenomena Demonstrates how to do transient, multidimensional simulation of multiphase processes The first book to apply kinetic theory to flow of particulates Is the only book to discuss numerical stability of multiphase equations and whether or not such equations are well-posed Explains the origin of bubbles and the concept of critical granular flow Presents clearly written exercises at the end of each chapter to facilitate understanding and further study

Transport Phenomena in Multiphase Systems

This volume fills the need for a textbook presenting basic governing and constitutive equations, followed by several engineering problems on multiphase flow and transport that are not provided in current advanced texts, monographs, or handbooks. The unique emphasis of this book is on the sound formulation of the basic equations describing multiphase transport and how they can be used to design processes in selected industrially important fields. The clear underlying mathematical and physical bases of the interdisciplinary description of multiphase flow and transport are the main themes, along with advances in the kinetic theory for particle flow systems. The book may be used as an upper-level undergraduate or graduate textbook, as a reference by professionals in the design of processes that deal with a variety of multiphase systems, and by practitioners and experts in multiphase science in the area of computational fluid dynamics (CFD) at U.S. national laboratories, international universities, research laboratories and institutions, and in the chemical, pharmaceutical, and petroleum industries. Distinct from other books on multiphase flow, this volume shows clearly how the basic multiphase equations can be used in the design and scale-up of multiphase processes. The authors represent a combination of nearly two centuries of experience and innovative application of multiphase transport representing hundreds of publications and several books. This book serves to encapsulate the essence of their wisdom and insight, and:

Theory of Dispersed Multiphase Flow

Mathematics Research Center Symposium: Theory of Dispersed Multiphase Flow covers the proceedings of an advanced seminar conducted by the Mathematics Research Center of the University of Wisconsin-Madison on May 26-28, 1982. The book focuses on solutions of long chain polymers in liquids, magnetic control of particle suspensions in fluid streams, aerosols, dense granular flows, and ice crystals or vapor bubbles dispersed in river waters. The selection first elaborates on the effects of interactions between particles on the rheology of dispersions; rheology of concentrated macromolecular solutions; and a survey of

results in the mathematical theory of fluidization. Discussions focus on Rayleigh-Taylor instabilities, linear instability theory, steady solutions, general theory for polymer solutions and suspensions, electrostatically concentrated suspensions, and pair interaction theories. The text then examines instability in settling of suspensions due to Brownian effects; enhanced sedimentation in vessels having inclined walls; and simple kinetic theory of Brownian diffusion in vapors and aerosols. The text takes a look at the simulation of aerosol dynamics, continuum modeling of two-phase flows, multiphase mixture theory for fluid-particle flows, and mixture theory for turbulent diffusion of heavy particles. Topics include plane gravity flow, decomposition and averaging, isothermal flows of dilute suspensions, kinematics and the equations of motion, diffusional regularization, kinematic waves, and aerosol formation and growth in uniform systems. The selection is a valuable source of data for researchers interested in the theory of dispersed multiphase flow.

Particulates And Continuum-Multiphase Fluid Dynamics

Treating multiphase systems with emphasis on the aspect of fluid dynamics and as an introduction to research in multiphase flow, this book covers definitive concepts, methods, and theories which have been validated by experimental results. A textbook for college seniors and graduate students and a research reference, it is a coherent presentation that facilitates the understanding of physical interactions. The book's focus is fluid dynamics, with extension to other transport processes of heat and mass transfer, and chemical relations to illustrate applications of multiphase flow. The exercise problems at the end of each chapter assist the reader in formulating and solving physical problems and gaining a sense of magnitude of interacting effects and events. Extended details and corollaries are also included in these exercise problems. Some of the topics in the exercise problems may also be incorporated as topics for the lectures.

