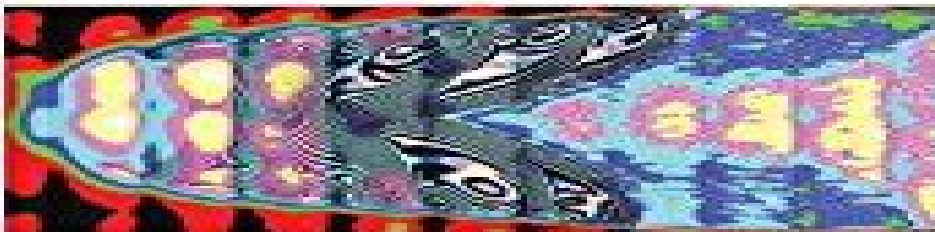
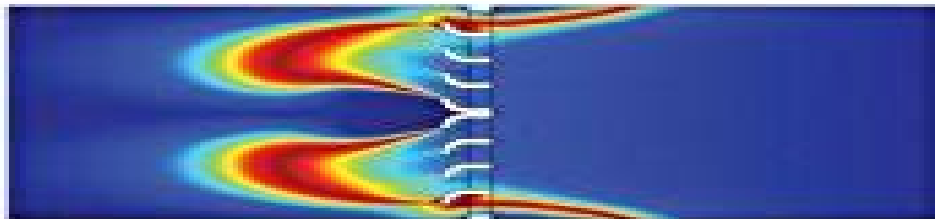


THIRD EDITION

CHEMICAL INDUSTRIES/138

Transport Phenomena Fundamentals

Joel L. Plawsky



Transport Phenomena Fundamentals Third Edition Chemical Industries

James G. Speight



Transport Phenomena Fundamentals Third Edition Chemical Industries:

Transport Phenomena Fundamentals Joel L. Plawsky, 2001-04-25 This volume is organized to highlight the parallels and the differences between the transport phenomena. It facilitates comprehension and retention of basic momentum, heat, mass, and charge transport processes and properties and features a balance equation format based on systematic addition and analysis of each term in the balance equation. There are more than 1300 equations and end of chapter problems are provided to reinforce important text material. **Transport Phenomena Fundamentals, Third Edition** Joel L.

Plawsky, 2014-01-23 The third edition of *Transport Phenomena Fundamentals* continues with its streamlined approach to the subject of transport phenomena based on a unified treatment of heat, mass, and momentum transport using a balance equation approach. The new edition makes more use of modern tools for working problems such as COMSOL, Maple, and MATLAB. It introduces new problems at the end of each chapter and sorts them by topic for ease of use. It also presents new concepts to expand the utility of the text beyond chemical engineering. The text is divided into two parts which can be used for teaching a two-term course. Part I covers the balance equation in the context of diffusive transport: momentum, energy, mass, and charge. Each chapter adds a term to the balance equation, highlighting that term's effects on the physical behavior of the system and the underlying mathematical description. Chapters familiarize students with modeling and developing mathematical expressions based on the analysis of a control volume, the derivation of the governing differential equations, and the solution to those equations with appropriate boundary conditions. Part II builds on the diffusive transport balance equation by introducing convective transport terms, focusing on partial rather than ordinary differential equations. The text describes paring down the microscopic equations to simplify the models and solve problems, and it introduces macroscopic versions of the balance equations for when the microscopic approach fails or is too cumbersome. The text discusses the momentum, Bernoulli energy, and species continuity equations, including a brief description of how these equations are applied to heat exchangers, continuous contactors, and chemical reactors. The book also introduces the three fundamental transport coefficients: the friction factor, the heat transfer coefficient, and the mass transfer coefficient, in the context of boundary layer theory. The final chapter covers the basics of radiative heat transfer, including concepts such as blackbodies, graybodies, radiation shields, and enclosures. The third edition incorporates many changes to the material and includes updated discussions and examples and more than 70 new homework problems. **Transport Phenomena Fundamentals**

Joel L. Plawsky, 2020-02-27 The fourth edition of *Transport Phenomena Fundamentals* continues with its streamlined approach to the subject based on a unified treatment of heat, mass, and momentum transport using a balance equation approach. The new edition includes more worked examples within each chapter and adds confidence-building problems at the end of each chapter. Some numerical solutions are included in an appendix for students to check their comprehension of key concepts. Additional resources online include exercises that can be practiced using a wide range of software programs.

