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NONLINEAR SYSTEMS AND OPTIMIZATION FOR THE CHEMICAL ENGINEER

SOLVING NUMERICAL PROBLEMS

John Wiley & Sons **This third book in a suite of four practical guides is an engineer's companion to using numerical methods for the solution of complex mathematical problems. The required software is provided by way of the freeware mathematical library BzzMath that is developed and maintained by the authors. The present volume focuses on optimization and nonlinear systems solution. The book describes numerical methods, innovative techniques and strategies that are all implemented in a well-established, freeware library. Each of these handy guides enables the reader to use and implement standard numerical tools for their work, explaining the theory behind the various functions and problem solvers, and showcasing applications in diverse scientific and engineering fields. Numerous examples, sample codes, programs and applications are proposed and discussed. The book teaches engineers and scientists how to use the latest and most powerful numerical methods for their daily work.**

PROBLEM SOLVING IN CHEMICAL ENGINEERING WITH NUMERICAL METHODS

Prentice Hall **"A companion book including interactive software for students and professional engineers who want to utilize problem-solving software to effectively and efficiently obtain solutions to realistic and complex**

problems. An Invaluable reference book that discusses and Illustrates practical numerical problem solving in the core subject areas of Chemical Engineering. Problem Solving in Chemical Engineering with Numerical Methods provides an extensive selection of problems that require numerical solutions from throughout the core subject areas of chemical engineering. Many are completely solved or partially solved using POLYMATH as the representative mathematical problem-solving software, Ten representative problems are also solved by Excel, Maple, Mathcad, MATLAB, and Mathematica. All problems are clearly organized and all necessary data are provided. Key equations are presented or derived. Practical aspects of efficient and effective numerical problem solving are emphasized. Many complete solutions are provided within the text and on the CD-ROM for use in problem-solving exercises."--BOOK JACKET.Title Summary field provided by Blackwell North America, Inc. All Rights Reserved

NUMERICAL METHODS FOR CHEMICAL ENGINEERS WITH MATLAB APPLICATIONS

Prentice Hall **Master numerical methods using MATLAB, today's leading software for problem solving. This complete guide to numerical methods in chemical engineering is the first to take full advantage of MATLAB's powerful calculation environment. Every chapter contains several examples using general MATLAB functions that implement the method and can also be applied to many other problems in the same category. The authors begin by introducing the solution of nonlinear equations using several standard approaches, including methods of successive substitution and linear interpolation; the Wegstein method, the Newton-Raphson method; the Eigenvalue method; and synthetic division algorithms. With these fundamentals in hand, they move on to simultaneous linear algebraic equations, covering matrix and vector operations; Cramer's rule; Gauss methods; the Jacobi method; and the characteristic-value problem. Additional coverage includes: Finite difference methods, and interpolation of equally and unequally spaced points Numerical differentiation and integration, including differentiation by backward, forward, and central finite differences; Newton-Cotes formulas; and the Gauss Quadrature Two detailed chapters on ordinary and partial differential equations Linear and nonlinear regression analyses, including least squares, estimated vector of parameters, method of steepest descent, Gauss-Newton method, Marquardt Method, Newton Method, and multiple nonlinear regression The numerical methods covered here represent virtually all of those commonly used by practicing chemical engineers. The focus on MATLAB enables readers to accomplish more, with less complexity, than was possible with traditional FORTRAN. For those unfamiliar with MATLAB, a brief introduction is provided as an Appendix. Over 60+ MATLAB examples, methods, and function scripts are covered, and all of them are included on**