Computational Methods in Multiphase Flow V

Together with turbulence, multiphase flow remains one of the most challenging areas of computational mechanics and experimental methods and numerous problems remain unsolved to date. Multiphase flows are found in all areas of technology, at all length scales and flow regimes. The fluids involved can be compressible or incompressible, linear or nonlinear. Because of the complexity of the problems, it is often essential to utilize advanced computational and experimental methods to solve the complex equations that describe them. Challenges in these simulations include modelling and tracking interfaces, dealing with multiple length scales, modelling nonlinear fluids, treating drop breakup and coalescence, characterizing phase structures, and many others. Experimental techniques, although expensive and difficult to perform, are essential to validate models. This book contains papers presented at the Fifth International Conference on Computational Methods in Multiphase Flow, which are grouped into the following topics: Multiphase Flow Simulation; Interaction of Gas, Liquids and Solids; Turbulent Flow; Environmental Multiphase Flow; Bubble and Drop Dynamics; Flow in Porous Media; Heat Transfer; Image Processing; Interfacial Behaviour.

Applied Mechanics Reviews

This book is for engineers and students to solve issues concerning the fluidized bed systems. It presents an analysis that focuses directly on the problem of predicting the fluid dynamic behavior which empirical data is limited or unavailable. The second objective is to provide a treatment of computational fluidization dynamics that is readily accessible to the non-specialist. The approach adopted in this book, starting with the formulation of predictive expressions for the basic conservation equations for mass and momentum using kinetic theory of granular flow. The analyses presented in this book represent a body of simulations and experiments research that has appeared in numerous publications over the last 20 years. This material helps to form the basis for university course modules in engineering and applied science at undergraduate and graduate level, as well as focused, post-experienced courses for the process, and allied industries.

Computational Fluid Dynamics and the Theory of Fluidization

Since the late 1970s there has been an explosion of industrial and academic interest in circulating fluidized beds. In part, the attention has arisen due to the environmental advantages associated with CFB (circulating . fluidized bed) combustion systems, the incorporation of riser reactors employing cir culating fluidized bed technology in petroleum refineries for fluid catalytic cracking and, to a lesser extent, the successes of CFB technology for calcina tion reactions and Fischer-Tropsch synthesis. In part, it was also the case that too much attention had been devoted to bubbling fluidized beds and it was time to move on to more complex and more advantageous regime,S of operation. Since 1980 a number of CFB processes have been commercialized. There have been five successful International Circulating Fluidized Bed Confer ences beginning in 1985, the most recent taking place in Beijing in May 1996. In addition, we have witnessed a host of other papers on CFB funda mentals and applications in journals and other archival publications. There have also been several review papers and books on specific CFB topics. However, there has been no comprehensive book reviewing the field and attempting to provide an overview of both fundamentals and applications. The purpose of this book is to fill this vacuum.

Computational heat and mass transfer – CHMT 2001- Vol. I

Address physical principles and unified theories governing multiphase flows, with methods, applications, and problems.

Circulating Fluidized Beds

This book analyses the use of a pulsed gas flow to structure bubbling gas-solid fluidised beds and to induce a special fluidisation state, called \"dynamically structured flow\

Dynamics of Multiphase Flows

Because of the importance of multiphase flows in a wide variety of industries, including power, petroleum, and numerous processing industries, an understanding of the behavior and underlying theoretical concepts of these systems is critical. Contributed by a team of prominent experts led by a specialist with more than thirty years of experience, the Multiphase Flow Handbook provides such an understanding, and much more. It covers all aspects of multiphase flows, from fundamentals to numerical methods and instrumentation. The book begins with an introduction to the fundamentals of particle/fluid/bubble interactions followed by gas/liquid flows and methods for calculating system parameters. It includes up-to-date information on practical industrial applications such as boiling and condensation, fluidized beds, aerosols, separation systems, pollution control, granular and porous media flow, pneumatic and slurry transport, and sprays. Coverage then turns to the most recent information on particle/droplet-fluid interactions, with a chapter devoted to microgravity and microscale flows and another on basic multiphase interactions. Rounding out the presentation, the authors discuss numerical methods, state-of-the art instrumentation, and advanced experimental techniques. Supplying up-to-date, authoritative information on all aspects of multiphase flows along with numerous problems and examples, the Multiphase Flow Handbook is the most complete reference available for understanding the flow of multiphase mixtures.

