Skelland Mass Transfer Solution

Handbook of Separation Process TechnologyJohn Wiley & Sons

A modern separation process textbook written for advanced undergraduate and graduate level courses in chemical engineering.

A problem-solving approach that helps students master new material and put their knowledge into practice The Second Edition of the acclaimed Principles and Modern Applications of Mass Transfer Operations continues to provide a thorough, accessible text that gives students the support and the tools they need to quickly move from theory to application. This latest edition has been thoroughly revised and updated with new discussions of such developing topics as membrane separations, ion exchange, multistage batch distillation, and chromatography and other adsorptive processes. Moreover, the Second Edition now covers mass transfer phenomena in biological systems, making the text appropriate for students in biochemical engineering as well as chemical engineering. Complementing the author's clear discussions are several features that help students quickly master new material and put their knowledge into practice, including: Twenty-five to thirty problems at the end of each chapter that enable students to use their newfound knowledge to solve problems Examples and problems that help students become proficient working with Mathcad Figures and diagrams that illustrate and clarify complex concepts and processes References facilitating further in-depth research into particular topics Ten appendices filled with helpful data and reference materials Ideal for a first course in mass transfer operations, this text has proven to be invaluable to students in chemical and environmental engineering as well as researchers and university faculty.

This textbook is targetted to undergraduate students in chemical engineering, chemical technology, and biochemical engineering for courses in mass transfer, separation processes, transport processes, and unit operations. The principles of mass transfer, both diffusional and convective have been comprehensively discussed. The application of these principles to separation processes is explained. The more common separation processes used in the chemical industries are individually described in separate chapters. The book also provides a good understanding of the construction, the operating principles, and the selection criteria of separation equipment. Recent developments in equipment have been included as far as possible. The procedure of equipment design and sizing has been illustrated by simple examples. An overview of different applications and aspects of membrane separation has also been provided. 'Humidification and water cooling', necessary in every process indus-try, is also described. Finally, elementary principles of 'unsteady state diffusion' and mass transfer accompanied by a chemical reaction are covered. SALIENT FEATURES : • A balanced coverage of theoretical principles and applications. • Important recent developments in mass transfer equipment and practice are included. • A large number of solved problems of varying levels of complexities showing the applications. of the theory are included. • Many end-chapter exercises. • Chapter-wise multiple choice questions. • An Instructors manual for the teachers.

Handbook of Industrial Mixing will explain the difference and uses of a variety of mixers including gear mixers, top entry mixers, side entry mixers, bottom entry mixers, on-line mixers, and submerged mixers The Handbook discusses the trade-offs among various mixers, concentrating on which might be considered for a particular process. Handbook of Industrial Mixing explains industrial mixers in a clear concise manner, and also: * Contains a CD-ROM with video clips showing different type of mixers in action and a overview of their uses. * Gives practical insights by the top professional in the field. * Details applications in key industries. * Provides the professional with information he did receive in school

This excellent monograph by two experts presents a generalized and systematic approach to the analytic solution of seven different classes of linear heat and mass diffusion problems. 1984 edition.

"This investigation was carried out to check the accuracy of the eigenvalues, $[lambda][subscript n]$, calculated by Wellek and Skelland, using some method other than the Rayleigh-Ritz technique and also, to determine the coefficients, $B[subscript n]$ in series solution, which were not calculated before. The eigenvalues were obtained by trial and error procedure using the standard Runge-Kutta method. The coefficients $B[subscript n]$ were obtained by using eigenvalues. By using this information the fractional extraction was calculated as a function of droplet contact time. The Wellek-Skelland modification was also solved by finite difference technique to compute fraction extracted as a function of contact time. The eigenvalues, $[lambda][subscript n]$, and coefficients, $B[subscript n]$, were also obtained by Hamming's method, and the values agreed with those obtained by the Runge-Kutta method to within 2%. The first eigenvalues obtained by Wellek and Skelland and the values obtained by the author were in agreement to within 5%. The family of curves of $E[subscript m]$ versus bt, obtained using finite difference method, is in agreement with the physical situation. Therefore, at the higher values of bt (> 0. 5) results observed using Runge-Kutta method should be used,and at lower values of bt (

This book has been written with the idea of providing the fundamentals for those who are interested in the field of heat transfer to non-Newtonian fluids. It is well recognized that non-Newtonian fluids are encountered in a number of transport processes and estimation of the heat transfer characteristics in the presence of these fluids requires analysis of equations that are far more complex than those encountered for Newtonian fluids. A deliberate effort has been made to demonstrate the methods of simplification of the complex equations and to put forth analytical expressions for the various heat transfer situations in as vivid a manner as possible. The book covers a broad range of topics from forced, natural and mixed convection without and with porous media. Laminar as well as turbulent flow heat transfer to non-Newtonian fluids have been treated and the criterion for transition from laminar to turbulent flow for natural convection has been established. The heat transfer characteristics of non-Newtonian fluids from inelastic power-law fluids to viscoelastic second-order fluids and mildly elastic drag reducing fluids are covered. This book can serve the needs of undergraduates, graduates and industry personnel from the fields of chemical engineering, material science and engineering, mechanical engineering and polymer engineering.

