

Fundamentals of Particle Technology

Richard Holdich



Particulate Systems Technology And Fundamentals

Hassan Khawaja, Mojtaba Moatamedi



Particulate Systems Technology And Fundamentals:

Introduction to Particle Technology Martin J. Rhodes, 2013-03-25 Particle technology is a term used to refer to the science and technology related to the handling and processing of particles and powders. The production of particulate materials with controlled properties tailored to subsequent processing and applications is of major interest to a wide range of industries including chemical and process food, pharmaceuticals, minerals and metals companies, and the handling of particles in gas and liquid solutions is a key technological step in chemical engineering. This textbook provides an excellent introduction to particle technology with worked examples and exercises. Based on feedback from students and practitioners worldwide, it has been newly edited and contains new chapters on slurry transport, colloids and fine particles, size enlargement, and the health effects of fine powders. Topics covered include: Characterization, Size Analysis, Processing, Granulation, Fluidization, Particle Formation, Granulation, Size Reduction, Storage and Transport, Hopper Design, Pneumatic Conveying, Standpipes, Slurry Flow, Separation, Filtration, Settling, Cyclones, Safety, Fire and Explosion Hazards, Health Hazards, Engineering the Properties of Particulate Systems, Colloids, Respirable Drugs, Slurry Rheology. This book is essential reading for undergraduate students of chemical engineering on particle technology courses. It is also valuable supplementary reading for students in other branches of engineering, applied chemistry, physics, pharmaceuticals, mineral processing, and metallurgy. Practitioners in industries in which powders are handled and processed may find it a useful starting point for gaining an understanding of the behavior of particles and powders. Review of the First Edition taken from *High Temperatures High Pressures* 1999 31 243 251. This is a modern textbook that presents clear cut knowledge. It can be successfully used both for teaching particle technology at universities and for individual study of engineering problems in powder processing.

Particle Technology and Engineering Jonathan P.K. Seville, Chuan-Yu Wu, 2016-05-20 Particle Technology and Engineering presents the basic knowledge and fundamental concepts that are needed by engineers dealing with particles and powders. The book provides a comprehensive reference and introduction to the topic ranging from single particle characterization to bulk powder properties, from particle-particle interaction to particle-fluid interaction, from fundamental mechanics to advanced computational mechanics for particle and powder systems. The content focuses on fundamental concepts, mechanistic analysis, and computational approaches. The first six chapters present basic information on properties of single particles and powder systems and their characterisation, covering the fundamental characteristics of bulk solids, powders, and building an understanding of density, surface area, porosity, and flow, as well as particle-fluid interactions, gas-solid and liquid-solid systems with applications in fluidization and pneumatic conveying. The last four chapters have an emphasis on the mechanics of particle and powder systems, including the mechanical behaviour of powder systems during storage and flow, contact mechanics of particles, discrete element methods for modelling particle systems, and finite element methods for analysing powder systems. This thorough guide is beneficial to undergraduates in chemical and other types of

engineering to chemical and process engineers in industry and early stage researchers It also provides a reference to experienced researchers on mathematical and mechanistic analysis of particulate systems and on advanced computational methods Provides a simple introduction to core topics in particle technology characterisation of particles and powders interaction between particles gases and liquids and some useful examples of gas solid and liquid solid systems Introduces the principles and applications of two useful computational approaches discrete element modelling and finite element modelling Enables engineers to build their knowledge and skills and to enhance their mechanistic understanding of particulate systems

