

Transport Processes And Separation Process Principles Solution Manual

This new third edition provides a modern, unified treatment of the basic transport processes of momentum, heat, and mass transfer, as well as a broad treatment of the unit operations of chemical engineering. Coverage includes the latest membrane separation processes; discussion of bioprocesses; comprehensive treatment of the transport processes of momentum, heat, and mass transfer; adsorption processes; and more. A useful, up-to-date reference for practicing chemical engineers, agricultural engineers, food scientists, environmental engineers, biochemical engineers, and others who work in the process industries.

In this book, the fundamentals of chemical engineering are presented with respect to applications in micro system technology, microfluidics, and transport processes within microstructures. Special features of the book include the state-of-the-art in micro process engineering, a detailed treatment of transport phenomena for engineers, and a design methodology from transport effects to economic considerations.

The Complete, Unified, Up-to-Date Guide to Transport and Separation—Fully Updated for Today's Methods and Software Tools Transport Processes and Separation Process Principles, Fifth Edition, offers a unified and up-to-date treatment of momentum, heat,

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and mass transfer and separations processes. This edition—reorganized and modularized for better readability and to align with modern chemical engineering curricula—covers both fundamental principles and practical applications, and is a key resource for chemical engineering students and professionals alike. This edition provides New chapter objectives and summaries throughout Better linkages between coverage of heat and mass transfer More coverage of heat exchanger design New problems based on emerging topics such as biotechnology, nanotechnology, and green engineering New instructor resources: additional homework problems, exam questions, problem-solving videos, computational projects, and more Part 1 thoroughly covers the fundamental principles of transport phenomena, organized into three sections: fluid mechanics, heat transfer, and mass transfer. Part 2 focuses on key separation processes, including absorption, stripping, humidification, filtration, membrane separation, gaseous membranes, distillation, liquid—liquid extraction, adsorption, ion exchange, crystallization and particle-size reduction, settling, sedimentation, centrifugation, leaching, evaporation, and drying. The authors conclude with convenient appendices on the properties of water, compounds, foods, biological materials, pipes, tubes, and screens. The companion website (trine.edu/transport5ed/) contains additional homework problems that incorporate today's leading software, including Aspen/CHEMCAD, MATLAB, COMSOL, and Microsoft Excel.

In aseptic processing, food is stored at ambient temperatures in sterilized containers

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free of spoilage organisms and pathogens. The results of this food technology come in all shapes and sizes, from the consumer packages of milk on the shelves of the supermarket to the huge containers full of orange juice transported around the world by cargo ships. Over the last couple of decades, aseptic bulk storage and distribution has revolutionized the global food trade. For example, more than 90 percent of the approximately 24 million tons of fresh tomatoes harvested globally each year are aseptically processed and packaged for year-round remanufacture into various food products. The technology has also been applied to bring potable water and emergency food aid to survivors of the 2004 tsunami in Southeast Asia and the victims of Hurricane Katrina in 2005, as well as to other crisis situations worldwide. The construction of new aseptic facilities continues around the world, and an up-to-date understanding of the technology is essential for a new generation of food scientists and engineers alike. The contributors to this important textbook discuss all aspects of aseptic processing and packaging, focusing on the areas that most influence the success or failure of the process. Fully updated, this new edition covers all areas of chemistry, microbiology, engineering, packaging, and regulations as they relate to aseptic processing. Separation science plays a critical role in maintaining our standard of living and quality of life. Many industrial processes and general necessities such as chemicals, medicines, clean water, safe food, and energy sources rely on chemical separations. However, the process of chemical separations is often overlooked during product

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development and this has led to inefficiency, unnecessary waste, and lack of consensus among chemists and engineers. A reevaluation of system design, establishment of standards, and an increased focus on the advancement of separation science are imperative in supporting increased efficiency, continued U.S. manufacturing competitiveness, and public welfare. A Research Agenda for Transforming Separation Science explores developments in the industry since the 1987 National Academies report, Separation and Purification: Critical Needs and Opportunities. Many needs stated in the original report remain today, in addition to a variety of new challenges due to improved detection limits, advances in medicine, and a recent emphasis on sustainability and environmental stewardship. This report examines emerging chemical separation technologies, relevant developments in intersecting disciplines, and gaps in existing research, and provides recommendations for the application of improved separation science technologies and processes. This research serves as a foundation for transforming separation science, which could reduce global energy use, improve human and environmental health, and advance more efficient practices in various industries.

