

Introduction To Chemical Engineering Tools For Today And Tomorrow

While existing books related to DOE are focused either on process or mixture factors or analyze specific tools from DOE science, this text is structured both horizontally and vertically, covering the three most common objectives of any experimental research: * screening designs * mathematical modeling, and * optimization. Written in a simple and lively manner and backed by current chemical product studies from all around the world, the book elucidates basic concepts of statistical methods, experiment design and optimization techniques as applied to chemistry and chemical engineering. Throughout, the focus is on unifying the theory and methodology of optimization with well-known statistical and experimental methods. The author draws on his own experience in research and development, resulting in a work that will assist students, scientists and engineers in using the concepts covered here in seeking optimum conditions for a chemical system or process. With 441 tables, 250 diagrams, as well as 200 examples drawn from current chemical product studies, this is an invaluable and convenient source of information for all those involved in process optimization.

"The authors—a chemical engineer and a civil engineer—have complimented each other in delivering an introductory text on optimization for engineers of all disciplines. It covers a host of topics not normally addressed by other texts. Although introductory in nature, it is a book that will prove invaluable to me and my staff, and belongs on the shelves of practicing environmental and chemical engineers. The illustrative examples are outstanding and make this a unique and special book." —John D. McKenna, Ph.D., Principal, ETS, Inc., Roanoke, Virginia "The authors have adeptly argued that basic science courses—particularly those concerned with mathematics—should be taught to engineers by engineers. Also, books adopted for use in such courses should also be written by engineers. The readers of this book will acquire an understanding and appreciation of the numerous mathematical methods that are routinely employed by practicing engineers. Furthermore, this introductory text on optimization attempts to address a void that exists in college engineering curricula. I recommend this book without reservation; it is a library 'must' for engineers of all disciplines." —Kenneth J. Skipka, RTP Environmental Associates, Inc., Westbury, NY, USA Introduction to Optimization for Chemical and Environmental Engineers presents the introductory fundamentals of several optimization methods with accompanying practical engineering applications. It examines mathematical optimization calculations common to both environmental and chemical engineering professionals, with a primary focus on perturbation techniques, search methods, graphical analysis, analytical methods, linear programming, and more. The book presents numerous illustrative examples laid out in such a way as to develop the reader's technical understanding of optimization, with progressively difficult examples located at the end of each chapter. This book serves as a training tool for students and industry professionals alike. FEATURES Examines optimization concepts and methods used by environmental and chemical engineering practitioners. Presents solutions to real-world scenarios/problems at the end of each chapter. Offers a pragmatic approach to the application of mathematical tools to assist the reader in grasping the role of optimization in engineering problem-solving situations. Provides numerous illustrative examples. Serves as a text for introductory courses, or as a training tool for industry professionals.

Written by a highly regarded author with industrial and academic experience, this new edition of an established bestselling book provides practical guidance for students, researchers, and those in chemical engineering. The book includes a new section on sustainable energy, with sections on carbon capture and sequestration, as a result of increasing environmental awareness; and a companion website that includes problems, worked solutions, and Excel spreadsheets to enable students to carry out complex calculations.

For reasons both financial and environmental, there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance, energy efficiency, profitability, safety and reliability. However, with most chemical engineering application problems having many variables with complex inter-relationships, meeting these optimization objectives can be challenging. This is where Multi-Objective Optimization (MOO) is useful to find the optimal trade-offs among two or more conflicting objectives. This book provides an overview of the recent developments and applications of MOO for modeling, design and operation of chemical, petrochemical, pharmaceutical, energy and related processes. It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks, chromatographic systems, CO₂ emissions targeting for petroleum refining units, ecodesign of chemical processes, ethanol purification and cumene process design. Multi-Objective Optimization in Chemical Engineering: Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers involved in process design, modeling and optimization.

