

mole balances in ideal reactors for three common reactor types, energy balances in ideal reactors, and chemical reaction kinetics. The text also presents an introduction to nonideal reactors, and explores kinetics and reactors in catalytic systems. The book assumes that readers have some knowledge of thermodynamics, numerical methods, heat transfer, and fluid flow. The authors include an appendix for numerical methods, which are essential to solving most realistic problems in chemical reaction engineering. They also provide numerous worked examples and additional problems in each chapter. Given the significant number of chemical engineers involved in chemical process plant operation at some point in their careers, this book offers essential training for interpreting chemical reactor performance and improving reactor operation. What’s New in This Edition: Five new chapters on catalytic reaction engineering, including various catalytic reactions and kinetics, transport processes, and experimental methods Expanded coverage of adsorption Additional worked problems Reorganized material

The Omnibook aims to present the main ideas of reactor design in a simple and direct way. it includes key formulas, brief explanations, practice exercises, problems from experience and it skims over the field touching on all sorts of reaction systems. Most important of all it tries to show the reader how to approach the problems of reactor design and what questions to ask. In effect it tries to show that a common strategy threads its way through all reactor problems, a strategy which involves three factors: identifying the flow patter, knowing the kinetics, and developing the proper performance equation. It is this common strategy which is the heart of Chemical Reaction Engineering and identifies it as a distinct field of study.

The proceedings of the 20th International Conference on Fluidized Bed Combustion (FBC) collect 9 plenary lectures and 175 peer-reviewed technical papers presented in the conference held in Xi’an China in May 18-21,2009. The conference was the 20th conference in a series, covering the latest fundamental research results, as well as the application experience from pilot plants, demonstrations and industrial units regarding to the FBC science and technology. It was co-hosted by Tsinghua University, Southeast University, Zhejiang University, China Electricity Council and Chinese Machinery Industry Federation. A particular feature of the proceedings is the balance between the papers submitted by experts from industry and the papers submitted by academic researchers, aiming to bring academic knowledge to application as well as to define new areas for research. The authors of the proceedings are the most active researchers, technology developers, experienced and representative facility operators and manufacturers. They presented the latest research results, state-of-the-art development and projects, and the useful experience. The proceedings are divided into following sections: • CFB Boiler Technology, Operation and Design • Fundamental Research on Fluidization and Fluidized Combustion • C02 Capture and Chemical Looping • Gasification • Modeling and Simulation on FBC Technology • Environments and Pollutant Control • Sustainable Fuels The proceedings can be served as idea references for researchers, engineers, academia and graduate students, plant operators, boiler manufacturers, component suppliers, and technical managers who work on FBC fundamental research, technology development and industrial application.

Handbook of Petrochemical Processes

Fluid Catalytic Cracking Handbook

Chemical Looping Systems for Fossil Energy Conversions

Handbook of Gasification Technology

Proceedings of the Seminar on Experimental Approaches in Pyrometallurgical Research.

This text provides a teachable and readable approach to transport phenomena (momentum, heat, and mass transport) by providing numerous examples and applications, which are particularly important to metallurgical, ceramic, and materials engineers. Because the authors feel that it is important for students and practicing engineers to visualize the physical situations, they have attempted to lead the reader through the development and solution of the relevant differential equations by applying the familiar principles of conservation to numerous situations and by including many worked examples in each chapter. The book is organized in a manner characteristic of other texts in transport phenomena. Section I deals with the properties and mechanics of fluid motion; Section II with thermal properties and heat transfer; and Section III with diffusion and mass transfer. The authors depart from tradition by building on a presumed understanding of the relationships between the structure and properties of matter, particularly in the chapters devoted to the transport properties (viscosity, thermal conductivity, and the diffusion coefficients). In addition, generous portions of the text, numerous examples, and many problems at the ends of the chapters apply transport phenomena to materials processing.