Laminar Flow and Convective Transport Processes: Scaling Principles and Asymptotic Analysis presents analytic methods for the solution of fluid mechanics and convective transport processes, all in the laminar flow regime. This book brings together the results of almost 30 years of research on the use of nondimensionalization, scaling principles,

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and asymptotic analysis into a comprehensive form suitable for presentation in a core graduate-level course on fluid mechanics and the convective transport of heat. A considerable amount of material on viscous-dominated flows is covered. A unique feature of this book is its emphasis on scaling principles and the use of asymptotic methods, both as a means of solution and as a basis for qualitative understanding of the correlations that exist between independent and dependent dimensionless parameters in transport processes. *Laminar Flow and Convective Transport Processes* is suitable for use as a textbook for graduate courses in fluid mechanics and transport phenomena and also as a reference for researchers in the field.

The advancements in micro- and nano-fabrication techniques, especially in the last couple of decades, have led research communities, over the world, to invest unprecedented levels of attention on the science and technology of micro- and nano-scale devices and the concerned applications. With an intense focus on micro- and nanotechnology from a fluidic perspective, *Microfluidics and Microscale Transport Processes* provides a broad review of advances in this field. A comprehensive compendium of key indicators to recent developments in some very active research topics in microscale transport processes, it supplies an optimal balance between discussions of concrete applications and development of fundamental understanding. The chapters discuss a wide range of issues in the sub-domains of capillary transport, fluidic resistance, electrokinetics, substrate modification, rotational microfluidics, and

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the applications of the phenomena of these sub-domains in diverse situations ranging from non-biological to biological ones like DNA hybridization and cellular biomicrofluidics. The book also addresses a generic problem of particle transport in nanoscale colloidal suspensions and includes a chapter on Lattice-Boltzmann methods for phase-changing problems which represents a generic particle based approach that may be useful to address many microfluidic problems of interdisciplinary relevance. This book covers a wide variety of topics related to advancements in different stages of mass transfer modelling processes. Its purpose is to create a platform for the exchange of recent observations, experiences, and achievements. It is recommended for those in the chemical, biotechnological, pharmaceutical, and nanotechnology industries as well as for students of natural sciences, technical, environmental and employees in companies which manufacture machines for the above-mentioned industries. This work can also be a useful source for researchers and engineers dealing with mass transfer and related issues.

Presenting mathematical prerequisites in summary tables, this book explains fundamental techniques of mathematical modeling processes essential to the food industry. The author focuses on providing an in-depth understanding of modeling techniques, rather than the finer mathematical points. Topics covered include modeling of transport phenomena, kin
In this textbook, the author teaches readers how to model and simulate a unit process operation through developing mathematical model equations, solving model equations manually, and comparing results with those simulated through software. It covers both lumped

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parameter systems and distributed parameter systems, as well as using MATLAB and Simulink to solve the system model equations for both. Simplified partial differential equations are solved using COMSOL, an effective tool to solve PDE, using the fine element method. This book includes end of chapter problems and worked examples, and summarizes reader goals at the beginning of each chapter.

Separation operations are crucial throughout the process industry with respect to energy consumption, contribution to investments and ability to achieve the desired product with the right specifications. Our main objective in creating this graduate level textbook is to present an overview of the fundamentals underlying the most frequently used industrial separation methods. We focus on their physical principles and the basic computation methods that are required to assess their technical and economical feasibility. The textbook is organized into three main parts. Separation processes for homogeneous mixtures are treated in the parts on equilibrium based molecular separations and rate-controlled molecular separations. The part on mechanical separation technology presents an overview of the most important techniques for heterogeneous mixture separation. Each chapter provides a condensed overview of the most commonly used equipment types. The textbook is concluded with a final chapter on the main considerations in selecting an appropriate separation process for a separation task. As the design of separation processes can only be learned by doing, we have included exercises at the end of each chapter. Short answers are given at the end of this book; detailed solutions are given in a separate solution manual.