Offers in-depth coverage of the latest advances in new and traditional separation technologies as they are used in a variety of ways to produce value-added products. Examines both fundamental and applied aspects of separation techniques.

Part II covers applications in greater detail. The three transport phenomena--heat, mass, and momentum transfer--are treated in depth through simultaneous (or parallel) developments.

Liquid Membranes: Principles and Applications in Chemical Separations and Wastewater Treatment discusses the principles and applications of the liquid membrane (LM) separation processes in organic and inorganic chemistry, analytical chemistry, biochemistry, biomedical engineering, gas separation, and wastewater treatment. It presents updated, useful, and systematized information on new LM separation technologies, along with new developments in the field. It provides an overview of LMs and LM processes, and it examines the mechanisms and kinetics of carrier-facilitated transport through LMs. It also discusses active transport, driven by oxidation-reduction, catalytic, and

bioconversion reactions on the LM interfaces; modifications of supported LMs; bulk aqueous hybrid LM processes with water-soluble carriers; emulsion LMs and their applications; and progress in LM science and engineering. This book will be of value to students and young researchers who are new to separation science and technology, as well as to scientists and engineers involved in the research and development of separation technologies, LM separations, and membrane reactors. - Provides comprehensive knowledge-based information on the principles and applications of a variety of liquid membrane separation processes. - Contains a critical analysis of new technologies published in the last 15 years.

Based on papers presented at a conference on food engineering, this book addresses the whole food production process, from receiving the raw materials through to packaging and distribution. Major themes are the opportunities/limitations afforded by the application of modern computer technology.

Food Engineering: Principles and Selected Applications explores the principles of food engineering that are needed for resolving problems of food processing and preservation. This book is divided into 11 chapters that provide numerous effective examples and discussions of unique aspects of the food industry, which utilize these principles. This book discusses first the boiling heat transfer and the multi-effect principle for evaporators, as well as the application of this principle to the special problems involved in evaporation of liquid foods. The subsequent chapters cover the principles of fluid dynamics and axial dispersion. The discussion then shifts to the effect of residence-time distribution on continuous sterilization processes. The concluding chapters examine the concepts of water activity and its effect upon various reactions important to food processing and quality. This book is intended for both students and practicing food engineers and technologists.

With a detailed analysis of the mass transport through membrane layers and its effect on different separation processes, this book provides a comprehensive look at the theoretical and practical aspects of membrane transport properties and functions. Basic equations for every membrane are provided to predict the mass transfer rate, the concentration distribution, the convective velocity, the separation efficiency, and the effect of chemical or biochemical reaction taking into account the heterogeneity of the membrane layer to help better understand the mechanisms of the separation processes. The reader will be able to describe membrane separation processes and the membrane reactors as well as choose the most suitable membrane structure for separation and for membrane reactor. Containing detailed discussion of the latest results in transport processes and separation processes, this book is essential for chemistry students and practitioners of chemical engineering and process engineering. Detailed survey of the theoretical and practical aspects of every membrane process with specific equations Practical examples discussed in detail with clear steps Will assist in planning and preparation of more efficient membrane structure separation

Clear and complete description of diffusion in fluids, for undergraduate students in chemical engineering.

Transport Modeling for Environmental Engineers and Scientists, Second Edition, builds on integrated transport courses in chemical engineering curricula, demonstrating the underlying unity of mass and momentum transport processes. It describes how these processes underlie the mechanics common to both pollutant transport and pollution control processes.

