

Mathematical Methods in Chemical Engineering

S. PUSHPAVANAM



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Pushpavanam

P. A. Ramachandran



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MATHEMATICAL METHODS IN CHEMICAL ENGINEERING S. PUSHPAVANAM, 1998-01-01 This comprehensive well organized and easy to read book presents concepts in a unified framework to establish a similarity in the methods of solutions and analysis of such diverse systems as algebraic equations ordinary differential equations and partial differential equations The distinguishing feature of the book is the clear focus on analytical methods of solving equations The text explains how the methods meant to elucidate linear problems can be extended to analyse nonlinear problems The book also discusses in detail modern concepts like bifurcation theory and chaos To attract engineering students to applied mathematics the author explains the concepts in a clear concise and straightforward manner with the help of examples and analysis The significance of analytical methods and concepts for the engineer scientist interested in numerical applications is clearly brought out Intended as a textbook for the postgraduate students in engineering the book could also be of great help to the research students

NUMERICAL, SYMBOLIC AND STATISTICAL COMPUTING FOR CHEMICAL ENGINEERS USING MATLAB Ghosh, Pallab, 2018-09-01 Numerical analytical and statistical computations are routine affairs for chemical engineers They usually prefer a single software to solve their computational problems and at present MATLAB has emerged as a powerful computational language which is preferably used for this purpose due to its built in functions and toolboxes Considering the needs and convenience of the students the author has made an attempt to write this book which explains the various concepts of MATLAB in a systematic way and makes its readers proficient in using MATLAB for computing It mainly focuses on the applications of MATLAB rather than its use in programming basic numerical algorithms Commencing with the introduction to MATLAB the text covers vector and matrix computations solution of linear and non linear equations differentiation and integration and solution of ordinary and partial differential equations Next analytical computations using the Symbolic Math Toolbox and statistical computations using the Statistics and Machine Learning Toolbox are explained Finally the book describes various curve fitting techniques using the Curve Fitting Toolbox Inclusion of all these advanced level topics in the book stands it out from the rest **KEY FEATURES** Numerous worked out examples to enable the readers understand the steps involved in solving the chemical engineering problems MATLAB codes to explain the computational techniques Several snapshots to help the readers understand the step by step procedures of using the toolboxes Chapter end exercises including short answer questions and numerical problems Appendix comprising the definitions of some important and special matrices Supplemented with Solutions Manual containing complete detailed solutions to the unsolved analytical problems Accessibility of selected colour figures including screenshots and results outputs of the programs cited in the text at www.phindia.com Pallab_Ghosh **TARGET AUDIENCE** BE B Tech Chemical Engineering ME M Tech Chemical Engineering *Computational Methods in Chemical Engineering with Maple* Ralph E. White, Venkat R. Subramanian, 2010-02-06 This book presents Maple solutions to a wide range of problems relevant to

chemical engineers and others Many of these solutions use Maple's symbolic capability to help bridge the gap between analytical and numerical solutions The readers are strongly encouraged to refer to the references included in the book for a better understanding of the physics involved and for the mathematical analysis This book was written for a senior undergraduate or a first year graduate student course in chemical engineering Most of the examples in this book were done in Maple 10 However the codes should run in the most recent version of Maple We strongly encourage the readers to use the classic worksheet mws option in Maple as we believe it is more user friendly and robust In chapter one you will find an introduction to Maple which includes simple basics as a convenience for the reader such as plotting solving linear and nonlinear equations Laplace transformations matrix operations do loop and while loop Chapter two presents linear ordinary differential equations in section 1 to include homogeneous and nonhomogeneous ODEs solving systems of ODEs using the matrix exponential and Laplace transform method In section two of chapter two nonlinear ordinary differential equations are presented and include simultaneous series reactions solving nonlinear ODEs with Maple's dsolve command stop conditions differential algebraic equations and steady state solutions Chapter three addresses boundary value problems

Advanced Transport Phenomena P. A. Ramachandran, 2014-09-25 An integrated modern approach to transport phenomena for graduate students featuring traditional and contemporary examples to demonstrate the diverse practical applications of the theory Written in an easy to follow style the basic principles of transport phenomena and model building are recapped in Chapters 1 and 2 before progressing logically through more advanced topics including physicochemical principles behind transport models Treatments of numerical analytical and computational solutions are presented side by side often with sample code in MATLAB to aid students understanding and develop their confidence in using computational skills to solve real world problems Learning objectives and mathematical prerequisites at the beginning of chapters orient students to what is required in the chapter and summaries and over 400 end of chapter problems help them retain the key points and check their understanding Online supplementary material including solutions to problems for instructors supplementary reading material sample computer codes and case studies complete the package

Computational Techniques for Process Simulation and Analysis Using MATLAB® Niket S. Kaisare, 2017-09-18 MATLAB has become one of the prominent languages used in research and industry and often described as the language of technical computing The focus of this book will be to highlight the use of MATLAB in technical computing or more specifically in solving problems in Process Simulations This book aims to bring a practical approach to expounding theories both numerical aspects of stability and convergence as well as linear and nonlinear analysis of systems The book is divided into three parts which are laid out with a Process Analysis viewpoint First part covers system dynamics followed by solution of linear and nonlinear equations including Differential Algebraic Equations DAE while the last part covers function approximation and optimization Intended to be an advanced level textbook for numerical methods simulation and analysis of process systems and computational programming lab it

covers following key points Comprehensive coverage of numerical analyses based on MATLAB for chemical process examples Includes analysis of transient behavior of chemical processes Discusses coding hygiene process animation and GUI exclusively Treatment of process dynamics linear stability nonlinear analysis and function approximation through contemporary examples Focus on simulation using MATLAB to solve ODEs and PDEs that are frequently encountered in process systems

