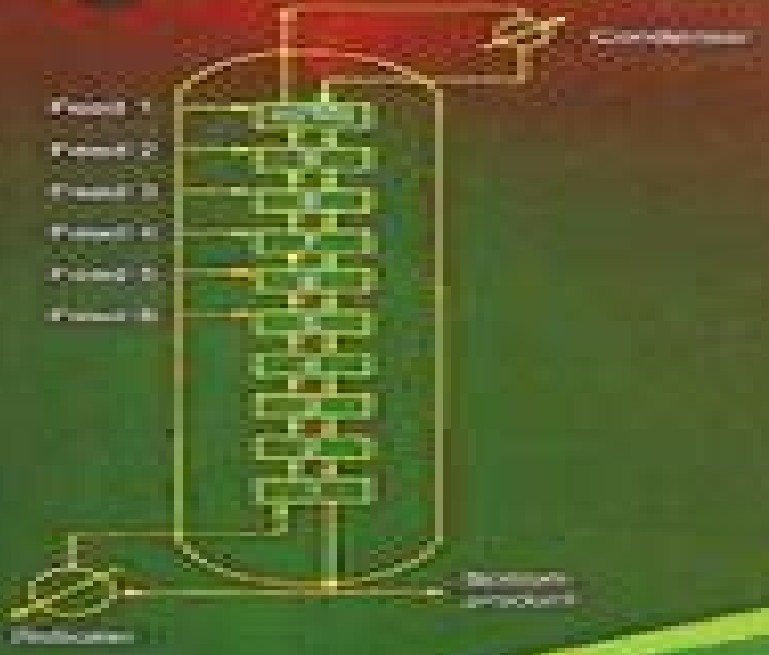
Second Edition

Chemical Process Modelling and Computer Simulation



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AMIYA K. JANA

Chemical Process Modelling And Computer Simulation

John Ingham,Irving J. Dunn,Elmar Heinzle,Jiri E. Prenosil,Jonathan B. Snape

Chemical Process Modelling And Computer Simulation:

CHEMICAL PROCESS MODELLING AND COMPUTER SIMULATION, THIRD EDITION JANA, AMIYA K.,2018-01-01 This comprehensive and thoroughly revised text now in its third edition continues to present the fundamental concepts of how mathematical models of chemical processes are constructed and demonstrate their applications to the simulation of three of the very important chemical engineering systems the chemical reactors distillation systems and vaporizing processes The book provides an integrated treatment of process description mathematical modelling and dynamic simulation of realistic problems using the robust process model approach and its simulation with efficient numerical techniques Theoretical background materials on activity coefficient models equation of state models reaction kinetics and numerical solution techniques needed for the development and simulation of mathematical models are also addressed in the book The topics of discussion related to tanks heat exchangers chemical reactors both continuous and batch biochemical reactors continuous and fed batch distillation columns continuous and batch equilibrium flash vaporizer refinery debutanizer column evaporator and steam generator contain several worked out examples and case studies to teach students how chemical processes are operated characterized and monitored using computer programming NEW TO THIS EDITION The inclusion of following three new chapters on Gas Absorption Liquid Liquid Extraction Column Once Through Steam Generator will further strengthen the text This book is designed for senior level undergraduate and first year postgraduate level courses in Chemical Process Modelling and Simulation The book will also be useful for students of petrochemical engineering biotechnology and biochemical engineering It can serve as a guide for research scientists and practising engineers as well **CHEMICAL PROCESS MODELLING AND COMPUTER SIMULATION** AMIYA K. JANA,2011-11-05 This comprehensive and thoroughly revised text now in its second edition continues to present the fundamental concepts of how mathematical models of chemical processes are constructed and demonstrate their applications to the simulation of two of the very important chemical engineering systems the chemical reactors and distillation systems The book provides an integrated treatment of process description mathematical modelling and dynamic simulation of realistic problems using the robust process model approach and its simulation with efficient numerical techniques Theoretical background materials on activity coefficient models equation of state models reaction kinetics and numerical solution techniques needed for the development of mathematical models are also addressed in the book The topics of discussion related to tanks heat exchangers chemical reactors both continuous and batch biochemical reactors continuous and fed batch distillation columns continuous and batch equilibrium flash vaporizer and refinery debutanizer column contain several worked out examples and case studies to teach students how chemical processes can be measured and monitored using computer programming The new edition includes two more chapters Reactive Distillation Column and Vaporizing Exchangers which will further strengthen the text This book is designed for senior level undergraduate and first year postgraduate level courses in