Computational fluid dynamics (CFD), which uses numerical analysis to predict and model complex flow behaviors and transport processes, has become a mainstream tool in

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engineering process research and development. Complex chemical processes often involve coupling between dynamics at vastly different length and time scales, as well as coupling of different physical models. The multiscale and multiphysics nature of those problems calls for delicate modeling approaches. This book showcases recent contributions in this field, from the development of modeling methodology to its application in supporting the design, development, and optimization of engineering processes.

This textbook is targeted 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 industry, 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

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exercises. • Chapter-wise multiple choice questions. • An Instructors manual for the teachers.

There are several physico-chemical processes that determine the behavior of multiphase fluid systems – e.g., the fluid dynamics in the different phases and the dynamics of the interface(s), mass transport between the fluids, adsorption effects at the interface, and transport of surfactants on the interface – and result in heterogeneous interface properties. In general, these processes are strongly coupled and local properties of the interface play a crucial role. A thorough understanding of the behavior of such complex flow problems must be based on physically sound mathematical models, which especially account for the local processes at the interface. This book presents recent findings on the rigorous derivation and mathematical analysis of such models and on the development of numerical methods for direct numerical simulations. Validation results are based on specifically designed experiments using high-resolution experimental techniques. A special feature of this book is its focus on an interdisciplinary research approach combining Applied Analysis, Numerical Mathematics, Interface Physics and Chemistry, as well as relevant research areas in the Engineering Sciences. The contributions originated from the joint interdisciplinary research projects in the DFG Priority Programme SPP 1506 “Transport Processes at Fluidic Interfaces.”

This textbook offers an introduction to multiple, interdependent transport phenomena as they occur in various fields of physics and technology like transport of momentum, heat, and matter. These phenomena are found in a number of combined processes in the fields of chemical, food, biomedical, and environmental sciences. The book puts a special emphasis on numerical modeling of both purely diffusive mechanisms and macroscopic transport such as fluid dynamics, heat and mass convection. To favor the applicability of the various concepts, they

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are presented with a simplicity of exposure, and synthesis has been preferred with respect to completeness. The book includes more than 130 graphs and figures, to facilitate the understanding of the various topics. It also presents many modeling examples throughout the text, to control that the learned material is properly understood.

This book presents recent research in the field of transport phenomena in porous materials, including heat and mass transfer, drying and adsorption. Covering a comprehensive range of topics related to the transport phenomenon in engineering (including state-of-the-art, theory and technological applications), it discusses some of the most important theoretical advances, computational developments and applications in porous materials domain. Providing an update on the current state of knowledge, this self-contained reference resource will appeal to scientists, researchers and engineers in a variety of disciplines, such as chemical, civil, agricultural and mechanical engineering.

Chemical Engineering Computation with MATLAB®, Second Edition continues to present basic to advanced levels of problem-solving techniques using MATLAB as the computation environment. The Second Edition provides even more examples and problems extracted from core chemical engineering subject areas and all code is updated to MATLAB version 2020. It also includes a new chapter on computational intelligence and: Offers exercises and extensive problem-solving instruction and solutions for various problems Features solutions developed using fundamental principles to construct mathematical models and an equation-oriented approach to generate numerical results Delivers a wealth of examples to demonstrate the

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implementation of various problem-solving approaches and methodologies for problem formulation, problem solving, analysis, and presentation, as well as visualization and documentation of results Includes an appendix offering an introduction to MATLAB for readers unfamiliar with the program, which will allow them to write their own MATLAB programs and follow the examples in the book Provides aid with advanced problems that are often encountered in graduate research and industrial operations, such as nonlinear regression, parameter estimation in differential systems, two-point boundary value problems and partial differential equations and optimization This essential textbook readies engineering students, researchers, and professionals to be proficient in the use of MATLAB to solve sophisticated real-world problems within the interdisciplinary field of chemical engineering. The text features a solutions manual, lecture slides, and MATLAB program files._

The Complete, Unified, Up-to-Date Guide to Transport and Separation-Fully Updated for Today's Methods and Software Tools Transport Processes and Separation Process Principles, Fifth Edition, offers a unified and up-to-date treatment of momentum, heat, and mass transfer and separations processes. This edition-reorganized and modularized for better readability and to align with modern chemical engineering curricula-covers both fundamental principles and practical applications, and is a key resource for chemical engineering students and professionals alike. This edition provides New chapter objectives and summaries throughout Better linkages between