the book's CD

INTRODUCTION TO CHEMICAL ENGINEERING COMPUTING

John Wiley & Sons

PROBLEM SOLVING IN CHEMICAL AND BIOCHEMICAL ENGINEERING WITH POLYMATH, EXCEL, AND MATLAB

Prentice-Hall PTR **Problem Solving in Chemical and Biochemical Engineering with POLYMATH", Excel, and MATLAB , Second Edition, is a valuable resource and companion that integrates the use of numerical problem solving in the three most widely used software packages: POLYMATH, Microsoft Excel, and MATLAB. Recently developed POLYMATH capabilities allow the automatic creation of Excel spreadsheets and the generation of MATLAB code for problem solutions. Students and professional engineers will appreciate the ease with which problems can be entered into POLYMATH and then solved independently in all three software packages, while taking full advantage of the unique capabilities within each package. The book includes more than 170 problems requiring numerical solutions. This greatly expanded and revised second edition includes new chapters on getting started with and using Excel and MATLAB. It also places special emphasis on biochemical engineering with a major chapter on the subject and with the integration of biochemical problems throughout the book. General Topics and Subject Areas, Organized by Chapter Introduction to Problem Solving with Mathematical Software Packages Basic Principles and Calculations Regression and Correlation of Data Introduction to Problem Solving with Excel Introduction to Problem Solving with MATLAB Advanced Problem-Solving Techniques Thermodynamics Fluid Mechanics Heat Transfer Mass Transfer Chemical Reaction Engineering Phase Equilibrium and Distillation Process Dynamics and Control Biochemical Engineering Practical Aspects of Problem-Solving Capabilities Simultaneous Linear Equations Simultaneous Nonlinear Equations Linear, Multiple Linear, and Nonlinear Regressions with Statistical Analyses Partial Differential Equations (Using the Numerical Method of Lines) Curve Fitting by Polynomials with Statistical Analysis Simultaneous Ordinary Differential Equations (Including Problems Involving Stiff Systems, Differential-Algebraic Equations, and Parameter Estimation in Systems of Ordinary Differential Equations) The Book's Web Site (http://www.problemsolvingbook.com) Provides solved and partially solved problem files for all three software packages, plus additional materials Describes discounted purchase options for educational version of POLYMATH available to book purchasers Includes detailed, selected problem solutions in Maple", Mathcad , and Mathematica"**

TIME DEPENDENT CHEMICAL PROCESSES

WITH SPECIAL REFERENCE TO THEIR SIMULATION AND OPTIMISATION

John Wiley & Sons **Algebraic equations / Analogue simulation/ Analytical methods in process control / Chemical reactor simulations / Digital simulation /Dynamic processes, modelling and simulation / Dynamic programming / Extension of the principles Numerical integration methods / Optimisation minimum values of functions / Pontryagin's maximum principle / Process control simulations / The simulation of distillation processes Successive improvement techniques.**

RECENT ADVANCES IN COMPUTATIONAL SCIENCE AND ENGINEERING

CODES FOR BOUNDARY-VALUE PROBLEMS IN ORDINARY DIFFERENTIAL EQUATIONS

PROCEEDINGS OF A WORKING CONFERENCE, MAY 14-17, 1978

Springer Science & Business Media **Conceptually, a database consists of objects and relationships. Object Relationship Notation (ORN) is a simple notation that more precisely defines relationships by combining UML multiplicities with uniquely defined referential actions. Object Relationship Notation (ORN) for Database Applications: Enhancing the Modeling and Implementation of Associations shows how ORN can be used in UML class diagrams & database definition languages (DDLs) to better model & implement relationships & thus more productively develop database applications. For the database developer, it presents many examples of relationships modeled using ORN-extended class diagrams & shows how these relationships are easily mapped to an ORN-extended SQL or Object DDL. For the DBMS developer, it presents the specifications & algorithms needed to implement ORN in a relational and object DBMS. This book also describes tools that can be downloaded or accessed via the Web. These tools allow databases to be modeled using ORN and implemented using automatic code generation that adds ORN support to Microsoft SQL Server and Progress Object Store.**

NONLINEAR OSCILLATIONS IN PHYSICAL SYSTEMS

Many of today's most exciting questions in the physical and life sciences concern the behavior of nonlinear systems, especially the onset of chaotic behavior under deterministic conditions. Available for the first time in paperback, this book offers a fundamental explanation of nonlinear oscillations in physical systems. Originally intended for electrical engineers, this book remains an important reference for the increasing numbers of researchers studying nonlinear phenomena in physics, chemical engineering, biology, medicine, and other fields. All problems in mechanics are basically nonlinear from the outset, and the linearizations commonly practiced are approximating devices. Focusing attention on those features of problems where nonlinearity results in distinctive new

phenomena, the author stresses the relationship between analysis and experiment.