Chemical Process Modelling and Simulation The book will also be useful for students of petrochemical engineering biotechnology and biochemical engineering It can serve as a guide for research scientists and practising engineers as well

Modeling and Simulation of Chemical Process Systems Nayef Ghasem,2018-11-08 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 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 Computational Methods for Process Simulation W. Fred Ramirez,1997-11-20 Process Modelling and simulation have proved to be extremely successful engineering tools for the design and optimisation of physical chemical and biochemical processes The use of simulation has expanded rapidly over the last two decades because of the availability of large high speed computers and indeed has become even more widespread with the rise of the desk top PC resources now available to nearly every engineer and student In the chemical industry large realistic non linear problems are routinely solved with the aid of computer simulation This has a number of benefits including easy assessment of the economic desirability of a project convenient investigation of the effects of changes to system variables and finally the introduction of mathematical rigour into the design process and inherent assumptions that may not have been there before Computational Methods for Process Simulation develops the methods needed for the simulation of real processes to be found in the process industries It also stresses the engineering fundamentals used in developing process models Steady state and dynamic systems are considered for both spatially lumped and spatially distributed problems It develops analytical and numerical computational techniques for algebraic ordinary and partial differential equations and makes use of computer software routines that are widely available Dedicated software examples are available via the internet Written for a compulsory course element in the US Includes examples using software used in academia and industry Software available via the Internet

Process Modeling and Simulation for Chemical Engineers Simant Ranjan Upreti,2017 This book provides a rigorous treatment of the fundamental concepts and techniques involved in process modeling and simulation The book allows the reader to i Get a solid grasp of under the hood mathematical results ii Develop models of sophisticated processes iii Transform models to different geometries and domains as appropriate iv Utilize various model simplification techniques v Learn simple and effective computational methods for model simulation vi Intensify the effectiveness of their research Modeling and Simulation for Chemical Engineers Theory and Practice begins with an introduction to the terminology of process modeling and simulation Chapters 2 and 3 cover fundamental and constitutive relations while Chapter 4 on model formulation builds on these relations Chapters 5 and 6 introduce the advanced techniques of model transformation and

simplification Chapter 7 deals with model simulation and the final chapter reviews important mathematical concepts Presented in a methodical systematic way this book is suitable as a self study guide or as a graduate reference and includes examples schematics and diagrams to enrich understanding End of chapter problems with solutions and computer software available online are designed to further stimulate readers to apply the newly learned concepts End of chapter problems with solutions and computer software available online are designed to further stimulate readers to apply the newly learned concepts **Chemical Engineering Dynamics** John Ingham,Irving J. Dunn,Elmar Heinzle,Jiri E. Prenosil,Jonathan B. Snape,2008-02-08 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 **Computer Methods in Chemical Engineering** NAYEF. GHASEM,2021-11-17 While various software packages have become essential for performing unit operations and other kinds of processes in chemical engineering the fundamental theory and methods of calculation must also be understood in order to effectively test the validity of these packages and verify the results Computer Methods in Chemical Engineering Second Edition presents the most used simulation software along with the theory involved It covers chemical engineering thermodynamics fluid mechanics material and energy balances mass transfer operations reactor design and computer applications in chemical engineering The highly anticipated Second Edition is thoroughly updated to reflect the latest updates in the featured software and has added a focus on real reactors introduces AVEVA Process Simulation software and includes new and updated appendixes Through this book students learn What chemical engineers do The functions and theoretical background of basic chemical engineering unit operations How to simulate chemical processes using software packages How to size chemical process units manually and