Students taking their first chemical engineering course plunge into the 'nuts and bolts' of mass and energy balances and often miss the broad view of what chemical engineers do. This 1998 text offers a well-paced introduction to chemical engineering. Students are first introduced to the fundamental steps in design and three methods of analysis: mathematical modeling, graphical methods, and dimensional analysis. The book then describes how to apply engineering skills, such as how to simplify calculations through assumptions and approximations; how to verify calculations, significant figures, spreadsheets, graphing (standard, semi-log and log-log); and how to use data maps. In addition, the book teaches engineering skills through the design and analysis of chemical processes and process units in order to assess product quality, economics, safety, and environmental impact. This text will help undergraduate students in chemical engineering develop engineering skills early in their studies. Lecturer's solution manual available from the publisher on request.

Introduction to Chemical Engineering: Tools for Today and Tomorrow, 5th Edition Tools for Today and Tomorrow Wiley Global Education

This textbook introduces the concepts and tools that biomedical and chemical engineering students need to know in order to translate engineering problems into a numerical representation using scientific fundamentals. Modeling concepts focus on problems that are directly related to biomedical and chemical engineering. A variety of computational tools are presented, including MATLAB, Excel, Mathcad, and COMSOL, and a brief introduction to each tool is accompanied by multiple computer lab experiences. The numerical methods covered are basic linear algebra and basic statistics, and traditional methods like Newton's method, Euler Integration, and trapezoidal integration. The book presents the reader with numerous examples and worked problems, and practice problems are included at the end of each chapter. Focuses on problems and methods unique to biomedical and chemical engineering; Presents modeling concepts drawn from chemical, mechanical, and materials engineering; Ancillary materials include lecture notes and slides and online videos that enable a flipped classroom or individual study.

Outlines the concepts of chemical engineering so that non-chemical engineers can interface with and understand basic chemical engineering concepts Overviews the difference between laboratory and industrial scale practice of chemistry, consequences of mistakes, and approaches needed to scale a lab reaction process to an operating scale Covers basics of chemical reaction engineering, mass, energy, and fluid energy balances, how economics are scaled, and the nature of various types of flow sheets and how they are developed vs. time of a project Details the basics of fluid flow and transport, how fluid flow is characterized and explains the difference between positive displacement and centrifugal pumps along with their limitations and safety aspects of these differences Reviews the importance and approaches to controlling chemical processes and the safety aspects of controlling chemical processes, Reviews the important chemical engineering design aspects of unit operations including distillation, absorption and stripping, adsorption, evaporation and crystallization, drying and solids handling, polymer manufacture, and the basics of tank and agitation system design

CAMD or Computer Aided Molecular Design refers to the design of molecules with desirable properties. That is, through CAMD, one determines molecules that match a specified set of (target) properties. CAMD as a technique has a very large potential as in principle, all kinds of chemical, bio-chemical and material products can be designed through this technique. This book mainly deals with macroscopic properties and therefore does not cover molecular design of large, complex chemicals such as drugs. While books have been written on computer aided molecular design relating to drugs and large complex chemicals, a book on systematic formulation of CAMD problems and solutions, with emphasis on theory and practice, which helps one to learn, understand and apply the technique is currently unavailable. · This title brings together the theoretical aspects related to Computer Aided Molecular Design, the different techniques that have been developed and the different applications that have been reported. · Contributing authors are among the leading researchers and users of CAMD · First book available giving a systematic formulation of CAMD problems and solutions

Optimization is used to determine the most appropriate value of variables under given conditions. The primary focus of using optimisation techniques is to measure the maximum or minimum value of a function depending on the circumstances. This book discusses problem formulation and problem solving with the help of algorithms such as secant method, quasi-Newton method, linear programming and dynamic programming. It also explains important chemical processes such as fluid flow systems, heat exchangers, chemical reactors and distillation systems using solved examples. The book begins by explaining the fundamental concepts followed by an elucidation of various modern techniques including trust-region methods, Levenberg–Marquardt algorithms, stochastic optimization, simulated annealing and statistical optimization. It studies the multi-objective optimization technique and its applications in chemical engineering and also discusses the theory and applications of various optimization software tools including LINGO, MATLAB, MINITAB and GAMS.