Dynamically Structured Flow in Pulsed Fluidised Beds

Fluid Dynamics is one of the most important topics of applied mathematics and physics. Together with complex flows and turbulence, multiphase flows remains one of the most challenging areas of computational mechanics, and even seemingly simple problems remain unsolved to date. Multiphase flows are found in all areas of technology, at all length scales and flow regimes. The fluids involved can be compressible or incompressible, linear or nonlinear. Because of the complexity of the problem, it is often essential to utilize advanced computational and experimental methods to solve the complex equations that describe them. Challenges in these simulations include nonlinear fluids, treating drop breakup and coalescence, characterizing phase structures, and many others.This volume brings together work presented at the Fourth

International Conference on Computational and Experimental Methods in Multiphase and Complex Flows. Featured topics include: Suspensions; Bubble and Drop Dynamics; Flow in Porous Media; Interfaces; Turbulent Flow; Injectors and Nozzles; Particle Image Velocimetry; Macroscale Constitutive Models; Large Eddy Simulation; Finite Volumes; Interface Tracking Methods; Biological Flows; Environmental Multiphase Flow; Phase Changes and Stochastic Modelling.

Multiphase Flow Handbook

There is increasing world-wide interest in obtaining an understanding of various multiphase flow phenomena and problems in terms of a common language of multiphase flow. This volume contains state-of-the-art papers which have been contributed from all over the world by experts working on all aspects of multiphase flows. The volume also highlights international technology-sharing in the fields of energy, environment and public health, in order to create a brighter and sustainable future for man and for all life in the next century. It is intended that this volume will serve as a major source of literature for the advancement of multiphase flow and allied fields.

Computational Methods in Multiphase Flow IV

This book presents the select proceedings of 5th International Conference on Mechanical Engineering (ICOME 2021). It discusses the recent challenges and trends in renewable energy in Asia. Various topics covered include electrical energy, new and renewable energy, energy engineering and management, fuels and combustion, turbomachinery, and HVAC. The book will be a valuable reference for students, researchers, and professionals interested in sustainable energy and allied fields.

Multiphase Flow 1995

This book covers the topic of multiphase flow in detail, providing clear explanations of the physics behind solid particles in fluids. It is illustrated with frequent worked examples and algorithms, enabling the reader to develop the required tools for simulating the flow of fluids with solid particles.

Recent Advances in Renewable Energy Systems

The contributions in this book address both the kinetic approach one using the Boltzmann equation for dissipative gases as well as the less established hydrodynamic description. The last part of the book is devoted to driven granular gases and their analogy with molecular fluids.

Multiphase Flow with Solid Particles

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Granular Gas Dynamics

\"This book provides various approaches to computational gas-solids flow and will aid the researchers, graduate students and practicing engineers in this rapidly expanding area\"--Provided by publisher.

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This book concerns the most up-to-date advances in computational transport phenomena (CTP), an emerging tool for the design of gas-solid processes such as fluidized bed systems. The authors examine recent work in kinetic theory and CTP and illustrate gas-solid processes’ many applications in the energy, chemical, pharmaceutical, and food industries. They also discuss the kinetic theory approach in developing constitutive

equations for gas-solid flow systems and how it has advanced over the last decade as well as the possibility of obtaining innovative designs for multiphase reactors, such as those needed to capture CO2 from flue gases. Suitable as a concise reference and a textbook supplement for graduate courses, Computational Transport Phenomena of Gas-Solid Systems is ideal for practitioners in industries involved with the design and operation of processes based on fluid/particle mixtures, such as the energy, chemicals, pharmaceuticals, and food processing.

Computational Gas-Solids Flows and Reacting Systems: Theory, Methods and Practice

This book closes the gap between Chemical Reaction Engineering and Fluid Mechanics. It provides the basic theory for momentum, heat and mass transfer in reactive systems. Numerical methods for solving the resulting equations as well as the interplay between physical and numerical modes are discussed. The book is written using the standard terminology of this community. It is intended for researchers and engineers who want to develop their own codes, or who are interested in a deeper insight into commercial CFD codes in order to derive consistent extensions and to overcome \"black box\" practice. It can also serve as a textbook and reference book.