available for simulating engineering problems such as COMSOL Maple Fluent Aspen Mathematica Python and MATLAB lecture notes and past exams This edition incorporates a wider range of problems to expand the utility of the text beyond chemical engineering The text is divided into two parts which can be used for teaching a two term course Part I covers the balance equation in the context of diffusive transport momentum energy mass and charge Each chapter adds a term to the balance equation highlighting that term's effects on the physical behavior of the system and the underlying mathematical description Chapters familiarize students with modeling and developing mathematical expressions based on the analysis of a control volume the derivation of the governing differential equations and the solution to those equations with appropriate boundary conditions Part II builds on the diffusive transport balance equation by introducing convective transport terms focusing on partial rather than ordinary differential equations The text describes paring down the full microscopic equations governing the phenomena to simplify the models and develop engineering solutions and it introduces macroscopic versions of the balance equations for use where the microscopic approach is either too difficult to solve or would yield much more information than is actually required The text discusses the momentum Bernoulli energy and species continuity equations including a brief description of how these equations are applied to heat exchangers continuous contactors and chemical reactors The book introduces the three fundamental transport coefficients the friction factor the heat transfer coefficient and the mass transfer coefficient in the context of boundary layer theory Laminar flow situations are treated first followed by a discussion of turbulence The final chapter covers the basics of radiative heat transfer including concepts such as blackbodies graybodies radiation shields and enclosures

Transport Phenomena Fundamentals, Second Edition Joel L.

Plawsky, 2009-09-24 Although the practice of chemical engineering has broadened to encompass problems in a range of disciplines including biology biochemistry and nanotechnology one of the curriculum's foundations is built upon the subject of transport phenomena Transport Phenomena Fundamentals Second Edition provides a unified treatment of heat mass and momentum transport based on a balance equation approach Designed for a two term course Used in a two term transport phenomena sequence at Rensselaer Polytechnic Institute this text streamlines the approach to how the subject is taught The first part of the book takes students through the balance equation in the context of diffusive transport be it momentum energy mass or charge Each chapter adds a term to the balance equation highlighting the effects of that addition on the physical behavior of the system and the underlying mathematical description The second half of the book builds upon the balance equation description of diffusive transport by introducing convective transport terms focusing on partial rather than ordinary differential equations The Navier Stokes and convective transport equations are derived from balance equations in both macroscopic and microscopic forms Includes examples and problems drawn from Comsol software The second edition of this text is now enhanced by the use of finite element methods in the form of examples and extended homework problems A series of example modules are associated with each chapter of the text Some of the modules are used to produce examples in

the text and some are discussed in the homework at the end of each chapter All of the modules are located online at an accompanying website which is designed to be a living component of the course available on the download tab

The Chemistry and Technology of Petroleum, Fifth Edition James G. Speight, 2014-02-26 With demand for petroleum products increasing worldwide there is a tendency for existing refineries to seek new approaches to optimize efficiency and throughput In addition changes in product specifications due to environmental regulations greatly influence the development of petroleum refining technologies These factors underlie the need for this fifth edition of The Chemistry and Technology of Petroleum which continues in the tradition of the bestselling fourth edition proving readers with a detailed overview of the chemistry and technology of petroleum as it evolves into the twenty first century The new edition has been updated with the latest developments in the refining industry including new processes as well as updates on evolving processes and various environmental regulations The book covers issues related to economics and future refineries examines the changing character of refinery feedstock and offers new discussions on environmental aspects of refining It contains more than 300 figures and tables including chemical structures and process flow sheets A useful reference for scientists and engineers in the petroleum industry as well as in the catalyst manufacturing industry this book introduces readers to the science and technology of petroleum beginning with its formation in the ground and culminating in the production of a wide variety of products and petrochemical intermediates

Chemical Reaction Engineering and Reactor Technology, Second Edition Tapio O. Salmi, Jyri-Pekka Mikkola, Johan P. W rn , 2019-07-11 The role of the chemical reactor is crucial for the industrial conversion of raw materials into products and numerous factors must be considered when selecting an appropriate and efficient chemical reactor Chemical Reaction Engineering and Reactor Technology defines the qualitative aspects that affect the selection of an industrial chemical reactor and couples various reactor models to case specific kinetic expressions for chemical processes Thoroughly revised and updated this much anticipated Second Edition addresses the rapid academic and industrial development of chemical reaction engineering Offering a systematic development of the chemical reaction engineering concept this volume explores essential stoichiometric kinetic and thermodynamic terms needed in the analysis of chemical reactors homogeneous and heterogeneous reactors reactor optimization aspects residence time distributions and non ideal flow conditions in industrial reactors solutions of algebraic and ordinary differential equation systems gas and liquid phase diffusion coefficients and gas film coefficients correlations for gas liquid systems solubilities of gases in liquids guidelines for laboratory reactors and the estimation of kinetic parameters The authors pay special attention to the exact formulations and derivations of mass energy balances and their numerical solutions Richly illustrated and containing exercises and solutions covering a number of processes from oil refining to the development of specialty and fine chemicals the text provides a clear understanding of chemical reactor analysis and design