The field of Chemical Engineering and its link to computer science is in constant evolution and new engineers have a variety of tools at their disposal to tackle their everyday problems. Introduction to Software for Chemical Engineers, Second Edition provides a quick guide to the use of various computer packages for chemical engineering applications. It covers a range of software applications from Excel and general mathematical packages such as MATLAB and MathCAD to process simulators, CHEMCAD and ASPEN, equation-based modeling languages, gProms, optimization software such as GAMS and AIMS, and specialized software like CFD or DEM codes. The different packages are introduced and applied to solve typical problems in fluid mechanics, heat and mass transfer, mass and energy balances, unit operations, reactor engineering, process and equipment design and control. This new edition offers a wider view of packages including open source software such as R, Python and Julia. It also includes complete examples in ASPEN Plus, adds ANSYS Fluent to CFD codes, Lingo to the optimization packages, and discusses Engineering Equation Solver. It offers a global idea of the capabilities of the software used in the chemical engineering field and provides examples for solving real-world problems. Written by leading experts, this book is a must-have reference for chemical engineers looking to grow in their careers through the use of new and improving computer software. Its user-friendly approach to simulation and optimization as well as its example-based presentation of the software, makes it a perfect teaching tool for both undergraduate and master levels.

The field of chemical engineering is in constant evolution, and access to information technology is changing the way chemical engineering problems are addressed. Inspired by the need for a user-friendly chemical engineering text that demonstrates the real-world applicability of different computer programs, Introduction to Software for Chemical Engineers acquaints readers with the capabilities of various general purpose, mathematical, process modeling and simulation, optimization, and specialized software packages, while explaining how to use the software to solve typical problems in fluid mechanics, heat and mass transfer, mass and energy balances, unit operations, reactor engineering,

and process and equipment design and control. Employing nitric acid production, methanol and ammonia recycle loops, and SO₂ oxidation reactor case studies and other practical examples, Introduction to Software for Chemical Engineers shows how computer packages such as Excel, MATLAB®, Mathcad, CHEMCAD, Aspen HYSYS®, gPROMS, CFD, DEM, GAMS, and AIMMS are used in the design and operation of chemical reactors, distillation columns, cooling towers, and more. Make Introduction to Software for Chemical Engineers your go-to guide and quick reference for the use of computer software in chemical engineering applications.

Experimental Methods and Instrumentation for Chemical Engineers, Second Edition, touches many aspects of engineering practice, research, and statistics. The principles of unit operations, transport phenomena, and plant design constitute the focus of chemical engineering in the latter years of the curricula. Experimental methods and instrumentation is the precursor to these subjects. This resource integrates these concepts with statistics and uncertainty analysis to define what is necessary to measure and to control, how precisely and how often. The completely updated second edition is divided into several themes related to data: metrology, notions of statistics, and design of experiments. The book then covers basic principles of sensing devices, with a brand new chapter covering force and mass, followed by pressure, temperature, flow rate, and physico-chemical properties. It continues with chapters that describe how to measure gas and liquid concentrations, how to characterize solids, and finally a new chapter on spectroscopic techniques such as UV/Vis, IR, XRD, XPS, NMR, and XAS. Throughout the book, the author integrates the concepts of uncertainty, along with a historical context and practical examples. A problem solutions manual is available from the author upon request. Includes the basics for 1st and 2nd year chemical engineers, providing a foundation for unit operations and transport phenomena Features many practical examples Offers exercises for students at the end of each chapter Includes up-to-date detailed drawings and photos of equipment

The Second Edition features new problems that engage readers in contemporary reactor design Highly praised by instructors, students, and chemical engineers, Introduction to Chemical Engineering Kinetics & Reactor Design has been extensively revised and updated in this Second Edition. The text continues to offer a solid background in chemical reaction kinetics as well as in material and energy balances, preparing readers with the foundation necessary for success in the design of chemical reactors. Moreover, it reflects not only the basic engineering science, but also the mathematical tools used by today's engineers to solve problems associated with the design of chemical reactors.