Computational Transport Phenomena of Fluid-Particle Systems

This book puts forward the concept of the Diameter-Transformed Fluidized Bed (DTFB): a fluidized bed characterized by the coexistence of multiple flow regimes and reaction zones, achieved by transforming the bed into several sections of different diameters. It reviews fundamental aspects, including computational fluid dynamics simulations and industrial practices in connection with DTFB. In particular, it highlights an example concerning the development of maximizing iso-paraffins (MIP) reactors for regulating complex, fluid catalytic cracking reactions in petroleum refineries. The book is a must-have for understanding how academic and industrial researchers are now collaborating in order to develop novel catalytic processes.

Chemical Reactor Modeling

Multiphysics Modelling of Fluid-Particulate Systems provides an explanation of how to model fluid-particulate systems using Eulerian and Lagrangian methods. The computational cost and relative merits of the different methods are compared, with recommendations on where and how to apply them provided. The science underlying the fluid-particulate phenomena involves computational fluid dynamics (for liquids and gases), computational particle dynamics (solids), and mass and heat transfer. In order to simulate these systems, it is essential to model the interactions between phases and the fluids and particles themselves. This book details instructions for several numerical methods of dealing with this complex problem. This book is essential reading for researchers from all backgrounds interested in multiphase flows or fluid-solid modeling, as well as engineers working on related problems in chemical engineering, food science, process engineering, geophysics or metallurgical processing. Provides detailed coverage of Resolved and Unresolved Computational Fluid Dynamics - Discrete Element Method (CFD-DEM), Smoothed Particle Hydrodynamics, and their various attributes Gives an excellent summary of a range of simulation techniques and provides numerical examples Starts with a broad introduction to fluid-particulate systems to help readers from a range of disciplines grasp fundamental principles

Diameter-Transformed Fluidized Bed

This book explores the Energy Minimization Multi-scale (EMMS) theory and the drag model for heterogeneous gas-solid fluidized flows. The results show that the cluster density plays a critical role with regard to drag. A novel cluster model is proposed and indicates that the profile of cluster density is single-peaked with the maximum value located at solid concentrations of 0.1~0.15. The EMMS theory is improved with the cluster model and an accurate drag model is developed. The model’s universality is achieved by investigating the relationship between the heterogeneity and flow patterns. The drag model is subsequently

verified numerically and experimentally.

Multiphysics Modelling of Fluid-Particulate Systems

The purpose of this book is to introduce researchers and graduate students to a broad range of applications of computational simulations, with a particular emphasis on those involving computational fluid dynamics (CFD) simulations. The book is divided into three parts: Part I covers some basic research topics and development in numerical algorithms for CFD simulations, including Reynolds stress transport modeling, central difference schemes for convection-diffusion equations, and flow simulations involving simple geometries such as a flat plate or a vertical channel. Part II covers a variety of important applications in which CFD simulations play a crucial role, including combustion process and automobile engine design, fluid heat exchange, airborne contaminant dispersion over buildings and atmospheric flow around a re-entry capsule, gas-solid two phase flow in long pipes, free surface flow around a ship hull, and hydrodynamic analysis of electrochemical cells. Part III covers applications of non-CFD based computational simulations, including atmospheric optical communications, climate system simulations, porous media flow, combustion, solidification, and sound field simulations for optimal acoustic effects.

Investigations on Mesoscale Structure in Gas–Solid Fluidization and Heterogeneous Drag Model

This book tells the story of how the science of computational multiphase flow began in an effort to better analyze hypothetical light water power reactor accidents, including the “loss of coolant” accident. Written in the style of a memoir by an author with 40 years’ engineering research experience in computer modeling of fluidized beds and slurries, multiphase computational fluid dynamics, and multiphase flow, most recently at Argonne National Laboratory, the book traces how this new science developed during this time into RELAP5 and other computer programs to encompass realistic descriptions of phenomena ranging from fluidized beds for energy and chemicals production, slurry transport, pyroclastic flow from volcanoes, hemodynamics of blood-borne cells, and flow of granular particulates. Such descriptions are not possible using the classical single-phase Navier-Stokes equations. Whereas many books on computational techniques and computational fluid dynamics have appeared, they do not trace the historical development of the science in any detail, and none touch on the beginnings of multiphase science. A robust, process-rich account of technologic evolution, the book is ideal for students and practitioners of mechanical, chemical, nuclear engineering, and the history of science and technology.