Synthetics, Mineral Oils, and Bio-Based Lubricants Leslie R. Rudnick, 2020-01-29 Highlighting the major economic and industrial changes in the

lubrication industry since the first edition Synthetics Mineral Oils and Bio Based Lubricants Chemistry and Technology Third Edition highlights the major economic and industrial changes in the lubrication industry and outlines the state of the art in each major lubricant application area Chapters cover the use of lubricant fluids growth or decline of market areas and applications potential new applications production capacities and regulatory issues including biodegradability toxicity and food production equipment lubrication The highly anticipated third edition features new and updated chapters including those on automatic and continuously variable transmission fluids fluids for food grade applications oil soluble polyalkylene glycols functional bio based lubricant base stocks farnesene derived polyolefins estolides bio based lubricants from soybean oil and trends in construction equipment lubrication Features include Contains an index of terms acronyms and analytical testing methods Presents the latest conventions for describing upgraded mineral oil base fluids Considers all the major lubrication areas engine oils industrial lubricants food grade applications greases and space age applications Includes individual chapters on lubricant applications such as environmentally friendly disk drive and magnetizable fluids for major market areas around the globe In a single unique volume Synthetics Mineral Oils and Bio Based Lubricants Chemistry and Technology Third Edition offers property and performance information of fluids theoretical and practical background to their current applications and strong indicators for global market trends that will influence the industry for years to come

Handbook of Petrochemical Processes James G. Speight, 2019-06-13 The petrochemical industry is a scientific and engineering field that encompasses the production of a wide range of chemicals and polymers The purpose of this book is not only to provide a follow on to form the later chapters of the highly successful Chemistry and Technology of Petroleum 5th Edition but also provides a simplified approach to a very diverse chemical subject dealing with the chemistry and technology of various petroleum and petrochemical process Following from the introductory chapters this book provides the readers with a valuable source of information containing insights into petrochemical reactions and products process technology and polymer synthesis Provides readers with a valuable source of information containing insights into petrochemical reactions and products process technology and polymer synthesis Introduces the reader to the various petrochemical intermediates are generally produced by chemical conversion of primary petrochemicals to form more complicated derivative products The reactions and processes involved in transforming petroleum based hydrocarbons into the chemicals that form the basis of the multi billion dollar petrochemical industry are reviewed and described The book includes information on new process developments for the production of raw materials and intermediates for petrochemicals Includes a description of the origin of the raw materials for the petrochemicals industry including an overview of the coal chemicals industry **Introduction to Process Control** Jose A. Romagnoli, Ahmet Palazoglu, 2020-07-14 Introduction to Process Control Third Edition continues to provide a bridge between traditional and modern views of process control by blending conventional topics with a broader perspective of integrated process operation control and information systems Updated and expanded throughout this third

edition addresses issues highly relevant to today's teaching of process control. Discusses smart manufacturing, new data preprocessing techniques, and machine learning and artificial intelligence concepts that are part of current smart manufacturing decisions. Includes extensive references to guide the reader to the resources needed to solve modeling, classification, and monitoring problems. Introduces the link between process optimization and process control, optimizing control, including the effect of disturbances on the optimal plant operation, the concepts of steady state and dynamic back off, as ways to quantify the economic benefits of control, and how to determine an optimal transition policy during a planned production change. Incorporates an introduction to the modern architectures of industrial computer control systems with real case studies and applications to pilot scale operations. Analyzes the expanded role of process control in modern manufacturing, including model-centric technologies and integrated control systems. Integrates data processing, reconciliation, and intelligent monitoring in the overall control system architecture. Drawing on the authors' combined 60 years of teaching experiences, this classroom-tested text is designed for chemical engineering students but is also suitable for industrial practitioners who need to understand key concepts of process control and how to implement them. The text offers a comprehensive pedagogical approach to reinforce learning and presents a concept first followed by an example, allowing students to grasp theoretical concepts in a practical manner and uses the same problem in each chapter, culminating in a complete control design strategy. A vast number of exercises throughout ensure readers are supported in their learning and comprehension. Downloadable MATLAB toolboxes for process control education, as well as the main simulation examples from the book, offer a user-friendly software environment for interactively studying the examples in the text. These can be downloaded from the publisher's website. Solutions manual is available for qualifying professors from the publisher.