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coverage of heat and mass transfer More coverage of heat exchanger design New problems based on emerging topics such as biotechnology, nanotechnology, and green engineering New instructor resources: additional homework problems, exam questions, problem-solving videos, computational projects, and more Part 1 thoroughly covers the fundamental principles of transport phenomena, organized into three sections: fluid mechanics, heat transfer, and mass transfer. Part 2 focuses on key separation processes, including absorption, stripping, humidification, filtration, membrane separation, gaseous membranes, distillation, liquid-liquid extraction, adsorption, ion exchange, crystallization and particle-size reduction, settling, sedimentation, centrifugation, leaching, evaporation, and drying. The authors conclude with convenient appendices on the properties of water, compounds, foods, biological materials, pipes, tubes, and screens. The companion website (trine.edu/transport5ed/) contains additional homework problems that incorporate today's leading software, including Aspen/CHEMCAD, MATLAB, COMSOL, and Microsoft Excel.

Separation and purification processes play a critical role in biorefineries and their optimal selection, design and operation to maximise product yields and improve overall process efficiency. Separations and purifications are necessary for upstream processes as well as in maximising and improving product recovery in downstream processes. These processes account for a significant fraction of the total capital and operating costs and also are highly energy intensive. Consequently, a better understanding of

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separation and purification processes, current and possible alternative and novel advanced methods is essential for achieving the overall techno-economic feasibility and commercial success of sustainable biorefineries. This book presents a comprehensive overview focused specifically on the present state, future challenges and opportunities for separation and purification methods and technologies in biorefineries. Topics covered include: Equilibrium Separations: Distillation, liquid-liquid extraction and supercritical fluid extraction. Affinity-Based Separations: Adsorption, ion exchange, and simulated moving bed technologies. Membrane Based Separations: Microfiltration, ultrafiltration and diafiltration, nanofiltration, membrane pervaporation, and membrane distillation. Solid-liquid Separations: Conventional filtration and solid-liquid extraction. Hybrid/Integrated Reaction-Separation Systems: Membrane bioreactors, extractive fermentation, reactive distillation and reactive absorption. For each of these processes, the fundamental principles and design aspects are presented, followed by a detailed discussion and specific examples of applications in biorefineries. Each chapter also considers the market needs, industrial challenges, future opportunities, and economic importance of the separation and purification methods. The book concludes with a series of detailed case studies including cellulosic bioethanol production, extraction of algae oil from microalgae, and production of biopolymers. Separation and Purification Technologies in Biorefineries is an essential resource for scientists and engineers, as well as researchers and academics working in the broader conventional and emerging

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bio-based products industry, including biomaterials, biochemicals, biofuels and bioenergy.

Fundamentals and Operations in Food Process Engineering deals with the basic engineering principles and transport processes applied to food processing, followed by specific unit operations with a large number of worked-out examples and problems for practice in each chapter. The book is divided into four sections: fundamentals in food process engineering, mechanical operations in food processing, thermal operations in food processing and mass transfer operations in food processing. The book is designed for students pursuing courses on food science and food technology, including a broader section of scientific personnel in the food processing and related industries.

Appropriate for one-year transport phenomena (also called transport processes) and separation processes course. First semester covers fluid mechanics, heat and mass transfer; second semester covers separation process principles (includes unit operations). The title of this Fourth Edition has been changed from Transport Processes and Unit Operations to Transport Processes and Separation Process Principles (Includes Unit Operations). This was done because the term Unit Operations has been largely superseded by the term Separation Processes which better reflects the present modern nomenclature being used. The main objectives and the format of the Fourth Edition remain the same. The sections on momentum transfer have been greatly expanded, especially in the sections on fluidized beds, flow meters, mixing, and

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non-Newtonian fluids. Material has been added to the chapter on mass transfer. The chapters on absorption, distillation, and liquid-liquid extraction have also been enlarged. More new material has been added to the sections on ion exchange and crystallization. The chapter on membrane separation processes has been greatly expanded especially for gas-membrane theory.