Advanced Heat Transfer, Second Edition provides a comprehensive presentation of intermediate and advanced heat transfer, and a unified treatment including both single and multiphase systems. It provides a fresh perspective, with coverage of new emerging fields within heat transfer, such as solar energy and cooling of microelectronics. Conductive, radiative and convective modes of heat transfer are presented, as are phase change modes. Using the latest solutions methods, the text is ideal for the range of engineering majors taking a second-level heat transfer course/module, which enables them to succeed in later coursework in energy systems, combustion, and chemical reaction engineering.

Rotary reactors or rotary kilns are the reactors facilitating the chemical reaction between the gas and solid phases usually at high temperatures. This book, which is written by an expert in the field, describes the principles of the rotary reactor and the mode of its operation. These reactors are widely used in various chemical process industries (food, pharmaceuticals) and metallurgical industries. The book defines the physicochemical aspects of the rotart reactors and provides theoretical equations of their operation. The first part of this book presents the fundamentals; solid movement, conversion of solids, and heat transfer. The middle part of the book applies these equations to a variety of processes which have been developed so far, and shows how they are used. In its last part, conceptual designs of novel rotary reactors are proposed, which performance characteristics are predicted on the basis of above equations, especially, in gasification of solid wastes. - Defines the rotary reactors and their mode of operation. - Defines all operating parameters and gives equations to predict the operation of rotary reactors under various conditions. - Includes a number of practical examples from various industrial applications (metallurgical waste treatment etc).

Provides a holistic approach to multiphase catalytic reactors from their modeling and design to their applications in industrial manufacturing of chemicals Covers theoretical aspects and examples of fixed-bed, fluidized-bed, trickle-bed, slurry, monolith and microchannel reactors Includes chapters covering experimental techniques and practical guidelines for lab-scale testing of multiphase reactors Includes mathematical content focused on design equations and empirical relationships characterizing different multiphase reactor types together with an assortment of computational tools Involves detailed coverage of multiphase reactor applications such as Fischer-Tropsch synthesis, fuel processing for fuel cells, hydrotreating of oil fractions and biofuels processing

Computational Methods in Multiphase Flow V

Engineering Flow and Heat Exchange

Butterworths Series in Chemical Engineering

32nd European Symposium on Computer Aided Process Engineering

Reaction Kinetics for Chemical Engineers

Reaction Kinetics for Chemical Engineers focuses on chemical kinetics, including homogeneous reactions, nonisothermal systems, flow reactors, heterogeneous processes, granular beds, catalysis, and scale-up methods. The publication first takes a look at fundamentals and homogeneous isothermal reactions. Topics include simple reactions at constant volume or pressure, material balance in complex reactions, homogeneous catalysis, effect of temperature, energy of activation, law of mass action, and classification of reactions. The book also elaborates on adiabatic and programmed reactions, continuous stirred reactors, and homogeneous flow reactions. Topics include nonisothermal flow reactions, semiflow processes, tubular-flow reactors, material balance in flow problems, types of flow processes, rate of heat input, constant heat-transfer coefficient, and nonisothermal conditions. The text ponders on uncatalyzed heterogeneous reactions, fluid-phase reactions catalyzed by solids, and fixed and fluidized beds of particles. The transfer processes in granular masses, fluidization, heat and mass transfer, adsorption rates and equilibria, diffusion and combined mechanisms, diffusive mass transfer, and mass-transfer coefficients in chemical reactions are discussed. The publication is a dependable source of data for chemical engineers and readers wanting to explore chemical kinetics.

This thoroughly updated edition of Fluid Catalytic Cracking Handbook provides practical information on the design, operation, troubleshooting, and optimization of fluid catalytic cracking (FCC) facilities. Based on the author's years of field experience, this expanded, second edition covers the latest technologies to improve the profitability and reliability of the FCC units, and provides several "no-to-low-cost" practical recommendations. A new chapter supplies valuable recommendations for debottlenecking and optimizing the performance of cat cracker operations.

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.