The Chemistry and Technology of Coal, Third Edition James G. Speight, 2012-09-04

The demand for coal use for electricity generation and coal products, particularly liquid fuels and chemical feedstocks, is increasing throughout the world. Traditional markets such as North America and Europe are experiencing a steady increase in demand, whereas emerging Asian markets such as India and China are witnessing a rapid surge in demand for clean liquid fuels. A detailed and comprehensive overview of the chemistry and technology of coal in the twenty-first century. The Chemistry and Technology of Coal, Third Edition, also covers the relationship of coal industry processes with environmental regulations, as well as the effects of combustion products on the atmosphere. Maintaining and enhancing the clarity of presentation that made the previous editions so popular, this book examines the effects of combustion products on the atmosphere, details practical elements of coal evaluation procedures, clarifies misconceptions concerning the organic structure of coal, discusses the physical, thermal, electrical, and mechanical properties of coal, analyzes the development and current status of combustion and gasification techniques. In addition to two new chapters, Coal Use and the Environment and Coal and Energy Security, much of the material in this edition has been rewritten to incorporate the latest developments in the coal industry. Citations from review

articles patents other books and technical articles with substantial introductory material are incorporated into the text for further reference The Chemistry and Technology of Coal Third Edition maintains its initial premise to introduce the science of coal beginning with its formation in the ground to the production of a wide variety of products and petrochemical intermediates in the twenty first century The book will prove useful for scientists and engineers already engaged in the coal and or catalyst manufacturing industry looking for a general overview or update on the clean coal technology as well as professional researchers and students in chemistry and engineering

Handbook of Petroleum Refining James G. Speight, 2016-10-26 Petroleum refining involves refining crude petroleum as well as producing raw materials for the petrochemical industry This book covers current refinery processes and process types that are likely to come on stream during the next three to five decades The book includes 1 comparisons of conventional feedstocks with heavy oil tar sand bitumen and bio feedstocks 2 properties and refinability of the various feedstocks 3 thermal processes versus hydroprocesses and 4 the influence of refining on the environment

Fundamentals of Automatic Process Control Uttam Ray Chaudhuri, Utpal Ray Chaudhuri, 2012-10-29 Strong theoretical and practical knowledge of process control is essential for plant practicing engineers and operators In addition being able to use control hardware and software appropriately engineers must be able to select or write computer programs that interface the hardware and software required to run a plant effectively Designed to help readers understand control software and strategies that mimic human activities Fundamentals of Automatic Process Control provides an integrated introduction to the hardware and software of automatic control systems Featured Topics Basic instruments control systems and symbolic representations Laplacian mathematics for applications in control systems Various disturbances and their effects on uncontrolled processes Feedback control loops and traditional PID controllers Laplacian analysis of control loops Tuning methods for PID controllers Advanced control systems Virtual laboratory software included on CD ROM Modern plants require operators and engineers to have thorough knowledge of instrumentation hardware as well as good operating skills This book explores the theoretical analysis of the process dynamics and control via a large number of problems and solutions spread throughout the text This balanced presentation coupled with coverage of traditional and advanced systems provides an understanding of industrial realities that prepares readers for the future evolution of industrial operations

Industrial Solvents Handbook, Revised And Expanded Nicholas P. Cheremisinoff, 2003-04-15 Keeping pace with current trends in solvent production this volume builds upon its previous edition with broader coverage of safe handling practices health effects physical properties and chemical synthesis routes to some of the most important organic solvents used in the chemical and allied process industries This handy reference features a glossary of solvent terminology and an easy to reference index of synonyms for chemicals and solvents The Second Edition features new and updated chapters on the major classes of organic solvents descriptions for general use and the chemical formulation thermodynamic properties health and toxicity and combustible characteristics of solvents