Computational Simulations and Applications

Multiscale modeling is becoming essential for accurate, rapid simulation in science and engineering. This book presents the results of three decades of research on multiscale modeling in process engineering from principles to application, and its generalization for different fields. This book considers the universality of meso-scale phenomena for the first time, and provides insight into the emerging discipline that unifies them, meso-science, as well as new perspectives for virtual process engineering. Multiscale modeling is applied in areas including: multiphase flow and fluid dynamics chemical, biochemical and process engineering mineral processing and metallurgical engineering energy and resources materials science and engineering Jinghai Li is Vice-President of the Chinese Academy of Sciences (CAS), a professor at the Institute of Process Engineering, CAS, and leader of the EMMS (Energy-minimizing multiscale) Group. Wei Ge, Wei Wang, Ning Yang and Junwu Wang are professors at the EMMS Group, part of the Institute of Process Engineering, CAS. Xinhua Liu, Limin Wang, Xianfeng He and Xiaowei Wang are associate professors at the EMMS Group, part of the Institute of Process Engineering, CAS. Mooson Kwauk is an emeritus director of the Institute of Process Engineering, CAS, and is an advisor to the EMMS Group.

The History of Multiphase Science and Computational Fluid Dynamics

For the first time, a book is being edited to address how results from one scale can be shifted or related to another scale, say from macro to micro or vice versa. The new approach retains the use of the equilibrium mechanics within a scale level such that cross scale results can be connected by scale invariant criteria. Engineers in different disciplines should be able to understand and use the results.

From Multiscale Modeling to Meso-Science

A concise and clear treatment of the fundamentals of fluidization, with a view to its applications in the process and energy industries.

Multiscaling in Molecular and Continuum Mechanics: Interaction of Time and Size from Macro to Nano

This book presents select proceedings of Conference on Recent Trends in Fluid Dynamics Research (RTFDR-21). It signifies the current research trends in fluid dynamics and convection heat transfer for both laminar and turbulent flow structures. The topics covered include fluid mechanics and applications, microfluidics and nanofluidics, numerical methods for multiphase flows, cavitation, combustion, fluid-particle interactions in turbulence, biological flows, CFD, experimental fluid mechanics, convection heat transfer, numerical heat transfer, fluid power, experimental heat transfer, heat transfer, non-newtonian rheology, and boundary layer theory. The book also discusses various fundamental and application-based research of fluid dynamics, heat transfer, combustion, etc., by theoretical and experimental approaches. The book will be a valuable reference for beginners, researchers, and professionals interested in fluid dynamics research and allied fields.

Essentials of Fluidization Technology

Provides a comprehensive review on the brand-new development of several multiphase reactor techniques applied in energy-related processes Explains the fundamentals of multiphase reactors as well as the sophisticated applications Helps the reader to understand the key problems and solutions of clean coal conversion techniques Details the emerging processes for novel refining technology, clean coal conversion techniques, low-cost hydrogen productions and CO2 capture and storage Introduces current energy-related processes and links the basic principles of emerging processes to the features of multiphase reactors providing an overview of energy conversion in combination with multiphase reactor engineering Includes case studies of novel reactors to illustrate the special features of these reactors

Recent Trends in Fluid Dynamics Research

This book comprises the proceedings of the Annual Conference of the Canadian Society of Civil Engineering 2021. The contents of this volume focus on specialty conferences in construction, environmental, hydrotechnical, materials, structures, transportation engineering, etc. This volume will prove a valuable resource for those in academia and industry.

Multiphase Reactor Engineering for Clean and Low-Carbon Energy Applications

Granular materials are a special topic of recent research and are a milestone of science and technology. These materials are very simple: they are large conglomerations of discrete macroscopic particles. Granular materials have a broad area of development, which is growing rapidly day by day. Their impact on commercial applications and academia and education is huge. The basic points of this book are the important applications and properties of granular materials. For example, special mention is made of rheological points, shapes, and civil engineering aspects.