Taking a highly pragmatic approach to presenting the principles and applications of chemical engineering, this companion text for students and working professionals offers an easily accessible guide to solving problems using computers. The primer covers the core concepts of chemical engineering, from conservation laws all the way up to chemical kinetics, without heavy stress on theory and is designed to accompany traditional larger core texts. The book presents the basic principles and techniques of chemical engineering processes and helps readers identify typical problems and how to solve them. Focus is on the use of systematic algorithms that employ numerical methods to solve different chemical engineering problems by describing and transforming the information. Problems are assigned for each chapter, ranging from simple to difficult, allowing readers to gradually build their skills and tackle a broad range of problems. MATLAB and Excel® are used to solve many examples and the more than 70 real examples throughout the book include computer or hand solutions, or in many cases both. The book also includes a variety of case studies to illustrate the concepts and a downloadable file containing fully worked solutions to the book's

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problems on the publisher's website. Introduces the reader to chemical engineering computation without the distractions caused by the contents found in many texts. Provides the principles underlying all of the major processes a chemical engineer may encounter as well as offers insight into their analysis, which is essential for design calculations. Shows how to solve chemical engineering problems using computers that require numerical methods using standard algorithms, such as MATLAB® and Excel®. Contains selective solved examples of many problems within the chemical process industry to demonstrate how to solve them using the techniques presented in the text. Includes a variety of case studies to illustrate the concepts and a downloadable file containing fully worked solutions to problems on the publisher's website. Offers non-chemical engineers who are expected to work with chemical engineers on projects, scale-ups and process evaluations a solid understanding of basic concepts of chemical engineering analysis, design, and calculations.

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

Separation Process Essentials provides an interactive approach for students to learn the main separation processes (distillation, absorption, stripping, and solvent extraction) using material and energy balances with equilibrium relationships, while referring readers to other more complete works when needed. Membrane separations are included as an example of non-equilibrium processes. This book reviews and builds on

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material learned in the first chemical engineering courses such as Material and Energy Balances and Thermodynamics as applied to separations. It relies heavily on example problems, including completely worked and explained problems followed by "Try This At Home" guided examples. Most examples have accompanying downloadable Excel spreadsheet simulations. The book also offers a complementary website, <http://separationsbook.com>, with supplementary material such as links to YouTube tutorials, practice problems, and the Excel simulations. This book is aimed at second and third year undergraduate students in Chemical engineering, as well as professionals in the field of Chemical engineering, and can be used for a one semester course in separation processes and unit operations.

The knowledge of quantitative turbulence mechanics relies heavily upon the definition of the concept of a vortex in mathematical terms. This reference work introduces the reader to Liutex, which is an accepted, accurate and mathematical definition of a vortex. The core of this book is a compilation of several papers on the subject. presented in the 13th World Congress of Computational Mechanics (WCCM2018), Symposium 704, Mathematics and Computations for Multiscale Structures of Turbulent and Other Complex Flows, New York, United States on July 27, 2018. This compilation also includes other research papers which explain the work done on the vortex definition, vortex identification and turbulence structure from different insight angles including mathematics, computational physics and experiments. The thirteen chapters in this volume will be informative to scientists and engineers who are interested in advanced theories about fluid dynamics, vortex science and turbulence research.

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Transport Processes and Separation Process Principles(includes Unit Operations)Prentice Hall
This edition of 'Micro Process Engineering' was originally published in the successful series 'Advanced Micro & Nanosystems'. Authors from leading industrial players and research institutions present a concise and didactical introduction to Micro Process Engineering, the combination of microtechnology and process engineering into a most promising and powerful tool for revolutionizing chemical processes and industrial mass production of bulk materials, fine chemicals, pharmaceuticals and many other products. The book takes the readers from the fundamentals of engineering methods, transport processes, and fluid dynamics to device conception, simulation and modelling, control interfaces and issues of modularity and compatibility. Fabrication strategies and techniques are examined next, focused on the fabrication of suitable microcomponents from various materials such as metals, polymers, silicon, ceramics and glass. The book concludes with actual applications and operational aspects of micro process systems, giving broad coverage to industrial efforts in America, Europe and Asia as well as laboratory equipment and education.