RECENT PROGRESS IN COMPUTATIONAL SCIENCES AND ENGINEERING (2 VOLS)

CRC Press **This volume brings together selected contributed papers presented at the International Conference of Computational Methods in Science and Engineering (ICCMSE 2006), held in Chania, Greece, October 2006. The conference aims to bring together computational scientists from several disciplines in order to share methods and ideas. The ICCMSE is unique in its kind. It regroups original contributions from all fields of the traditional Sciences, Mathematics, Physics, Chemistry, Biology, Medicine and all branches of Engineering. It would be perhaps more appropriate to define the ICCMSE as a conference on computational science and its applications to science and engineering. Topics of general interest are: Computational Mathematics, Theoretical Physics and Theoretical Chemistry. Computational Engineering and Mechanics, Computational Biology and Medicine, Computational Geosciences and Meteorology, Computational Economics and Finance, Scientific Computation. High Performance Computing, Parallel and Distributed Computing, Visualization, Problem Solving Environments, Numerical Algorithms, Modelling and Simulation of Complex System, Web-based Simulation and Computing, Grid-based Simulation and Computing, Fuzzy Logic, Hybrid Computational Methods, Data Mining, Information Retrieval and Virtual Reality, Reliable Computing, Image Processing, Computational Science and Education etc. More than 800 extended abstracts have been submitted for consideration for presentation in ICCMSE 2005. From these 500 have been selected after international peer review by at least two independent reviewers.**

NUMERICAL METHODS FOR NONLINEAR ENGINEERING MODELS

Springer Science & Business Media **There are many books on the use of numerical methods for solving engineering problems and for modeling of engineering artifacts. In addition there are many styles of such presentations ranging from books with a major emphasis on theory to books with an emphasis on applications. The purpose of this book is hopefully to present a somewhat different approach to the use of numerical methods for - gineering applications. Engineering models are in general nonlinear models where the response of some appropriate engineering variable depends in a nonlinear manner on the - plication of some independent parameter. It is certainly true that for many types of engineering models it is sufficient to approximate the real physical world by some linear model. However, when engineering environments are pushed to - treme conditions, nonlinear effects are always encountered. It is also such - treme conditions that are of major importance in determining the reliability or failure limits of engineering systems. Hence it is essential**

than engineers have a toolbox of modeling techniques that can be used to model nonlinear engineering systems. Such a set of basic numerical methods is the topic of this book. For each subject area treated, nonlinear models are incorporated into the discussion from the very beginning and linear models are simply treated as special cases of more general nonlinear models. This is a basic and fundamental difference in this book from most books on numerical methods.

NUMERICAL METHODS AND MODELING FOR CHEMICAL ENGINEERS

Courier Corporation **This text introduces the quantitative treatment of differential equations arising from modeling physical phenomena in chemical engineering. Coverage includes recent topics such as ODE-IVPs, emphasizing numerical methods and modeling of 1984-era commercial mathematical software.**

NONLINEAR SYSTEMS

DESIGN, APPLICATIONS AND ANALYSIS

Nova Science Publishers **A non-linear system is a set of nonlinear equations, which may be algebraic, ordinary differential, partial differential, fractional, integral or a combination of these. Especially, nowadays, the term dynamical system is used as a synonym of nonlinear systems where the nonlinear equations represent the evolution of a solution over time. So, the notion of dynamical systems arose following the name of equations governing the motion of a system of particles, even though the nonlinear system may have no application to mechanics. Also, from an engineering point of view a nonlinear system may be represented with a feedback loop in which the output of an element is not proportional to its input. Over the last few decades, nonlinear systems have been used to describe a great variety of phenomena, in social and life sciences as well as in physical sciences and engineering. The theory of nonlinear systems has applications to problems of population growth, economics, chemical reactions, celestial mechanics, physiology of nerves, onset of turbulence, regulation of heartbeats, electronic circuits, cryptography, secure communications and many others. Nonlinear dynamical systems, which present chaotic behaviour, are of great importance due to their applications in science and engineering. Chaotic systems are nonlinear dynamical systems and maps that are highly sensitive to initial conditions. The sensitivity of initial conditions is usually called the butterfly effect for dynamical systems and maps. So, nowadays the design and analysis of nonlinear systems and especially chaotic systems has gained the interest of the research community due to the fact that many phenomena on financial, physical, biological, chemical, mechanical and engineering systems can be modelled and studied through the perspective of non-linear dynamics. These nonlinear systems can be modelled by discrete-time or continuous-time**