Introduction to Chemical Engineering Kinetics & Reactor Design enables readers to progressively build their knowledge and skills by applying the laws of conservation of mass and energy to increasingly more difficult challenges in reactor design. The first one-third of the text emphasizes general principles of chemical reaction kinetics, setting the stage for the subsequent treatment of reactors intended to carry out homogeneous reactions, heterogeneous catalytic reactions, and biochemical transformations. Topics include: Thermodynamics of chemical reactions Determination of reaction rate expressions Elements of heterogeneous catalysis Basic concepts in reactor design and ideal reactor models Temperature and energy effects in chemical reactors Basic and applied aspects of biochemical transformations and bioreactors About 70% of the problems in this Second Edition are new. These problems, frequently based on articles culled from the research literature, help readers develop a solid understanding of the material. Many of these new problems also offer readers opportunities to use current software applications such as Mathcad and MATLAB®. By enabling readers to progressively build and apply their knowledge, the Second Edition of Introduction to Chemical Engineering Kinetics & Reactor Design remains a premier text for students in chemical engineering and a valuable resource for practicing engineers.

Tools for Chemical Product Design: From Consumer Products to Biomedicine describes the challenges involved in systematic product design across a variety of industries and provides a comprehensive overview of mathematical tools aimed at the design of chemical products, from molecular design to customer products. Chemical product design has become increasingly important over the past decade and includes a wide range of sectors including gasoline additives and blends in the petroleum industry, active ingredients and excipients in the pharmaceutical industry, and a variety of consumer products and specialty chemicals. Traditionally, such products have been designed through trial and error methods, which not only are time-consuming, but more importantly only provide limited knowledge that can be translated into next generation products. Features an impressive collection of contributions from leading researchers in the field Presents the latest tools available across a variety of industries Describes the challenges involved in systematic product design as well as the latest methods for solving such problems Covers a wide range of sectors including gasoline additives and blends in the petroleum industry, active ingredients and excipients in the pharmaceutical industry, and a variety of consumer products and specialty chemicals

This book serves as an introduction to the subject, giving readers the tools to solve real-world chemical reaction engineering problems. It features a section of fully solved examples as well as end of chapter problems. It includes coverage of catalyst characterization and its impact on kinetics and reactor modeling. Each chapter presents simple ideas and concepts which build towards more complex and realistic cases and situations. Introduces an in-depth kinetics analysis Features well developed sections on the major topics of catalysts, kinetics, reactor design, and modeling Includes a chapter that showcases a fully worked out example detailing a typical problem that is faced when performing laboratory work Offers end of chapter problems and a solutions manual for adopting professors Aimed at advanced chemical engineering undergraduates and graduate students taking chemical reaction engineering courses as well as chemical engineering professionals, this textbook provides the knowledge to tackle real problems within the industry.

In this book, the modelling of dynamic chemical engineering processes is presented in a highly understandable way using the unique combination of simplified fundamental theory and direct hands-on computer simulation. The mathematics is kept to a minimum, and yet the nearly 100 examples supplied on www.wiley-vch.de illustrate almost every aspect of chemical engineering science. Each example is

described in detail, including the model equations. They are written in the modern user-friendly simulation language Berkeley Madonna, which can be run on both Windows PC and Power-Macintosh computers. Madonna solves models comprising many ordinary differential equations using very simple programming, including arrays. It is so powerful that the model parameters may be defined as "sliders", which allow the effect of their change on the model behavior to be seen almost immediately. Data may be included for curve fitting, and sensitivity or multiple runs may be performed. The results can be seen simultaneously on multiple-graph windows or by using overlays. The resultant learning effect of this is tremendous. The examples can be varied to fit any real situation, and the suggested exercises provide practical guidance. The extensive experience of the authors, both in university teaching and international courses, is reflected in this well-balanced presentation, which is suitable for the teacher, the student, the chemist or the engineer. This book provides a greater understanding of the formulation and use of mass and energy balances for chemical engineering, in a most stimulating manner. This book is a third edition, which also includes biological, environmental and food process examples.