Introduction to Chemical Engineering S. PUSHPAVANAM, 2012-05-09 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

Recent Trends in Mathematical Sciences J. C. Misra, 2001 Contributed papers

Simulation and Optimization in Process Engineering Michael Bortz, Norbert Asprion, 2022-04-16 Simulation and Optimization in Process Engineering The Benefit of Mathematical Methods in Applications of the Process Industry brings together examples where the successful transfer of progress made in mathematical simulation and optimization has led to innovations in an industrial context that created substantial benefit Containing introductory accounts on scientific progress in the most relevant topics of process engineering substance properties simulation optimization optimal control and real time optimization the examples included illustrate how such scientific progress has been transferred to innovations that delivered a measurable impact covering details of the methods used and more With each chapter bringing together expertise from academia and industry this book is the first of its kind providing demonstratable insights Recent mathematical methods are transformed into industrially relevant innovations Covers recent progress in mathematical simulation and optimization in a process engineering context with chapters written by experts from both academia and industry Provides insight into challenges in industry aiming for a digitized world

Books In Print 2004-2005 Ed Bowker Staff, Staff Bowker, Ed, 2004

European Symposium on Computer Aided Process Engineering - 14 Ana Paula Barbosa-Póvoa, Henrique Matos, 2004-05-14 This book contains papers presented at the 14th European Symposium on Computer Aided Process Engineering ESCAPE 14 The ESCAPE symposia bring together scientists students and engineers from academia and industry who are active in the research and application of Computer

Aided Process Engineering The objective of ESCAPE 14 is to highlight the use of computers and information technology tools on five specific themes 1 Product and Process Design 2 Synthesis and Process Integration 3 Process Control and Analysis 4 Manufacturing Process Operations 5 New Challenges in CAPE Provides this year s comprehensive overview of the current state of affairs in the CAPE community Contains reports from the frontiers of science by the field s most respected scientists Special Keynote by Professor Roger Sargent Long Term Achievement CAPE Award winner **Mathematical methods in chemical engineering** Victor G. Jenson, Godfrey V. Jeffreys, 1972 Process and Chemical Engineering, 2002

Applications of Metaheuristics in Process Engineering Jayaraman Valadi, Patrick Siarry, 2014-08-07 Metaheuristics exhibit desirable properties like simplicity easy parallelizability and ready applicability to different types of optimization problems such as real parameter optimization combinatorial optimization and mixed integer optimization They are thus beginning to play a key role in different industrially important process engineering applications among them the synthesis of heat and mass exchange equipment synthesis of distillation columns and static and dynamic optimization of chemical and bioreactors This book explains cutting edge research techniques in related computational intelligence domains and their applications in real world process engineering It will be of interest to industrial practitioners and research academics

Applied Mathematical Methods for Chemical Engineers, Second Edition Norman W. Loney, 2006-09-22 Focusing on the application of mathematics to chemical engineering Applied Mathematical Methods for Chemical Engineers Second Edition addresses the setup and verification of mathematical models using experimental or other independently derived data An expanded and updated version of its well respected predecessor this book uses worked examples to illustrate several mathematical methods that are essential in successfully solving process engineering problems The book first provides an introduction to differential equations that are common to chemical engineering followed by examples of first order and linear second order ordinary differential equations ODEs Later chapters examine Sturm Liouville problems Fourier series integrals linear partial differential equations PDEs and regular perturbation The author also focuses on examples of PDE applications as they relate to the various conservation laws practiced in chemical engineering The book concludes with discussions of dimensional analysis and the scaling of boundary value problems and presents selected numerical methods and available software packages New to the Second Edition Two popular approaches to model development shell balance and conservation law balance One dimensional rod model and a planar model of heat conduction in one direction Systems of first order ODEs Numerical method of lines using MATLAB and Mathematica where appropriate This invaluable resource provides a crucial introduction to mathematical methods for engineering and helps in choosing a suitable software package for computer based algebraic applications *Encyclopedia of Fluid Mechanics*, 1986 Mathematical Methods in Chemical Engineering Arvind Varma, Massimo Morbidelli, 2008 Applied Mathematical Methods for Chemical Engineers Norman W. Loney, 2016-03-09 This book uses worked examples to showcase several mathematical methods that are essential to solving real world process

engineering problems The third edition includes additional examples related to process control Bessel Functions and contemporary areas such as drug delivery The author inserts more depth on specific applications such as nonhomogeneous cases of separation of variables adds a section on special types of matrices such as upper and lower triangular matrices incorporates examples related to biomedical engineering applications and expands the problem sets of numerous chapters

Faculties, Publications, and Doctoral Theses in Chemistry and Chemical Engineering at United States

Universities American Chemical Society. Committee on Professional Training,1991

Proceedings of the Indian

National Science Academy Indian National Science Academy,2003

Mathematical Methods in Chemical and Biological Engineering Binay Kanti Dutta,2016-11-03 *Mathematical Methods in Chemical and Biological Engineering* describes basic to moderately advanced mathematical techniques useful for shaping the model based analysis of chemical and biological engineering systems Covering an ideal balance of basic mathematical principles and applications to physico chemical problems this book presents examples drawn from recent scientific and technical literature on chemical engineering biological and biomedical engineering food processing and a variety of diffusional problems to demonstrate the real world value of the mathematical methods Emphasis is placed on the background and physical understanding of the problems to prepare students for future challenging and innovative applications

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