mathematical models. This book aims to bridge the gap between the design/analysis and applications, which are the two research stages on the progress of nonlinear systems and also which open up some new directions of real applications, where chaos can be put up to technological use, including secure communication systems, electronic circuits design, memristors and radar. Finally, this book can serve as an updated and handy reference for university professors, graduate students, laboratory researchers as well as physicists and applied mathematicians who are interested in studying the chaos and its applications through the field of nonlinear systems.

ALBRIGHT'S CHEMICAL ENGINEERING HANDBOOK

CRC Press **Taking greater advantage of powerful computing capabilities over the last several years, the development of fundamental information and new models has led to major advances in nearly every aspect of chemical engineering. Albright’s Chemical Engineering Handbook represents a reliable source of updated methods, applications, and fundamental concepts that will continue to play a significant role in driving new research and improving plant design and operations. Well-rounded, concise, and practical by design, this handbook collects valuable insight from an exceptional diversity of leaders in their respective specialties. Each chapter provides a clear review of basic information, case examples, and references to additional, more in-depth information. They explain essential principles, calculations, and issues relating to topics including reaction engineering, process control and design, waste disposal, and electrochemical and biochemical engineering. The final chapters cover aspects of patents and intellectual property, practical communication, and ethical considerations that are most relevant to engineers. From fundamentals to plant operations, Albright’s Chemical Engineering Handbook offers a thorough, yet succinct guide to day-to-day methods and calculations used in chemical engineering applications. This handbook will serve the needs of practicing professionals as well as students preparing to enter the field.**

DIFFERENTIAL AND DIFFERENTIAL-ALGEBRAIC SYSTEMS FOR THE CHEMICAL ENGINEER

SOLVING NUMERICAL PROBLEMS

John Wiley & Sons **Engineers and other applied scientists are frequently faced with models of complex systems for which no rigorous mathematical solution can be calculated. To predict and calculate the behaviour of such systems, numerical approximations are frequently used, either based on measurements of real life systems or on the behaviour of simpler models. This is essential work for example for the process engineer implementing simulation, control and optimization of chemical processes for design and**

operational purposes. This fourth in a suite of five practical guides is an engineer's companion to using numerical methods for the solution of complex mathematical problems. It explains the theory behind current numerical methods and shows in a step-by-step fashion how to use them. The volume focuses on differential and differential-algebraic systems, providing numerous real-life industrial case studies to illustrate this complex topic. It describes the methods, innovative techniques and strategies that are all implemented in a freely available toolbox called BzzMath, which is developed and maintained by the authors and provides up-to-date software tools for all the methods described in the book. Numerous examples, sample codes, programs and applications are taken from a wide range of scientific and engineering fields, such as chemical engineering, electrical engineering, physics, medicine, and environmental science. As a result, engineers and scientists learn how to optimize processes even before entering the laboratory. With additional online material including the latest version of BzzMath Library, installation tutorial, all examples and sample codes used in the book and a host of further examples.

MATHCAD FOR CHEMICAL ENGINEERS

Trafford Publishing **Mathcad for Chemical Engineers demonstrates the use of Mathcad 13, which is the latest version of one of the most powerful and popular computational software packages in the world, for solving various chemical engineering problems. The book serves as a must-to-have guide and quick reference for chemical engineers and those who would like to learn and use Mathcad as their computational tool. This book can also be used as a textbook for chemical engineering education on computing using Mathcad. The book contains many real-life chemical engineering examples from various areas: material and energy balance, thermodynamics, transport phenomena, kinetics and reactor design, unit operations, engineering economics, and operations management. Unlike other books of similar theme, concise, but comprehensive, explanations are given in each chapter and step-by-step procedures of solving mathematical problems are also given for quick reference. Many examples allow readers to experience the power of Mathcad in solving chemical engineering problems. The book has chapters on Mathcad fundamentals, solving a single algebraic equation and a system of algebraic equations, curve fitting, integration and differentiation, solving a single ordinary differential equation (ODE) and a system of ODEs, solving a single partial differential equation (PDE) and a system of PDEs, and programming in Mathcad. There are a number of exercise problems at the end of each chapter that allow readers to further expose themselves to various chemical engineering problems. Although Mathcad 13 is the software package chosen by the authors and used throughout the book, most of the features discussed can also be applied using earlier versions of Mathcad. Furthermore, although Mathcad will**