Industrial Chemical Process Analysis and Design uses chemical engineering principles to explain the transformation of basic raw materials into major chemical products. The book discusses traditional processes to create products like nitric acid, sulphuric acid, ammonia, and methanol, as well as more novel products like bioethanol and biodiesel. Historical perspectives show how current chemical processes have developed over years or even decades to improve their yields, from the discovery of the chemical reaction or physico-chemical principle to the industrial process needed to yield commercial quantities. Starting with an introduction to process design, optimization, and safety, Martin then provides stand-alone chapters—in a case study fashion—for commercially important chemical production processes. Computational software tools like MATLAB®, Excel, and Chemcad are used throughout to aid process analysis. Integrates principles of chemical engineering, unit operations, and chemical reactor engineering to understand process synthesis and analysis Combines traditional computation and modern software tools to compare different solutions for the same problem Includes historical perspectives and traces the improving efficiencies of commercially important chemical production processes Features worked examples and end-of-chapter problems with solutions to show the application of concepts discussed in the text

The idea of editing a book on modern software architectures and tools for CAPE (Computer Aided Process Engineering) came about when the editors of this volume realized that existing titles relating to CAPE did not include references to the design and development of CAPE software. Scientific software is needed to solve CAPE related problems by industry/academia for research and development, for education and training and much more. There are increasing demands for CAPE software to be versatile, flexible, efficient, and reliable. This means that the role of software architecture is also gaining increasing importance. Software architecture needs to reconcile the objectives of the software; the framework defined by the CAPE methods; the computational algorithms; and the user needs and tools (other software) that help to develop the CAPE software. The object of this book is to bring to the reader, the software side of the story with respect to computer aided process engineering.

This book is an outgrowth of the author's teaching experience of a course on Introduction to Chemical Engineering to the first-year chemical engineering students of the Indian Institute of Technology Madras. The book serves to introduce the students to the role of a chemical engineer in society. In addition to the classical industries, the role of chemical engineers in several esoteric areas such as semiconductor processing and biomedical engineering is discussed. Besides highlighting the principles and processes of chemical engineering, the book shows how chemical engineering concepts from the basic sciences and economics are used to seek solutions to engineering problems. The book is rich in examples of innovative solutions found to problems faced in chemical industry. It includes a wide spectrum of topics, selected from the industrial interactions of the author. It encourages the student to see the similarities in the concepts which govern apparently dissimilar examples. It introduces various concepts, using both physical and mathematical bases, to facilitate the understanding of difficult processes such as the scale-up process. The book contains several case studies on safety, ethics and environmental issues in chemical process industries.

Step-by-step instructions enable chemical engineers to masterkey software programs and solve complex problems Today, both students and professionals in chemical engineering must solve increasingly complex problems dealing with refineries, fuel cells, microreactors, and pharmaceutical plants, to name a few. With this book as their guide, readers learn to solve these problems using their computers and Excel, MATLAB, Aspen Plus, and COMSOL Multiphysics. Moreover, they learn how to check their solutions and validate their results to make sure they have solved the problems correctly. Now in its Second Edition, Introduction to Chemical Engineering Computing is based on the author's firsthand teaching experience. As a result, the emphasis is on problem solving. Simple introductions help readers become conversant with each program and then tackle a broad range of problems in chemical engineering, including: Equations of state Chemical reaction equilibria Mass balances with recycle streams Thermodynamics and simulation of mass transfer equipment Process simulation Fluid flow in two and three dimensions All the chapters contain clear instructions, figures, and examples to guide readers through all the programs and types of chemical engineering problems. Problems at the end of each chapter, ranging from simple to difficult, allow readers to gradually build their skills, whether they solve the problems themselves or in teams. In addition, the book's accompanying website lists the core principles learned from each problem, both from a chemical engineering and a computational perspective. Covering a broad range of disciplines and problems within chemical engineering, Introduction to Chemical Engineering Computing is recommended for both undergraduate and graduate students as well as practicing engineers who want to know how to choose the right computer software program and tackle almost any chemical engineering problem.