Particulate Systems in Nano- and Biotechnologies Wolfgang Sigmund,Hassan El-Shall,Dinesh O. Shah,Brij M. Moudgil,2008-12-22 Despite the widespread growth and acceptance of particulate technology challenges in the design operation and manufacturing of these systems still exists These critical issues must be resolved so that particle technology may continue to serve as a foundation for new nano and biotechnologies Particulate Systems in Nano and Biotechnologies pres Unit Operations of Particulate Solids Enrique Ortega-Rivas,2016-04-19 Suitable for practicing engineers and engineers in training this book covers the most important operations involving particulate solids Through clear explanations of theoretical principles and practical laboratory exercises the text provides an understanding of the behavior of powders and pulverized systems It also helps readers develop skills for operating optimizing and innovating particle processing technologies and machinery in order to carry out industrial operations The author explores common bulk solids processing operations including milling agglomeration fluidization mixing and solid fluid separation *Particulate Systems* John K. Beddow,1983 **Processing of Particulate Solids** J.P. Seville,Ugammaur Tüzün,R. Clift,2012-12-06 Over half of the products of the chemical and process industries are sold in a particulate form The range of such products is vast from agrochemicals to pigments from detergents to foods from plastics to pharmaceuticals However surveys of the performance of processes designed to produce particulate products have consistently shown inadequate design and poor reliability Particle technology is a new subject facing new challenges Chemical and process engineering is becoming less concerned with the design of plants to produce generic simple chemicals which are often single phase fluids and is now more concerned with speciality effect chemicals which may often be in particulate form Chemical and process engineers are also being recruited in increasing numbers into areas outside their traditional fields such as the food industry pharmaceuticals and the manufacture of a wide variety of consumer products This book has been written to meet their needs It provides comprehensive coverage of the technology of particulate solids in a form which is both accessible and concise enough to be useful to engineering and science students in the final year of an undergraduate degree and at Master s level Although it was written with students of chemical engineering in mind it will also be of use and interest to students of other disciplines It comprises an account of the fundamentals of teh subject illustrated by worked examples and followed by a wide range of selected applications **Multiphysics Modelling of Fluid-Particulate Systems** Hassan Khawaja,Mojtaba

Moatamedi,2020-03-14 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 *NBS Special Publication* ,1968 *Population Balances* Doraiswami Ramkrishna,2000-08-08 Engineers encounter particles in a variety of systems The particles are either naturally present or engineered into these systems In either case these particles often significantly affect the behavior of such systems This book provides a framework for analyzing these dispersed phase systems and describes how to synthesize the behavior of the population particles and their environment from the behavior of single particles in their local environments Population balances are of key relevance to a very diverse group of scientists including astrophysicists high energy physicists geophysicists colloid chemists biophysicists materials scientists chemical engineers and meteorologists Chemical engineers have put population balances to most use with applications in the areas of crystallization gas liquid liquid liquid and solid liquid dispersions liquid membrane systems fluidized bed reactors aerosol reactors and microbial cultures Ramkrishna provides a clear and general treatment of population balances with emphasis on their wide range of applicability New insight into population balance models incorporating random particle growth dynamic morphological structure and complex multivariate formulations with a clear exposition of their mathematical derivation is presented Population Balances provides the only available treatment of the solution of inverse problems essential for identification of population balance models for breakage and aggregation processes particle nucleation growth processes and more This book is especially useful for process engineers interested in the simulation and control of particulate systems Additionally comprehensive treatment of the stochastic formulation of small systems provides for the modeling of stochastic systems with promising new areas of applications such as the design of sterilization systems and radiation treatment of cancerous tumors A clear and general treatment of population balances with emphasis on their wide range of applicability Thus all processes involving solid fluid and liquid liquid dispersions biological populations etc are encompassed Provides new

insight into population balance models incorporating random particle growth dynamic morphological structure and complex multivariate formulations with a clear exposition of their mathematical derivation Presents a wide range of solution techniques Monte Carlo simulation methods with a lucid exposition of their origin and scope for enhancing computational efficiency An account of self similar solutions of population balance equations and their significance to the treatment of data on particulate systems The only available treatment of the solution of inverse problems essential for identification of population balance models for breakage and aggregation processes particle nucleation and growth processes and so on A comprehensive treatment of the stochastic formulation of small systems with several new applications

Chemical Engineering Volume 2 J H Harker, J R Backhurst, J.F. Richardson, 2013-10-22 Chemical Engineering Volume 2 covers the properties of particulate systems including the character of individual particles and their behaviour in fluids Sedimentation of particles both singly and at high concentrations flow in packed and fluidised beds and filtration are then examined The latter part of the book deals with separation processes such as distillation and gas absorption which illustrate applications of the fundamental principles of mass transfer introduced in Chemical Engineering Volume 1 In conclusion several techniques of growing importance adsorption ion exchange chromatographic and membrane separations and process intensification are described A logical progression of chemical engineering concepts volume 2 builds on fundamental principles contained in Chemical Engineering volume 1 and these volumes are fully cross referenced Reflects the growth in complexity and stature of chemical engineering over the last few years Supported with further reading at the end of each chapter and graded problems at the end of the book