Proceedings of the Canadian Society of Civil Engineering Annual Conference 2021

A guide to the important chemical engineering concepts for the development of new drugs, revised second edition The revised and updated second edition of Chemical Engineering in the Pharmaceutical Industry offers a guide to the experimental and computational methods related to drug product design and development. The second edition has been greatly expanded and covers a range of topics related to formulation design and process development of drug products. The authors review basic analytics for quantitation of drug product quality attributes, such as potency, purity, content uniformity, and dissolution, that are addressed with consideration of the applied statistics, process analytical technology, and process control. The 2nd Edition is divided into two separate books: 1) Active Pharmaceutical Ingredients (API's) and 2) Drug Product Design, Development and Modeling. The contributors explore technology transfer and scale-up of batch processes that are exemplified experimentally and computationally. Written for engineers working in the field, the book examines in-silico process modeling tools that streamline experimental screening approaches. In addition, the authors discuss the emerging field of continuous drug product manufacturing. This revised second edition: Contains 21 new or revised chapters, including chapters on quality by design, computational approaches for drug product modeling, process design with PAT and process control, engineering challenges and solutions Covers chemistry and engineering activities related to dosage form design, and process development, and scale-up Offers analytical methods and applied statistics that highlight drug product quality attributes as design features Presents updated and new example calculations and associated solutions Includes contributions from leading experts in the field Written for pharmaceutical engineers, chemical engineers, undergraduate and graduation students, and professionals in the field of pharmaceutical sciences and manufacturing, Chemical Engineering in the Pharmaceutical Industry, Second Edition contains information designed to be of use from the engineer's perspective and spans information from solid to semi-solid to lyophilized drug products.

Granularity in Materials Science

This book gathers contributions on a variety of flowing collective systems. While primarily focusing on pedestrian dynamics, they also reflect the latest developments in areas such as vehicular traffic and granular flows and address related emerging topics such as self-propelled particles, data transport, swarm behavior, intercellular transport, and collective dynamics of biological systems. Combining fundamental research and practical applications in the various fields discussed, the book offers a valuable asset for researchers and practitioners alike.

Chemical Engineering in the Pharmaceutical Industry

This book is the result of a careful selection of contributors in the field of CFD. It is divided into three sections according to the purpose and approaches used in the development of the contributions. The first section describes the \"high-performance computing\" (HPC) tools and their impact on CFD modeling. The second section is dedicated to \"CFD models for local and large-scale industrial phenomena.\" Two types of approaches are basically contained here: one concerns the adaptation from global to local scale, - e.g., the applications of CFD to study the climate changes and the adaptations to local scale. The second approach, very challenging, is the multiscale analysis. The third section is devoted to \"CFD in numerical modeling approach for experimental cases.\" Its chapters emphasize on the numerical approach of the mathematical models associated to few experimental (industrial) cases. Here, the impact and the importance of the mathematical modeling in CFD are focused on. It is expected that the collection of these chapters will enrich the state of the art in the CFD domain and its applications in a lot of fields. This collection proves that CFD is a highly interdisciplinary research area, which lies at the interface of physics, engineering, applied mathematics, and computer science.

Traffic and Granular Flow 2019

Micro Fluidization: Fundamentals and Applications provides background and history on micro fluidized bed research and development, summarizes and analyzes the hydrodynamic characteristics of gas-solid micro fluidized beds, and delves into areas such as research results of delayed onsets of minimum, bubbling and slugging fluidization regimes, as well as of the advanced transitions to turbulent and fast fluidization regimes. Based on these results, the wall effects – the key mechanism resulting in the unique behavior of micro fluidization – are analyzed. Other sections discuss gas and solid mixing characteristics in terms of gas residence time distribution, gas backmixing, and solids mixing. Final sections focus on presentations of the so-called micro fluidized bed reaction analyzer (MFBRA) – a powerful tool for catalyst screening, process development, optimization of reaction parameters, studies of reaction mechanism and kinetics, among many other purposes. The book describes, in detail, the MFBRA's system design characteristics, analytic methodologies and various applications in thermochemical and catalytic reaction analysis. Includes up-to-date information (all related research results and insights) on micro fluidized beds, including how they are comprehensively summarized and analyzed Describes and explains the unique characteristics of micro fluidized beds Covers the fundamental aspects and applications related to gas-solids, liquid-solids, and gas-liquid-solids micro fluidized beds Provides up-to-date and potential applications of micro fluidized beds