Advanced Data Analysis and Modeling in Chemical Engineering provides the mathematical foundations of different areas of chemical engineering and describes typical applications. The book presents the key areas of chemical engineering, their mathematical foundations, and corresponding modeling techniques. Modern industrial production is based on solid scientific methods, many of which are part of chemical engineering. To produce new substances or materials, engineers must devise special reactors and procedures, while also observing stringent safety requirements and striving to optimize the efficiency jointly in economic and ecological terms. In chemical engineering, mathematical methods are considered to be driving forces of many innovations in material design and process development. Presents the main mathematical problems and models of chemical engineering and provides the reader with contemporary methods and tools to solve them Summarizes in a clear and straightforward way, the contemporary trends in the interaction between mathematics and chemical engineering vital to chemical engineers in their daily work Includes classical analytical methods, computational methods, and methods of symbolic computation Covers the latest cutting edge computational methods, like symbolic computational methods

The field of chemical engineering is undergoing a global "renaissance," with new processes, equipment, and sources changing literally every day. It is a dynamic, important area of study and the basis for some of the most lucrative and integral fields of science. Introduction to Chemical Engineering offers a comprehensive overview of the concept, principles and applications of chemical engineering. It explains the distinct chemical engineering knowledge which gave rise to a general-purpose technology and broadest engineering field. The book serves as a conduit between college education and the real-world chemical engineering practice. It answers many questions students and young engineers often ask which include: How is what I studied in the classroom being applied in the industrial setting? What steps do I need to take to become a professional chemical engineer? What are the career diversities in chemical engineering and the engineering knowledge required? How is chemical engineering design done in real-world? What are the chemical engineering computer tools and their applications? What are the prospects, present and future challenges of chemical engineering? And so on. It also provides the information

new chemical engineering hires would need to excel and cross the critical novice engineer stage of their career. It is expected that this book will enhance students understanding and performance in the field and the development of the profession worldwide. Whether a new-hire engineer or a veteran in the field, this is a must—have volume for any chemical engineer's library.

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.

While chemical products are useful in their own right—they address the demands and needs of the masses—they also drain our natural resources and generate unwanted pollution. Green Chemical Engineering: An Introduction to Catalysis, Kinetics, and Chemical Processes encourages minimized use of non-renewable natural resources and fosters maximized pollution prevention. This text stresses the importance of developing processes that are environmentally friendly and incorporate the role of green chemistry and reaction engineering in designing these processes. Focused on practical application rather than theory, the book integrates chemical reaction engineering and green chemical engineering, and is divided into two sections. The first half of the book covers the basic principles of chemical reaction engineering and reactor design, while the second half of the book explores topics on green reactors, green catalysis, and green processes. The authors mix in elaborate illustrations along with important developments, practical applications, and recent case studies. They also include numerous exercises, examples, and problems covering the various concepts of reaction engineering addressed in this book, and provide MATLAB® software used for developing computer codes and solving a number of reaction engineering problems. Consisting of six chapters organized into two sections, this text: Covers the basic principles of chemical kinetics and catalysis Gives a brief introduction to classification and the various types of chemical reactors Discusses in detail the differential and integral methods of analysis of rate equations for different types of reactions Presents the development of rate equations for solid catalyzed reactions and enzyme catalyzed biochemical reactions Explains methods for estimation of kinetic parameters from batch reactor data Details topics on homogeneous reactors Includes graphical procedures for the design of multiple reactors Contains topics on heterogeneous reactors including catalytic and non-catalytic reactors Reviews various models for non-catalytic gas–solid and gas–liquid reactions Introduces global rate equations and explicit design equations for a variety of non-catalytic reactors Gives an overview of novel green reactors and the application of CFD technique in the modeling of green reactors Offers detailed discussions of a number of novel reactors Provides a brief introduction to CFD and the application of CFD Highlights the development of a green catalytic process and the application of a green catalyst in the treatment of industrial effluent Comprehensive and thorough in its coverage, Green Chemical Engineering: An Introduction to Catalysis, Kinetics, and Chemical Processes explains the basic concepts of green engineering and reactor design fundamentals, and provides key knowledge for students at technical universities and professionals already working in the industry.