with software How to fit experimental data How to solve linear and nonlinear algebraic equations as well as ordinary differential equations Along with exercises and references each chapter contains a theoretical description of process units followed by numerous examples that are solved step by step via hand calculations and computer simulation using Hysys Unisim PRO II Aspen Plus and SuperPro Designer Adhering to the Accreditation Board for Engineering and Technology ABET criteria the book gives chemical engineering students and professionals the tools needed to solve real problems involving thermodynamics and fluid phase equilibria fluid flow material and energy balances heat exchangers reactor design distillation absorption and liquid extraction This highly anticipated second edition textbook has added a focus on real reactors introduces AVEVA Process Simulation software and includes new and updated appendixes This new edition includes many examples simulated by recent software packages In addition fluid package information is introduced in correlation to the numerical problems in book Lastly an updated solutions manual and PowerPoint lecture slides are provided in addition to new video guides and Unisim programme files _ **Chemical Engineering Dynamics** John Ingham,Irving J. Dunn,Elmar Heinzle,Jiří E. Přenosil,2008-07-11 In this book the reader is guided through the complex study of dynamic chemical engineering systems by the unique combination of a simplified presentation of the fundamental theory Part 1 and direct hands on computer experimentation with the provision of 85 accompanying computer based simulation examples Part 2 supplied on diskette The ISIM digital simulation language is very simple to use and its powerful interactive nature enables the readers to create their own simulations based on their own specific problems This powerful dynamic ISIM software is ready to run on any DOS personal computer The treatment employed in this book is well tried and tested based on over 20 years experience in teaching an international post experience course Whether for the teacher the student the chemist or engineer this book serves as the key to a greater understanding of chemical engineering dynamics through the fun and enjoyment of active learning Modeling and Simulation of Chemical Process Systems Nayef Ghasem,2018-11-08 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 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 *Process Modelling and Model Analysis* Ian T. Cameron,Katalin Hangos,2001-05-23 Process Modelling and Model Analysis describes the use of models in process engineering Process engineering is all about manufacturing of just about anything To manage processing and manufacturing systematically the engineer has to bring together many different techniques and analyses of the interaction between various aspects of the process For example process engineers would apply models to perform feasibility analyses of novel process designs assess

environmental impact and detect potential hazards or accidents To manage complex systems and enable process design the behavior of systems is reduced to simple mathematical forms This book provides a systematic approach to the mathematical development of process models and explains how to analyze those models Additionally there is a comprehensive bibliography for further reading a question and answer section and an accompanying Web site developed by the authors with additional data and exercises Introduces a structured modeling methodology emphasizing the importance of the modeling goal and including key steps such as model verification calibration and validation Focuses on novel and advanced modeling techniques such as discrete hybrid hierarchical and empirical modeling Illustrates the notions tools and techniques of process modeling with examples and advances applications Process Modeling and Simulation for Chemical Engineers Simant Ranjan Upreti,2017 This book provides a rigorous treatment of the fundamental concepts and techniques involved in process modeling and simulation The book allows the reader to i Get a solid grasp of under the hood mathematical results ii Develop models of sophisticated processes iii Transform models to different geometries and domains as appropriate iv Utilize various model simplification techniques v Learn simple and effective computational methods for model simulation vi Intensify the effectiveness of their research Modeling and Simulation for Chemical Engineers Theory and Practice begins with an introduction to the terminology of process modeling and simulation Chapters 2 and 3 cover fundamental and constitutive relations while Chapter 4 on model formulation builds on these relations Chapters 5 and 6 introduce the advanced techniques of model transformation and simplification Chapter 7 deals with model simulation and the final chapter reviews important mathematical concepts Presented in a methodical systematic way this book is suitable as a self study guide or as a graduate reference and includes examples schematics and diagrams to enrich understanding End of chapter problems with solutions and computer software available online are designed to further stimulate readers to apply the newly learned concepts End of chapter problems with solutions and computer software available online are designed to further stimulate readers to apply the newly learned concepts **Chemical Engineering Computation with MATLAB®** Yeong Koo Yeo,2020-12-15 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 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

_ *A Step by Step Approach to the Modeling of Chemical Engineering Processes* Liliane Maria Ferrareso Lona,2019-06-06 This book treats modeling and simulation in a simple way that builds on the existing knowledge and intuition of students They will learn how to build a model and solve it using Excel Most chemical engineering students feel a shiver down the spine when they see a set of complex mathematical equations generated from the modeling of a chemical engineering system This is because they usually do not understand how to achieve this mathematical model or they do not know how to solve the equations system without spending a lot of time and effort Trying to understand how to generate a set of mathematical equations to represent a physical system to model and solve these equations to simulate is not a simple task A model most of the time takes into account all phenomena studied during a Chemical Engineering course In the same way there is a multitude of numerical methods that can be used to solve the same set of equations generated from the modeling and many different computational languages can be adopted to implement the numerical methods As a consequence of this comprehensiveness and combinatorial explosion of possibilities most books that deal with this subject are very extensive and embracing making need for a lot of time and effort to go through this subject It is expected that with this book the chemical engineering student and the future chemical engineer feel motivated to solve different practical problems involving chemical processes knowing they can do that in an easy and fast way with no need of expensive software *Integrated Design and Simulation of Chemical Processes* Alexandre C. Dimian,Costin Sorin Bildea,Anton A. Kiss,2014-09-18 This comprehensive work shows how to design and develop innovative optimal and sustainable chemical processes by applying the principles of process systems engineering leading to integrated sustainable processes with green attributes Generic systematic methods are employed supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models New to the second edition are chapters on product design and batch processes with applications in specialty chemicals process intensification methods for designing compact equipment with high energetic efficiency plantwide control for managing the key factors affecting the plant dynamics and operation health safety and environment issues as well as sustainability analysis for achieving high environmental performance All chapters are completely rewritten or have been revised This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students being compatible with academic requirements world wide The inclusion of the newest design methods will be of great value to professional chemical engineers Systematic approach to developing innovative and sustainable chemical