always evolve into a newer version, most of the contents in this book will be applicable for any subsequent version of Mathcad.

GROUP INVARIANCE IN ENGINEERING BOUNDARY VALUE PROBLEMS

Springer Science & Business Media **REFEREN CES . 156 9 Transforma.tion of a Boundary Value Problem to an Initial Value Problem . 157 9.0 Introduction . 157 9.1 Blasius Equation in Boundary Layer Flow . 157 9.2 Longitudinal Impact of Nonlinear Viscoplastic Rods . 163 9.3 Summary . 168 REFERENCES . . . . . 168 . 10 From Nonlinear to Linear Differential Equa.tions Using Transformation Groups. . . . . 169 . 10.1 From Nonlinear to Linear Differential Equations . 170 10.2 Application to Ordinary Differential Equations -Bernoulli's Equation . . . . . 173 10.3 Application to Partial Differential Equations -A Nonlinear Chemical Exchange Process . 178 10.4 Limitations of the Inspectional Group Method . 187 10.5 Summary . 188 REFERENCES . . . . 188 11 Miscellaneous Topics . 190 11.1 Reduction of Differential Equations to Algebraic Equations 190 11.2 Reduction of Order of an Ordinary Differential Equation . 191 11.3 Transformat.ion From Ordinary to Partial Differential Equations-Search for First Integrals . . . . . " 193 . 11.4 Reduction of Number of Variables by Multiparameter Groups of Transformations . . . . 194 11.5 Self-Similar Solutions of the First and Second Kind . . 202 11.6 Normalized Representation and Dimensional Consideration 204 REFERENCES .206 Problems . 208 .220 Index .. Chapter 1 INTRODUCTION AND GENERAL OUTLINE Physical problems in engineering science are often described by dif ferential models either linear or nonlinear. There is also an abundance of transformations of various types that appear in the literature of engineer ing and mathematics that are generally aimed at obtaining some sort of simplification of a differential model.**

AN INTRODUCTION TO DIFFERENTIAL EQUATIONS

DETERMINISTIC MODELING, METHODS AND ANALYSIS(VOLUME 1)

World Scientific Publishing Company **Volume 2: Stochastic Modeling, Methods, and Analysis This is a twenty-first century book designed to meet the challenges of understanding and solving interdisciplinary problems. The book creatively incorporates “cutting-edge” research ideas and techniques at the undergraduate level. The book also is a unique research resource for undergraduate/graduate students and interdisciplinary researchers. It emphasizes and exhibits the importance of conceptual understandings and its symbiotic relationship in the problem solving process. The book is proactive in preparing for the modeling of dynamic processes in various disciplines. It introduces a “break-down-the problem” type of approach in a way that creates “fun” and “excitement”. The book presents many learning tools like “step-by-step procedures (critical thinking)”, the concept of “math” being a language, applied examples from diverse fields,**

frequent recaps, flowcharts and exercises. Uniquely, this book introduces an innovative and unified method of solving nonlinear scalar differential equations. This is called the “Energy/Lyapunov Function Method”. This is accomplished by adequately covering the standard methods with creativity beyond the entry level differential equations course.