The authors have written a practical introductory text exploring the theory and applications of unit operations for environmental engineers that is a comprehensive update to Linvil Rich’s 1961 classic work, “Unit Operations in Sanitary Engineering”. The book is designed to serve as a training tool for those individuals pursuing degrees that include courses on unit operations. Although the literature is inundated with publications in this area emphasizing theory and theoretical derivations, the goal of this book is to present the subject from a strictly pragmatic introductory point-of-view, particularly for those individuals involved with environmental engineering. This book is concerned with unit operations, fluid flow, heat transfer, and mass transfer. Unit operations, by definition, are physical processes although there are some that include chemical and biological reactions. The unit operations approach allows both the practicing engineer and student to compartmentalize the various operations that constitute a process, and emphasizes introductory engineering principles so that the reader can then satisfactorily predict the performance of the various unit operation equipment.

Butterworths Monographs in Chemical Engineering

Gas-Liquid-Solid Fluidization Engineering

Concepts of Chemical Engineering for Chemists (Second Edition)

Fluidization Dynamics

Combustion Engineering, Second Edition

Multiphase flows, which can involve compressible or incompressible linear or nonlinear, fluids, Are found in all areas of technology, at all length scales and flow regimes. In spite of their ubiquitousness, however multiphase flow continues to be one of the most challenging areas of computational mechanics and experimental methods, with numerous problems remaining unsolved to date. Because the multiphase flow problems are so complex, advanced computational and experimental methods are often required to solve the equations that describe them. The many hallenges include modelling nonlinear fluids, modelling and tracking interfaces, dealing with multiple length scales, characterizing phase structures, and treating drop breakup and coalescence. Models must be validated, which requires the use of expensive and difficult experimental techniques. This book presents contributions on the latest research in these techniques, presented at the sixth in a biennial series of conferences on the subject that began in 2001. Featured topics include: Bubble and drop dynamics, Flow in porous media, Turbulent flow, Multiphase flow simulation, Image processing, Heat transfer, Interaction of gases, liquids and solids, Interface behaviour, Small scale phenomena, Atomization processes, and Liquid film behaviour.

Professor Levenspiel's text remains the most practical volume available on the design of heat transfer equipment - an excellent introduction to real-world applications for advanced undergraduates and an indispensable reference for professionals. Each chapter includes illustrative examples and problems.

This book provides a comprehensive mechanistic interpretation of the transport phenomena involved in various basic modes of gas-liquid-solid fluidization. These modes include, for example, those for three-phase fluidized beds, slurry columns, turbulent contact absorbers, and three-phase fluidized beds, slurry columns, turbulent contact absorbers, and three-phase transport. It summarizes the empirical correlations useful for predicting transport properties for each mode of of operation. Gas-Liquid-Solid Fluidization Engineering provides a comprehensive account of the state-of-the-art applications of the three-phase fluidization systems that are important in both small-and large-scale operations. These applications include fermentation, biological wastewater treatment, flue gas desulfurization and particulates removal, and resid hydrotreating. This book highlights the industrial implications of these applications. In addition, it discusses information gaps and future directions for research in this field.

Gasification is one of the most important advancements that has ever occurred in energy production. Using this technology, for example, coal can be gasified into a product that has roughly half the carbon footprint of coal. On a large scale, gasification could be considered a revolutionary development, not only prolonging the life of carbon-based fuels, but making them “greener” and cleaner. As long as much of the world still depends on fossil fuels, gasification will be an environmentally friendlier choice for energy production. But gasification is not just used for fossil fuels. Waste products that would normally be dumped into landfills or otherwise disposed of can be converted into energy through the process of gasification. The same is true of biofeedstocks and other types of feedstocks, thus making another argument for the widespread use of gasification. The Handbook of Gasification Technology covers all aspects of the gasification, in a “one-stop shop,” from the basic science of gasification and why it is needed to the energy sources, processes, chemicals, materials, and machinery used in the technology. Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook, this outstanding new volume is a must-have for any library.

Second Edition

Circulating Fluidized Bed Boilers

21st European Symposium on Computer Aided Process Engineering

Principles, Practice and Economics of Plant and Process Design

Computational Methods in Multiphase Flow VI

Focuses on the major research developments which are pertinent to engineers concerned with predictive methods and design of fluidization beds.

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.

Multiphase Reactive Flows

Advanced Heat Transfer

Transport Phenomena in Materials Processing

Introduction to Chemical Reactor Analysis, Second Edition