Advances in Heat Transfer

"The solution of a mathematical model is presented which describes mass transfer accompanied by a second-order chemical reaction inside a circulating, fluid sphere for the laminar flow region. The values for eight different mass transfer indices are presented as a function of the Peclet number, reaction number, diffusivity ratio, concentration ratio, and the dimensionless contact time. The results of this work are compared with the film and penetration theories for mass transfer with reaction as modified to apply inside a fluid sphere. This work corrects the three factors which limit the accuracy of applying previous theories to fluid spheres: geometrical description, fluid flow model, and the possibility of complete depletion of the reactant initially in the fluid sphere. The model assumes that all resistance to mass transfer in the continuous phase is negligible, that the reaction is irreversible, and that the system is isothermal. Experimental data were obtained for a system which consisted of a continuous phase of n-pentyl formate diffusing into falling aqueous drops which contain one formal sodium sulfate and 0.04 formal sodium hydroxide. The n-pentyl formate and sodium hydroxide undergo a second-order irreversible reaction inside the drop. For this experimental study the reaction numbers ranged from 3023 to 8953. The Peclet number ranged from 7.14 x 104 to 1.15 x 10 5 . The concentration ratio was 0.335 and the diffusivity ratio was 2.16. The Reynolds number ranged from 490 to 789. The experimental results for the total mass transferred were two to four times that predicted by the model developed in this work. The large experimental total mass transferred was due to the fact that the laminar velocity profiles inside the drop were not valid for the droplet Reynolds numbers encountered experimentally. The experimental results agreed reasonably well with a special combination of empirical correlations by Skelland and Wellek with the film theory combined with second-order chemical reaction"--Abstract, pages ii-iii.

Surveys the selection, design, and operation of most of the industrially important separation processes. Discusses the underlying principles on which the processes are based, and provides illustrative examples of the use of the processes in a modern context. Features thorough treatment of newer separation processes based on membranes, adsorption, chromatography, ion exchange, and chemical complexation. Includes a review of historically important separation processes such as distillation, absorption, extraction, leaching, and crystallization and considers these techniques in light of recent developments affecting them.

The purpose of this book, Transport Phenomena and Drying of Solids and Particulate Materials, is to provide a collection of recent contributions in the field of heat and mass transfer, transport phenomena, drying and wetting of solids and particulate materials. The main benefit of the book is that it discusses some of the most important topics related to the heat and mass transfer in solids and particulate materials. It includes a set of new developments in the field of basic and applied research work on the physical and chemical aspects of heat and mass transfer phenomena, drying and wetting processes, namely, innovations and trends in drying science and technology, drying mechanism and theory, equipment, advanced modelling, complex simulation and experimentation. At the same time, these topics will be going to the encounter of a variety of scientific and engineering disciplines. The book is divided in several chapters that intend to be a resume of the current state of knowledge for benefit of professional colleagues.

The subject of this book is to study the porous media and the transport processes occur there. As a first step, the authors discuss several techniques for artificial representation of porous.

Afterwards, they describe the single and multi phase flows in simplistic and complex porous structures in terms of macroscopic and microscopic equations as well as of their analytical and numerical solutions. Furthermore, macroscopic quantities such as permeability are introduced and reviewed. The book also discusses with mass transport processes in the porous media which are further strengthen by experimental validation and specific technological applications. This book makes use of state-of-the-art techniques for the modeling of transport processes in porous structures, and considers of realistic sorption mechanisms. It the applies advanced mathematical techniques for upscaling of the major quantities, and presents the experimental investigation and application, namely, experimental methods for the measurement of relevant transport properties. The main benefit of the book is that it discusses all the topics related to transport in porous media (including state-of-the-art applications) and presents some of the most important theoretical, numerical and experimental developments in porous media domain, providing a self-contained major reference that is appealing to both the scientists and the engineers. At the same time, these topics encounter a variety of scientific and engineering disciplines, such as chemical, civil, agricultural, mechanical engineering. The book is divided in several chapters that intend to be a resume of the current state of knowledge for benefit of related professionals and scientists.

Proceedings of the NATO Advanced Study Institute, Durham, New Hampshire, U.S.A., July 19-30, 1982

This book introduces the fundamental principles of the mass transfer phenomenon and its diverse applications in process industry. It covers the full spectrum of techniques for chemical separations and extraction. Beginning with molecular diffusion in gases, liquids and solids within a single phase, the mechanism of inter-phase mass transfer is explained with the help of several theories. The separation operations are explained comprehensively in two distinct ways—stage-wise contact and continuous differential contact. The primary design requirements of gas–liquid equipment are discussed. The book provides a detailed discussion on all individual gas–liquid, liquid–liquid, solid–gas, and solid–liquid separation processes. The students are also exposed to the underlying principles of the membrane-based separation processes. The book is replete with real applications of separation processes and equipment. Problems are worked out in each chapter. Besides, problems with answers, short questions, multiple choice questions with answers are given at the end of each chapter. The text is intended for a course on mass transfer, transport and separation processes prescribed for the undergraduate and postgraduate students of chemical engineering.