APPLIED CHEMISTRY AND CHEMICAL ENGINEERING, VOLUME 2

PRINCIPLES, METHODOLOGY, AND EVALUATION METHODS

CRC Press **This book covers many important aspects of applied chemistry and chemical engineering, focusing on three main aspects: principles, methodology and evaluation methods. It presents a selection of chapters on recent developments of theoretical, mathematical, and computational conceptions, as well as chapters on modeling and simulation of specific research themes covering applied chemistry and chemical engineering. This book attempts to bridge the gap between classical analysis and modern applications. Covering a selection of topics within the field of applied chemistry and chemical engineering, the book is divided into several parts: polymer chemistry and technology bioorganic and biological chemistry nanoscale technology selected topics This book is the second of the two-volume series Applied Chemistry and Chemical Engineering. The first volume is Volume 1: Mathematical and Analytical Techniques.**

NUMERICAL AND ANALYTICAL SOLUTIONS FOR SOLVING NONLINEAR EQUATIONS IN HEAT TRANSFER

IGI Global **Engineering applications offer benefits and opportunities across a range of different industries and fields. By developing effective methods of analysis, results and solutions are produced with higher accuracy. Numerical and Analytical Solutions for Solving Nonlinear Equations in Heat Transfer is an innovative source of academic research on the optimized techniques for analyzing heat transfer equations and the application of these methods across various fields. Highlighting pertinent topics such as the differential transformation method, industrial applications, and the homotopy perturbation method, this book is ideally designed for engineers, researchers, graduate students, professionals, and academics interested in applying new mathematical techniques in engineering sciences.**

MOVING FINITE ELEMENT METHOD

FUNDAMENTALS AND APPLICATIONS IN CHEMICAL ENGINEERING

CRC Press **This book focuses on process simulation in chemical engineering with a numerical algorithm based on the moving finite element method (MFEM). It offers new tools and approaches for modeling and simulating time-dependent problems with moving fronts and with moving boundaries**

described by time-dependent convection-reaction-diffusion partial differential equations in one or two-dimensional space domains. It provides a comprehensive account of the development of the moving finite element method, describing and analyzing the theoretical and practical aspects of the MFEM for models in 1D, 1D+1d, and 2D space domains. Mathematical models are universal, and the book reviews successful applications of MFEM to solve engineering problems. It covers a broad range of application algorithm to engineering problems, namely on separation and reaction processes presenting and discussing relevant numerical applications of the moving finite element method derived from real-world process simulations.

APPLIED MATHEMATICS AND MODELING FOR CHEMICAL ENGINEERS

John Wiley & Sons **This Second Edition of the go-to reference combines the classical analysis and modern applications of applied mathematics for chemical engineers. The book introduces traditional techniques for solving ordinary differential equations (ODEs), adding new material on approximate solution methods such as perturbation techniques and elementary numerical solutions. It also includes analytical methods to deal with important classes of finite-difference equations. The last half discusses numerical solution techniques and partial differential equations (PDEs). The reader will then be equipped to apply mathematics in the formulation of problems in chemical engineering. Like the first edition, there are many examples provided as homework and worked examples.**

ITERATIVE SPLITTING METHODS FOR DIFFERENTIAL EQUATIONS

CRC Press **Iterative Splitting Methods for Differential Equations explains how to solve evolution equations via novel iterative-based splitting methods that efficiently use computational and memory resources. It focuses on systems of parabolic and hyperbolic equations, including convection-diffusion-reaction equations, heat equations, and wave equations. In the theoretical part of the book, the author discusses the main theorems and results of the stability and consistency analysis for ordinary differential equations. He then presents extensions of the iterative splitting methods to partial differential equations and spatial- and time-dependent differential equations. The practical part of the text applies the methods to benchmark and real-life problems, such as waste disposal, elastics wave propagation, and complex flow phenomena. The book also examines the benefits of equation decomposition. It concludes with a discussion on several useful software packages, including r3t and FIDOS. Covering a wide range of theoretical and practical issues in multiphysics and multiscale problems, this book explores the benefits of using iterative splitting schemes to solve physical problems. It illustrates how iterative operator splitting methods are excellent decomposition methods for obtaining higher-order accuracy.**

FRONTIERS IN GLOBAL OPTIMIZATION

Springer Science & Business Media **Global Optimization has emerged as one of the most exciting new areas of mathematical programming. Global optimization has received a wide attraction from many fields in the past few years, due to the success of new algorithms for addressing previously intractable problems from diverse areas such as computational chemistry and biology, biomedicine, structural optimization, computer sciences, operations research, economics, and engineering design and control. The chapters in this volume focus on recent deterministic methods and stochastic methods for global optimization, distributed computing methods in global optimization, and applications of global optimization in several branches of applied science and engineering, computer science, computational chemistry, structural biology, and bio-informatics.**