Since the publication of the bestselling first edition, there have been numerous advances in the field of nuclear science. In medicine, accelerator based teletherapy and electron-beam therapy have become standard. New demands in national security have stimulated major advances in nuclear instrumentation. An ideal introduction to the fundamentals of nuclear science and engineering, this book presents the basic nuclear science needed to understand and quantify an extensive range of nuclear phenomena. New to the Second Edition— A chapter on radiation detection by Douglas McGregor Up-to-date coverage of radiation hazards, reactor designs, and medical applications Flexible organization of material that allows for quick reference This edition also takes an in-depth look at particle accelerators, nuclear fusion reactions and devices, and nuclear technology in medical diagnostics and treatment. In addition, the author discusses applications such as the direct conversion of nuclear energy into electricity. The breadth of coverage is unparalleled, ranging from the theory and design characteristics of nuclear reactors to the identification of biological risks associated with ionizing radiation. All topics are supplemented with extensive nuclear data compilations to perform a wealth of calculations. Providing extensive coverage of physics, nuclear science, and nuclear technology of all types, this up-to-date second edition of Fundamentals of Nuclear Science and Engineering is a key reference for any physicists or engineer.

This text is designed for an introductory course for first- year college students interested in chemical engineering. The goals of the book are to provide a brief overview of the chemical engineering discipline at a level appropriate for beginning students, and to do so within a 2-credit, 1-semester course.

Part I: Process design -- Introduction to design -- Process flowsheet development -- Utilities and energy efficient design -- Process simulation -- Instrumentation and process control -- Materials of construction -- Capital cost estimating -- Estimating revenues and production costs -- Economic evaluation of projects -- Safety and loss prevention --

General site considerations -- Optimization in design -- Part II: Plant design -- Equipment selection, specification and design -- Design of pressure vessels -- Design of reactors and mixers -- Separation of fluids -- Separation columns (distillation, absorption and extraction) -- Specification and design of solids-handling equipment -- Heat transfer equipment -- Transport and storage of fluids.

Elementary Principles of Chemical Processes, 4th Edition Student International Version prepares students to formulate and solve material and energy balances in chemical process systems and lays the foundation for subsequent courses in chemical engineering. The text provides a realistic, informative, and positive introduction to the practice of chemical engineering.

A compilation of the calculation procedures needed every day on the job by chemical engineers. Tables of Contents: Physical and Chemical Properties; Stoichiometry; Phase Equilibrium; Chemical-Reaction Equilibrium; Reaction Kinetics and Reactor Design; Flow of Fluids and Solids; Heat Transfer; Distillation; Extraction and Leaching; Crystallization; Filtration; Liquid Agitation; Size Reduction; Drying; Evaporation; Environmental Engineering in the Plant. Illustrations. Index.

Designed for introductory undergraduate courses in fluid mechanics for chemical engineers, this stand-alone textbook illustrates the fundamental concepts and analytical strategies in a rigorous and systematic, yet mathematically accessible manner. Using both traditional and novel applications, it examines key topics such as viscous stresses, surface tension, and the microscopic analysis of incompressible flows which enables students to understand what is important physically in a novel situation and how to use such insights in modeling. The many modern worked examples and end-of-chapter problems provide calculation practice, build confidence in analyzing physical systems, and help develop engineering judgment. The book also features a self-contained summary of the mathematics needed to understand vectors and tensors, and explains solution methods for partial differential equations. Including a full solutions manual for instructors available at www.cambridge.org/deen, this balanced textbook is the ideal resource for a one-semester course.

'Chemical engineering is the field of applied science that employs physical, chemical, and biological rate processes for the betterment of humanity'. This opening sentence of Chapter 1 has been the underlying paradigm of chemical engineering. Chemical Engineering: An Introduction is designed to enable the student to explore the activities in which a modern chemical engineer is involved by focusing on mass and energy balances in liquid-phase processes. Problems explored include the design of a feedback level controller, membrane separation, hemodialysis, optimal design of a process with chemical reaction and separation, washout in a bioreactor, kinetic and mass transfer limits in a two-phase reactor, and the use of the membrane reactor to overcome equilibrium limits on conversion. Mathematics is employed as a language at the most elementary level. Professor Morton M. Denn incorporates design meaningfully; the design and analysis problems are realistic in format and scope.