Chemical Process Performance Evaluation Ali Cinar,Ahmet Palazoglu,Ferhan Kayihan,2007-01-11 The latest advances in process monitoring data analysis and control systems are increasingly useful for maintaining the safety flexibility and environmental compliance of industrial manufacturing operations Focusing on continuous multivariate processes *Chemical Process Performance Evaluation* introduces statistical methods and modeling techniques *Chemical Engineering and Chemical Process Technology - Volume I* Ryszard Pohorecki,John Bridgwater,M. Molzahn. Rafiqul Gani and Crispulo Gallegos,2010-11-30 *Chemical Engineering and Chemical Process Technology* is a theme component of Encyclopedia of Chemical Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty Encyclopedias Chemical engineering is a branch of engineering dealing with processes in which materials undergo changes in their physical or chemical state These changes may concern size energy content composition and or other application properties Chemical engineering deals with many processes belonging to chemical industry or related industries petrochemical metallurgical food pharmaceutical fine chemicals coatings and colors renewable raw materials biotechnological etc and finds application in manufacturing of such products as acids alkalis salts fuels fertilizers crop protection agents ceramics glass paper colors dyestuffs plastics cosmetics vitamins and many others It also plays significant role in environmental protection biotechnology nanotechnology energy production and sustainable economical development The Theme on Chemical Engineering and Chemical Process Technology deals in five volumes and covers several topics such as Fundamentals of Chemical Engineering Unit Operations Fluids Unit Operations Solids Chemical Reaction Engineering Process Development Modeling Optimization and Control Process Management The Future of Chemical Engineering Chemical Engineering Education Main Products which are then expanded into multiple subtopics each as a chapter These five volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs

Chemical Reactor Modeling Hugo A. Jakobsen,2008-10-15 *Chemical Reactor Modeling* closes the gap between Chemical Reaction Engineering and Fluid Mechanics It presents the fundamentals of the single fluid and multi fluid models for the analysis of single and multiphase reactive flows in chemical reactors with a chemical reactor engineering rather than mathematical bias The book discusses numerical methods for solving the resulting equations as well as the interplay between physical and numerical modes It is organized in 12 chapters combining theoretical aspects and practical applications and covers some of the recent research in several areas of chemical reactor engineering This book contains a survey of the modern literature in the field of chemical reactor modeling The book is written by a Chemical Engineer for Chemical Process Engineers 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 for both students and

practitioners Handbook of Refinery Desulfurization Nour Shafik El-Gendy, James G. Speight, 2015-09-18 Handbook of Refinery Desulfurization describes the operation of the various desulfurization process units in a petroleum refinery It also explains the processes that produce raw materials for the petrochemical industry It illustrates all the possible processes to lower the sulfur contents in petroleum and its fractions to decrease emissions of sulfur **Re-Engineering the Chemical Processing Plant** Andrzej Stankiewicz, Jacob A. Moulijn, 2003-11-07 The first guide to compile current research and frontline developments in the science of process intensification PI Re Engineering the Chemical Processing Plant illustrates the design integration and application of PI principles and structures for the development and optimization of chemical and industrial plants This volume updates professionals on emerging PI equipment and methodologies to promote technological advances and operational efficacy in chemical biochemical and engineering environments and presents clear examples illustrating the implementation and application of specific process intensifying equipment and methods in various commercial arenas

Bubbles, Drops, and Particles in Non-Newtonian Fluids Raj P. Chhabra, Swati A. Patel, 2023-08-31 The third edition of Bubbles Drops and Particles in Non Newtonian Fluids provides comprehensive coverage of the scientific foundations and the latest advances in particle motion in non Newtonian media Thoroughly updating and expanding its best selling predecessor this edition addresses numerical and experimental developments in non Newtonian particulate systems It includes a new chapter on heat transfer in non Newtonian fluids in the free and mixed convection regimes and thus covers forced convection regimes separately in this edition Salient Features Demonstrates how dynamic behavior of single particles can yield useful information for modeling transport processes in complex multiphase flows Addresses heat transfer in Generalized Newtonian Fluid GNF visco plastic and visco elastic fluids throughout the book and outlines potential strategies for heat transfer enhancement Provides a new detailed section on the effect of confinement on heat transfer from bluff bodies in non Newtonian fluids Written in a clear and concise manner this book remains an excellent handbook and reference It is essential reading for students and researchers interested in exploring particle motion in different types of non Newtonian systems encountered in disciplines across engineering and the sciences **Chemical Process Engineering** Harry Silla, 2003-08-08 Chemical Process Engineering presents a systematic approach to solving design problems by listing the needed equations calculating degrees of freedom developing calculation procedures to generate process specifications mostly pressures temperatures compositions and flow rates and sizing equipment This illustrative reference text tabulates numerous easy to follow calculation procedures as well as the relationships needed for sizing commonly used equipment

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