KELLER-BOX METHOD AND ITS APPLICATION

Walter de Gruyter GmbH & Co KG **Most of the problems arising in science and engineering are nonlinear. They are inherently difficult to solve. Traditional analytical approximations are valid only for weakly nonlinear problems, and often break down for problems with strong nonlinearity. This book presents the current theoretical developments and applications of the Keller-box method to nonlinear problems. The first half of the book addresses basic concepts to understand the theoretical framework for the method. In the second half of the book, the authors give a number of examples of coupled nonlinear problems that have been solved by means of the Keller-box method. The particular area of focus is on fluid flow problems governed by nonlinear equation.**

LONGWAVE INSTABILITIES AND PATTERNS IN FLUIDS

Springer **This book summarizes the main advances in the field of nonlinear evolution and pattern formation caused by longwave instabilities in fluids. It will allow readers to master the multiscale asymptotic methods and become familiar with applications of these methods in a variety of physical problems. Longwave instabilities are inherent to a variety of systems in fluid dynamics, geophysics, electrodynamics, biophysics, and many others. The techniques of the derivation of longwave amplitude equations, as well as the analysis of numerous nonlinear equations, are discussed throughout. This book will be of value to researchers and graduate students in applied mathematics, physics, and engineering, in particular within the fields of fluid mechanics, heat and mass transfer theory, and nonlinear dynamics.**

ADVANCES IN THE CONTROL OF NONLINEAR SYSTEMS

Springer Science & Business Media **This volume is based on the course notes of the 2nd NCN Pedagogical School, the second in the series of Pedagogical**

Schools in the frame work of the European TMR project, "Breakthrough in the control of nonlinear systems (Nonlinear Control Network)". The school consists of four courses that have been chosen to give a broad range of techniques for the analysis and synthesis of nonlinear control systems, and have been developed by leading experts in the field. The topics covered are: Differential Algebraic Methods in Nonlinear Systems; Nonlinear QFT; Hybrid Systems; Physics in Control. The book has a pedagogical character, and is specially directed to postgraduates in most areas of engineering and applied sciences like mathematics and physics. It will also be of interest to researchers and practitioners needing a solid introduction to the above topics.

NUMERICAL METHODS WITH CHEMICAL ENGINEERING APPLICATIONS

Cambridge University Press **Designed primarily for undergraduates, but also graduates and practitioners, this textbook integrates numerical methods and programming with applications from chemical engineering. Combining mathematical rigor with an informal writing style, it thoroughly introduces the theory underlying numerical methods, its translation into MATLAB programs, and its use for solving realistic problems. Specific topics covered include accuracy, convergence and numerical stability, as well as stiffness and ill-conditioning. MATLAB codes are developed from scratch, and their implementation is explained in detail, all while assuming limited programming knowledge. All scripts employed are downloadable, and built-in MATLAB functions are discussed and contextualised. Numerous examples and homework problems - from simple questions to extended case studies - accompany the text, allowing students to develop a deep appreciation for the range of real chemical engineering problems that can be solved using numerical methods. This is the ideal resource for a single-semester course on numerical methods, as well as other chemical engineering courses taught over multiple semesters.**

CHEMICAL ENGINEERING

NUMERICAL METHODS FOR NONLINEAR ALGEBRAIC EQUATIONS

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MATHEMATICAL METHODS IN CHEMICAL ENGINEERING

PHI Learning Pvt. Ltd. **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 distin-guishing 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.