Granular Dynamics, Contact Mechanics and Particle System Simulations Colin Thornton, 2015-09-03 This book is devoted to the Discrete Element Method DEM technique a discontinuum modelling approach that takes into account the fact that granular materials are composed of discrete particles which interact with each other at the microscale level This numerical simulation technique can be used both for dispersed systems in which the particle particle interactions are collisional and compact systems of particles with multiple enduring contacts The book provides an extensive and detailed explanation of the theoretical background of DEM Contact mechanics theories for elastic elastic plastic adhesive elastic and adhesive elastic plastic particle particle interactions are presented Other contact force models are also discussed including corrections to some of these models as described in the literature and important areas of further research are identified A key issue in DEM simulations is whether or not a code can reliably simulate the simplest of systems namely the single particle oblique impact with a wall This is discussed using the output obtained from the contact force models described earlier which are compared for elastic and inelastic collisions In addition further insight is provided for the impact of adhesive particles The author then moves on to provide the results of selected DEM applications to agglomerate impacts fluidised beds and quasi static deformation demonstrating that the DEM technique can be used i to mimic experiments ii explore parameter sweeps including limiting values or iii identify new previously unknown phenomena

at the microscale In the DEM applications the emphasis is on discovering new information that enhances our rational understanding of particle systems which may be more significant than developing a new continuum model that encompasses all microstructural aspects which would most likely prove too complicated for practical implementation The book will be of interest to academic and industrial researchers working in particle technology process engineering and geomechanics both experimentalists and theoreticians

Handbook of Conveying and Handling of Particulate Solids A. Levy, Christopher J Kalman, 2001-10-22 This handbook presents comprehensive coverage of the technology for conveying and handling particulate solids Each chapter covers a different topic and contains both fundamentals and applications Usually each chapter or a topic within a chapter starts with one of the review papers Chapter 1 covers the characterization of the particulate materials Chapter 2 covers the behaviour of particulate materials during storage and presents recent developments in storage and feeders design and performance Chapter 3 presents fundamental studies of particulate flow while Chapters 4 and 5 present transport solutions and the pitfalls of pneumatic slurry and capsule conveying Chapters 6 7 and 8 cover both the fundamentals and development of processes for particulate solids starting from fluidisation and drying segregation and mixing and size reduction and enlargement Chapter 9 presents environmental aspects and the classification of the particulate materials after they have been handled by one of the above mentioned processes Finally Chapter 10 covers applications and developments of measurement techniques that are the heart of the analysis of any conveying or handling system

Design and Processing of Particulate Products Jim Litster, 2016-10-20 A unique text providing comprehensive coverage of fundamental particle science processing and technology Including quantitative tools real world case studies and end of chapter problems it is ideal for students in engineering and applied sciences as well as for practitioners in a range of industries manufacturing particulate products

Theory and Application of Morphological Analysis David W. Luerkens, 1991-07-24 This book is one in a series dedicated to fine particle science and technology Topics covered in the book include the role of definitions concepts hypothesis and laws morphological analysis of fine particles and surfaces analytical three dimensional representations of particle and surface morphologies the problem of invariance with respect to rotational transformations as well as transformations characterized by reflection and inversion matrix mechanics of particle characterization and general applications of morphological analysis in other areas of science

Non-Newtonian Flow R. P. Chhabra, J.F. Richardson, 1999-08-19 Non Newtonian materials are encountered in virtually all of the chemical and process industries and a full understanding of their nature and flow characteristics is an essential requirement for engineers and scientists involved in their formulation and handling This book will bridge the gap between much of the highly theoretical and mathematically complex work of the rheologist and the practical needs of those who have to design and operate plants in which these materials are handled and processed At the same time numerous references are included for the benefit of those who need to delve more deeply into the subject The starting point for any work on non newtonian fluids is their

characterisation over the range of conditions to which they are likely to be subjected during manufacture or utilisation and this topic is treated early on in the book in a chapter commissioned from an expert in the field of rheological measurements Coverage of topics is extensive and this book offers a unique and rich selection of material including the flow of single phase and multiphase mixtures in pipes in packed and fluidised bed systems heat and mass transfer in boundary layers and in simple duct flows and mixing etc An important and novel feature of the book is the inclusion of a wide selection of worked examples to illustrate the methods of calculation It also incorporates a large selection of problems for the reader to tackle himself