Environmental Transport Phenomena offers a detailed yet accessible introduction to transport phenomena. It begins by explaining the underlying principles and mechanisms that govern mass transport and continues by tackling practical problems spanning all subdisciplines of environmental science and chemical engineering. Assuming some knowledge of ordinary differential equations and a familiarity with basic applications of fluid mechanics, this classroom-tested text: Addresses mass conservation and macroscopic mass balances, placing a special emphasis on applications to environmental processes Covers the fundamentals of diffusive transport, applications of the diffusion equation, and diffusive transport in reactive systems

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Discusses convective transport, hydrodynamic dispersion, and transport in multiphase systems
Presents a mathematical framework for formulating and solving transport phenomena problems
Environmental Transport Phenomena makes an ideal textbook for a one-semester advanced undergraduate or graduate introductory course in transport phenomena. It provides a fundamental understanding of how to quantify the spread and distribution of contaminants in the environment as well as the basis for designing processes related to water purification, wastewater treatment, and solid waste disposal, among others.

The present book contains a comparison of existing theoretical models developed in order to describe membrane separation processes. In general, the permeation equations resulting from these models give inaccurate predictions of the mutual effects of the permeants involved, due to the simplifications adopted in their derivation. It is concluded that an optimum description of transport phenomena in tight (diffusion-type) membranes is achieved with the "solution-diffusion" model. According to this model each component of a fluid mixture to be separated dissolves in the membrane and passes through by diffusion in response to its gradient in the chemical potential. A modified Flory-Huggins equation has been derived to calculate the solubility of the permeants in the membrane material. Contrary to the original Flory-Huggins equation, the modified equation accounts for the large effect on solubility of crystallinity and elastic strain of the polymer chains by swelling. The equilibrium sorption of liquids computed with this equation was found to be in good agreement with experimental results. Also, the sorption of gases in both rubbery and glassy polymers could be described quantitatively with the modified Flory-Huggins equation without any need of the arbitrary Langmuir term, as required in the conventional "dual-mode" sorption model. Furthermore, fewer parameters are

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required than with the at least identical accuracy.

Transport Properties of Polymeric Membranes is an edited collection of papers that covers, in depth, many of the recent technical research accomplishments in transport characteristics through polymers and their applications. Using the transport through polymer membranes method leads to high separation efficiency, low running costs, and simple operating procedures compared to conventional separation methods. This book provides grounding in fundamentals and applications to give you all the information you need on using this method. This book discusses the different types of polymer, their blends, composites, nanocomposites and their applications in the field of liquid, gas and vapor transport. Some topics of note include modern trends and applications of polymer nanocomposites in solvent, vapor and gas transport; fundamentals and measurement techniques for gas and vapor transport in polymers; and transport properties of hydrogels. This handpicked selection of topics, and the combined expertise of contributors from global industry, academia, government and private research organizations, make this book an outstanding reference for anyone involved in the field of polymer membranes. Presents current trends in the field of transport of liquid, gas and vapor through various polymeric systems Features case studies focused on industrial applications of membrane technology, along with fundamentals of transport and materials Helps readers quickly look up a particular technique to learn key points, capabilities and drawbacks 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

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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

In this valuable volume, new and original research on various topics on chemical engineering and technology is presented on modeling and simulation, material synthesis, wastewater treatment, analytical techniques, and microreactors. The research presented here can be applied to technology in food, paper and pulp, polymers, petrochemicals, surface coatings, oil technology aspects, among other uses. The book is divided into five sections: modeling and simulation environmental applications materials and applications processes and applications analytical methods Topics include: modeling and simulation of chemical processes process integration and intensification separation processes advances in unit operations and processes chemical reaction engineering fuel and energy advanced materials CFD and transport processes wastewater treatment The valuable research presented here will be of interest to researchers, scientists, industry practitioners, as well as upper-level students.

This second edition attests to the impact of the subject matter in a variety of scientific and

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engineering disciplines. There has been tremendous growth in areas such as transport phenomena/materials science and processing. This book builds on and updates the editor's earlier work. It highlights recent advances in the motion of particles, drops and bubbles in complex fluids and represents a timely and needed addition to the literature on real (non-linear) materials. In particular, it contains state-of-the-art contributions from leading experts in areas such as particle deposition in membranes, flow of granular mixtures, food suspensions, foams, electro kinetic and thermo capillary driven flows, and two-phase flows.