ISSUES IN CHEMICAL ENGINEERING AND OTHER CHEMISTRY SPECIALTIES: 2011 EDITION

ScholarlyEditions **Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Chemical Engineering and other Chemistry Specialties. The editors have built Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Chemical Engineering and other Chemistry Specialties in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.**

30TH EUROPEAN SYMPOSIUM ON COMPUTER AIDED CHEMICAL ENGINEERING

Elsevier **30th European Symposium on Computer Aided Chemical Engineering, Volume 47 contains the papers presented at the 30th European Symposium of Computer Aided Process Engineering (ESCAPE) event held in Milan, Italy, May 24-27, 2020. It is a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students, and consultants for chemical industries. Presents findings and discussions from the 30th European Symposium of Computer Aided Process Engineering (ESCAPE) event Offers a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students, and consultants for chemical industries**

METHODS OF APPLIED MATHEMATICS FOR ENGINEERS AND

SCIENTISTS

Cambridge University Press **Based on course notes from over twenty years of teaching engineering and physical sciences at Michigan Technological University, Tomas Co's engineering mathematics textbook is rich with examples, applications and exercises. Professor Co uses analytical approaches to solve smaller problems to provide mathematical insight and understanding, and numerical methods for large and complex problems. The book emphasises applying matrices with strong attention to matrix structure and computational issues such as sparsity and efficiency. Chapters on vector calculus and integral theorems are used to build coordinate-free physical models with special emphasis on orthogonal co-ordinates. Chapters on ODEs and PDEs cover both analytical and numerical approaches. Topics on analytical solutions include similarity transform methods, direct formulas for series solutions, bifurcation analysis, Lagrange–Charpit formulas, shocks/rarefaction and others. Topics on numerical methods include stability analysis, DAEs, high-order finite-difference formulas, Delaunay meshes, and others. MATLAB® implementations of the methods and concepts are fully integrated.**

NONLINEAR PARAMETER OPTIMIZATION USING R TOOLS

John Wiley & Sons **Nonlinear Parameter Optimization Using R John C. Nash, Telfer School of Management, University of Ottawa, Canada A systematic and comprehensive treatment of optimization software using R In recent decades, optimization techniques have been streamlined by computational and artificial intelligence methods to analyze more variables, especially under non–linear, multivariable conditions, more quickly than ever before. Optimization is an important tool for decision science and for the analysis of physical systems used in engineering. Nonlinear Parameter Optimization with R explores the principal tools available in R for function minimization, optimization, and nonlinear parameter determination and features numerous examples throughout. Nonlinear Parameter Optimization with R: Provides a comprehensive treatment of optimization techniques Examines optimization problems that arise in statistics and how to solve them using R Enables researchers and practitioners to solve parameter determination problems Presents traditional methods as well as recent developments in R Is supported by an accompanying website featuring R code, examples and datasets Researchers and practitioners who have to solve parameter determination problems who are users of R but are novices in the field optimization or function minimization will benefit from this book. It will also be useful for scientists building and estimating nonlinear models in various fields such as hydrology, sports forecasting, ecology, chemical engineering, pharmaco-kinetics, agriculture, economics and statistics.**

MATHEMATICAL MODELLING AND SIMULATION IN CHEMICAL

ENGINEERING

Cambridge University Press **An easy to understand guide covering key principles of mathematical modelling and simulation in chemical engineering.**

ROBUST ENGINEERING DESIGNS OF PARTIAL DIFFERENTIAL SYSTEMS AND THEIR APPLICATIONS

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PROCEEDINGS OF THE MAPLE SUMMER WORKSHOP AND SYMPOSIUM, RENSSELAER POLYTECHNIC INSTITUTE, TROY, NEW YORK, AUGUST 9–13,1994

Springer Science & Business Media **The Maple Summer Workshop and Symposium, MSWS '94, reflects the growing commu nity of Maple users**

around the world. This volume contains the contributed papers. A careful inspection of author affiliations will reveal that they come from North America, Europe, and Australia. In fact, fifteen come from the United States, two from Canada, one from Australia, and nine come from Europe. Of European papers, two are from Ger many, two are from the Netherlands, two are from Spain, and one each is from Switzerland, Denmark, and the United Kingdom. More important than the geographical diversity is the intellectual range of the contributions. We begin to see in this collection of works papers in which Maple is used in an increasingly flexible way. For example, there is an application in computer science that uses Maple as a tool to create a new utility. There is an application in abstract algebra where Maple has been used to create new functionalities for computing in a rational function field. There are applications to geometrical optics, digital signal processing, and experimental design.