This concise book is a broad and highly motivational introduction for first-year engineering students to the exciting of field of chemical engineering. The material in the text is meant to precede the traditional second-year topics. It provides students with, 1) materials to assist them in deciding whether to major in chemical engineering; and 2) help for future chemical engineering majors to recognize in later courses the connections between advanced topics and relationships to the whole discipline. This text, or portions of it, may be useful for the chemical engineering portion of a broader freshman level introduction to engineering course that examines multiple engineering fields.

An Introduction to Materials Engineering and Science for Chemical and Materials Engineers provides a solid background in materials engineering and science for chemical and materials engineering students. This book: Organizes topics on two levels; by engineering subject area and by materials class. Incorporates instructional objectives, active-learning principles, design-oriented problems, and web-based information and visualization to provide a unique educational experience for the student. Provides a foundation for understanding the structure and properties of materials such as ceramics/glass, polymers, composites, bio-materials, as well as metals and alloys. Takes an integrated approach to the subject, rather than a "metals first" approach.

Introduction to Chemical Engineering Analysis Using Mathematica, Second Edition reviews the processes and designs used to manufacture, use, and dispose of chemical products using Mathematica, one of the most powerful mathematical software tools available for symbolic, numerical, and graphical computing. Analysis and computation are explained simultaneously. The book covers the core concepts of chemical engineering, ranging from the conservation of mass and energy to chemical kinetics. The text also shows how to use the latest version of Mathematica, from the basics of writing a few lines of code through developing entire analysis programs. This second edition has been fully revised and updated, and includes analyses of the conservation of energy, whereas the first edition focused on the conservation of mass and ordinary differential equations. Offers a fully revised and updated new edition, extended with conservation of energy Covers a large number of topics in chemical engineering analysis, particularly for applications to reaction systems Includes many detailed examples Contains updated and new worked problems at the end of the book Written by a prominent scientist in the field Chemical Engineering Process Simulation is ideal for students, early career researchers, and practitioners, as it guides you through chemical processes and unit operations using the main simulation softwares that are used in the industrial sector. This book will help you predict the characteristics of a process using mathematical models and computer-aided process simulation tools, as well as model and simulate process performance before detailed process design takes place. Content coverage includes steady and dynamic simulations, the similarities and differences between process simulators, an introduction to operating units, and convergence tips and tricks. You will also learn about the use of simulation for risk studies to enhance process resilience, fault finding in abnormal situations, and for training operators to control the process in difficult situations. This

experienced author team combines industry knowledge with effective teaching methods to make an accessible and clear comprehensive guide to process simulation. Ideal for students, early career researchers, and practitioners, as it guides you through chemical processes and unit operations using the main simulation softwares that are used in the industrial sector. Covers the fundamentals of process simulation, theory, and advanced applications Includes case studies of various difficulty levels to practice and apply the developed skills Features step-by-step guides to using Aspen Plus and HYSYS for process simulations available on companion site Helps readers predict the characteristics of a process using mathematical models and computer-aided process simulation tools

Covering the important task of the scale-up of processes from the laboratory to the production scale, this easily comprehensible and transparent book is divided into two sections. The first part details the theoretical principles, introducing the subject for readers without a profound prior knowledge of mathematics. It discusses the fundamentals of dimensional analysis, the treatment of temperature-dependent and rheological material values and scale-up where model systems or not available or only partly similar. All this is illustrated by 20 real-world examples, while 25 exercises plus solutions new to this edition practice and monitor learning. The second part presents the individual basic operations and covers the fields of mechanical, thermal, and chemical process engineering with respect to dimensional analysis and scale-up. The rules for scale-up are given and discussed for each operation. Other additions to this second edition are dimensional analysis of pelleting processes, and a historical overview of dimensional analysis and modeling, while all the chapters have been updated to take the latest literature into account. Written by a specialist with more than 40 years of experience in the industry, this book is specifically aimed at students as well as practicing engineers, chemists and process engineers already working in the field.

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