Catalyst Engineering Technology Jean W. L. Beeckman, 2020-08-18 This book gives a comprehensive explanation of what governs the breakage of extruded materials and what techniques are used to measure it The breakage during impact aka collision is explained using basic laws of nature allowing readers to determine the handling severity of catalyst manufacturing equipment and the severity of entire plants This information can then be used to improve on the architecture of existing plants and how to design grass roots plants The book begins with a summary of particle forming techniques in the particle technology industry It covers extrusion technology in more detail since extrusion is one of the workhorses for particle manufacture A section is also dedicated on how to describe transport and chemical reaction in such particulates for of course their final use It presents the fundamentals of the study of breakage by relating basic laws in different fields mechanics and physics and this leads to two novel dimensionless groups that govern breakage These topics are then apply these topics to R D scale up and manufacturing and shows how this approach is directly applicable

Powder Technology Hiroaki Masuda, Ko Higashitani, Hideto Yoshida, 2006-11-29 Drawing from the third edition of the bestselling Powder Technology Handbook this book is focused solely on analyzing the fundamental properties and behavior of particles and particle beds Powder Technology Fundamentals of Particles Powder Beds and Particle Generation concentrates on the most useful analytical methods of o

Concepts of Chemical Engineering for Chemists Stefaan Simons, 2019-03-15 Based on a former popular course of the same title Concepts of Chemical Engineering for Chemists outlines the basic aspects of chemical engineering for chemistry professionals It clarifies the terminology used and explains the systems methodology approach to process design and operation for chemists with limited chemical engineering knowledge The book provides practical insights into all areas of chemical engineering with well explained worked examples and case studies The new edition contains a revised chapter on Process Analysis and two new chapters Process and Personal Safety and Systems Integration and Experimental Design the latter drawing together material covered in the previous chapters so that readers can design and test their own pilot process systems This book is a guide for chemists and other scientists who either work alongside chemical engineers or who are undertaking chemical engineering type projects and who wish to communicate with their colleagues and understand chemical engineering principles

Introduction to Particle Technology Martin J. Rhodes, Jonathan Seville, 2024-05-16 INTRODUCTION TO PARTICLE TECHNOLOGY A new edition of the indispensable guide

to particulates and powders Particle technology concerns the formation processing and properties of the particles and powders which make up many of the products that surround us Such products range from the cement and aggregate in the built environment to pharmaceuticals and processed foods Most of the process industries involve particles either as essential components such as catalysts or as intermediate or final products and minerals such as the rare earths that are generally mined and processed in particulate form Particles can have many beneficial uses but they can also cause harm in the environment and through inhalation to the individual In all cases the powder properties particularly particle size are crucially important This well known textbook now in its 3rd edition provides an easily understood introduction to the underlying scientific principles of particle technology together with examples of how these principles can be used in practical design and operation of industrial processes Each chapter contains both worked examples and exercises for the student Based on feedback from students and users of the earlier editions this revised and expanded text includes introductory chapters on particles as products and on computational methods The topics have been selected to give coverage of the broad areas of particle technology and include Characterization size analysis surface area Processing granulation fluidization Particle formation granulation crystallisation tableting size reduction Storage and transport hopper design pneumatic conveying standpipes Separation filtration settling cyclones Safety fire and explosion hazards health hazards Engineering the properties of particulate systems to achieve desired product performance Discrete element modelling of particulate systems Introduction to Particle Technology 3rd Edition is essential reading for students of chemical engineering The text is also recommended reading for students of mechanical engineering applied chemistry pharmaceutics physics mineral processing and metallurgy and is an excellent source for practising engineers and scientists looking to establish a working knowledge of the subject Publications of the National Bureau of Standards ... Catalog United States. National Bureau of Standards,1983

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