Transport and Surface Phenomena provides an overview of the key transfers taking place in reactions and explores how calculations of momentum, energy and mass transfers can help researchers develop the most appropriate, cost effective solutions to chemical problems.

Beginning with a thorough overview of the nature of transport phenomena, the book goes on to explore balances in transport phenomena, including key equations for assessing balances, before concluding by outlining mathematical methods for solving the transfer equations.

Drawing on the experience of its expert authors, it is an accessible introduction to the field for students, researchers and professionals working in chemical engineering. The book and is also ideal for those in related fields such as physical chemistry, energy engineering, and materials science, for whom a deeper understanding of these interactions could enhance their work.

The past thirty years have witnessed a growing worldwide desire that positive actions be taken to restore and protect the environment from the degrading effects of all forms of pollution—air, water, soil, and noise. Because pollution is a direct or indirect consequence of waste, the seemingly idealistic demand for “zero discharge” can be construed as an unrealistic demand for zero waste. However, as long as waste continues to exist, we can only attempt to abate the

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subsequent pollution by converting it to a less noxious form. Three major questions usually arise when a particular type of pollution has been identified: (1) How serious is the pollution? (2) Is the technology to abate it available? and (3) Do the costs of abatement justify the degree of abatement achieved? This book is one of the volumes of the Handbook of Environmental Engineering series. The principal intention of this series is to help readers formulate answers to the last two questions above. The traditional approach of applying tried-and-true solutions to specific pollution problems has been a major contributing factor to the success of environmental engineering, and has accounted in large measure for the establishment of a "methodology of pollution control." However, the realization of the ever-increasing complexity and interrelated nature of current environmental problems renders it imperative that intelligent planning of pollution abatement systems be undertaken.

Basic Equations of Mass Transport Through a Membrane Layer, Second Edition, has been fully updated to deliver the latest research in the field. This volume covers the essentials of compound separation, product removal, concentration, and production in the chemical, biochemical, pharmaceutical, and food industries. It outlines the various membrane processes and their applications, offering a detailed mathematical description of mass transport and defining basic mass transport and concentration distribution expressions. Additionally, this book discusses the process parameters and application of the expressions developed for a variety of industrial applications. Comprehensive explanations of convective/diffusive mass transport are provided, both with and without polarization layers, that help predict and process performance and facilitate improvements to operation conditions and efficiency. Basic Equations of Mass Transport Through a Membrane Layer is an ideal resource for engineers

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and technologists in the chemical, biochemical, and pharmaceutical industries, as well as researchers, professors, and students in these areas at both an undergraduate and graduate level. Cites and analyzes mass transport equations developed for different membrane processes. Examines the effect of biochemical/chemical reactions in the presence of convective and diffusive flows in plane and cylindrical spaces. Defines the mass transfer rate for first- and zero-order reactions and analytical approaches are given for other-order reactions in closed mathematical forms. Analyzes the simultaneous convective and diffusive transports with same or different directions.

The Comprehensive Introduction to Standard and Advanced Separation for Every Chemical Engineer Separation Process Engineering, Second Edition helps readers thoroughly master both standard equilibrium staged separations and the latest new processes. The author explains key separation process with exceptional clarity, realistic examples, and end-of-chapter simulation exercises using Aspen Plus. The book starts by reviewing core concepts, such as equilibrium and unit operations; then introduces a step-by-step process for solving separation problems. Next, it introduces each leading processes, including advanced processes such as membrane separation, adsorption, and chromatography. For each process, the author presents essential principles, techniques, and equations, as well as detailed examples. Separation Process Engineering is the new, thoroughly updated edition of the author's previous book, Equilibrium Staged Separations. Enhancements include improved organization, extensive new coverage, and more than 75% new homework problems, all tested in the author's Purdue University classes. Coverage includes Detailed problems with real data, organized in a common format for easier understanding Modular simulation exercises that

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support courses taught with simulators without creating confusion in courses that do not use them Extensive new coverage of membrane separations, including gas permeation, reverse osmosis, ultrafiltration, pervaporation, and key applications A detailed introduction to adsorption, chromatography and ion exchange: everything students need to understand advanced work in these areas Discussions of standard equilibrium stage processes, including flash distillation, continuous column distillation, batch distillation, absorption, stripping, and extraction

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