processes Presents generic principles of process simulation for analysis creation and assessment Emphasis on sustainable development for the future of process industries Chemical Engineering Tanase Gh. Dobre,José G. Sanchez Marcano,2007-06-27 A description of the use of computer aided modeling and simulation in the development integration and optimization of industrial processes The two authors elucidate the entire procedure step by step from basic mathematical modeling to result interpretation and full scale process performance analysis They further demonstrate similitude comparisons of experimental results from different systems as a tool for broadening the applicability of the calculation methods Throughout the book adopts a very practical approach addressing actual problems and projects likely to be encountered by the reader as well as fundamentals and solution strategies for complex problems It is thus equally useful for student and professional engineers and chemists involved in industrial process and production plant design construction or upgrading *Modeling and Simulation in Chemical Engineering* Roger G. E. Franks,1972-06-16 *Product and Process Modelling* Ian T. Cameron,Rafiqul Gani,2011-09-12 This book covers the area of product and process modelling via a case study approach It addresses a wide range of modelling applications with emphasis on modelling methodology and the subsequent in depth analysis of mathematical models to gain insight via structural aspects of the models These approaches are put into the context of life cycle modelling where multiscale and multiform modelling is increasingly prevalent in the 21st century The book commences with a discussion of modern product and process modelling theory and practice followed by a series of case studies drawn from a variety of process industries The book builds on the extensive modelling experience of the authors who have developed models for both research and industrial purposes It complements existing books by the authors in the modelling area Those areas include the traditional petroleum and petrochemical industries to biotechnology applications food polymer and human health application areas The book highlights to important nature of modern product and process modelling in the decision making processes across the life cycle As such it provides an important resource for students researchers and industrial practitioners Ian Cameron is Professor in Chemical Engineering at the University of Queensland with teaching research and consulting activities in process systems engineering He has a particular interest in process modelling dynamic simulation and the application of functional systems perspectives to risk management having extensive industrial experience in these areas He continues to work closely with industry and government on systems approaches to process and risk management issues He received his BE from the University of New South Wales Australia and his PhD from imperial College London He is a Fellow of IChemE Rafiqul Gani is a Professor of Systems Design at the Department of Chemical and Biochemical Engineering Technical University of Denmark and the director of the Computer Aided Product Process Engineering Center CAPEC His research interests include the development of computer aided methods and tools for modelling property estimation and process product synthesis and design He received his BSc from Bangladesh University of Engineering and Technology in 1975 and his MSc in 1976 and PhD in 1980 from Imperial College

London He is the editor in chief of Computers and Chemical Engineering journal and Fellow of IChemE as well as AIChE Product and process modelling a wide range of case studies are covered Structural analysis of model systems insights into structure and solvability Analysis of future developments potential directions and significant research and development problems to be addressed Dynamic Process Modeling ,2010-12-06 Inspired by the leading authority in the field the Centre for Process Systems Engineering at Imperial College London this book includes theoretical developments algorithms methodologies and tools in process systems engineering and applications from the chemical energy molecular biomedical and other areas It spans a whole range of length scales seen in manufacturing industries from molecular and nanoscale phenomena to enterprise wide optimization and control As such this will appeal to a broad readership since the topic applies not only to all technical processes but also due to the interdisciplinary expertise required to solve the challenge The ultimate reference work for years to come Introduction to Modeling and Numerical Methods for Biomedical and Chemical Engineers Edward Gatzke,2021-09-02 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 Computational Methods for Process Simulation W. Fred Ramirez,1989 This develops the modelling and computational methods needed for the simulation of real processes Fundamental modelling techniques are discussed in order to develop mechanistically sound mathematical descriptions of physical chemical and biochemical processes

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