Computational Fluid Dynamics

Advanced polymer-based nanocomposite materials continue to become increasingly popular and important for a wide range of engineering applications, as evidenced by continued government initiatives involving R&D and commercialization of these substances. In the race to exploit the unique mechanical, thermal, and electrical properties of nanocomposite materials, researchers must also address new challenges to predict, understand, and manage the potentially adverse effects they could have on human lives and the environment. Nano- and Biocomposites focuses on the structural makeup of nanomaterials and their range of applications. It details the latest research in which biological applications of nanostructural resins have been conducted within in vitro and in vivo environments. Some of the applications explored in this book include: Tissue engineering and growth Mechanical and thermal stability enhancement of biocompatible polymers for artificial joints and scaffolding Thermal management for directed energy weapons, deicing, and electronics Structural performance for primary and secondary airframe structures, jet engines Electrical conductivity for lightning-strike protection, EMI, ESD, and energy storage Durability for chemical, wear, flame retardance, permeability Health monitoring for NDE certification, damage detection, and long-term degradation This compilation of author contributions is divided into two sections—Nanostructured Polymer Composites and Nano-Bio Composites. It provides a basic understanding of nanomaterial and nanocomposite research to explain the fundamentals of how nanostructured fillers strengthen polymer-based materials. With an emphasis on how nano- and biocomposites are used to create new biomedical applications, the text also focuses on the crucial yet often-ignored potential toxicity impact of using nanostructured materials. It presents important guidelines and new insights to stimulate investigation of anticipated research in this fascinating new field. Researchers, scientists, and academics will appreciate this cutting-edge exploration of nanomaterials, biomaterials, and the ever-evolving world of nano-biomaterials.

Micro Fluidization

This book is an undertaking of a pioneering work of uniting three vast fields of interfacial phenomena, rheology and fluid mechanics within the framework of solid-liquid two phase flow. No wonder, much finer books will be written in the future as the visionary aims of many nations in combining molecular chemistry, biology, transport and interfacial phenomena for the fundamental understanding of processes and capabilities of new materials will be achieved. Solid-liquid systems where solid particles with a wide range of physical properties, sizes ranging from nano- to macro- scale and concentrations varying from very dilute to highly concentrated, are suspended in liquids of different rheological behavior flowing in various regimes are taken up in this book. Interactions among solid particles in molecular scale are extended to aggregations in the macro scale and related to settling, flow and rheological behavior of the suspensions in a coherent, sequential

manner. The classical concept of solid particles is extended to include nanoparticles, colloids, microorganisms and cellular materials. The flow of these systems is investigated under pressure, electrical, magnetic and chemical driving forces in channels ranging from macro-scale pipes to micro channels. Complementary separation and mixing processes are also taken under consideration with micro- and macro-scale counterparts. - Up-to-date including emerging technologies - Coherent, sequential approach - Wide scope: microorganisms, nanoparticles, polymer solutions, minerals, wastewater sludge, etc - All flow conditions, settling and non-settling particles, non-Newtonian flow, etc - Processes accompanying conveying in channels, such as sedimentation, separation, mixing

Nano- and Biocomposites

This book aims to face particles in flows from many different, but essentially interconnected sides and points of view. Thus the selection of authors and topics represented in the chapters, ranges from deep mathematical analysis of the associated models, through the techniques of their numerical solution, towards real applications and physical implications. The scope and structure of the book as well as the selection of authors was motivated by the very successful summer course and workshop \"Particles in Flows" that was held in Prague in the August of 2014. This meeting revealed the need for a book dealing with this specific and challenging multidisciplinary subject, i.e. particles in industrial, environmental and biomedical flows and the combination of fluid mechanics, solid body mechanics with various aspects of specific applications.

Solid-Liquid Two Phase Flow

Particles in Flows