

Mathematical Modeling

Problems, Methods,
Applications

Edited by

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and

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Mathematical Modeling Problems Methods Applications

Antonella Petrillo, Fabio De Felice



Mathematical Modeling Problems Methods Applications:

Mathematical Modeling Li[u]dmila Aleksandrovna Uvarova, Anatolii V. Latyshev, 2001-12-31 This book contains review articles and original results in problems and methods of mathematical simulation and their applications in various fields The articles included are based on the reports that were presented at the Fourth International Mathematical Modeling Conference Moscow Russia June 27 July 1 2000 The book is intended for specialists as well as for post graduates and students in the areas of mathematical modeling algorithms and computational theory mathematical physics discrete mathematics physics physical chemistry transfer theory and economics

Mathematical Modeling Jonas Hall, Thomas Lingefj rd, 2016-06-13 A logical problem based introduction to the use of GeoGebra for mathematical modeling and problem solving within various areas of mathematics A well organized guide to mathematical modeling techniques for evaluating and solving problems in the diverse field of mathematics Mathematical Modeling Applications with GeoGebra presents a unique approach to software applications in GeoGebra and WolframAlpha The software is well suited for modeling problems in numerous areas of mathematics including algebra symbolic algebra dynamic geometry three dimensional geometry and statistics Featuring detailed information on how GeoGebra can be used as a guide to mathematical modeling the book provides comprehensive modeling examples that correspond to different levels of mathematical experience from simple linear relations to differential equations Each chapter builds on the previous chapter with practical examples in order to illustrate the mathematical modeling skills necessary for problem solving Addressing methods for evaluating models including relative error correlation square sum of errors regression and confidence interval Mathematical Modeling Applications with GeoGebra also includes Over 400 diagrams and 300 GeoGebra examples with practical approaches to mathematical modeling that help the reader develop a full understanding of the content Numerous real world exercises with solutions to help readers learn mathematical modeling techniques A companion website with GeoGebra constructions and screencasts Mathematical Modeling Applications with GeoGebra is ideal for upper undergraduate and graduate level courses in mathematical modeling applied mathematics modeling and simulation operations research and optimization The book is also an excellent reference for undergraduate and high school instructors in mathematics

Methods of Mathematical Modeling Hemen Dutta, 2025-08-01 Methods of Mathematical Modeling Advances and Applications delves into recent progress in this field highlighting innovative methods and their uses in different domains This book covers convergence analysis involving nonlinear integral equations and boundary value problems Navier Stokes equations in Sobolev Gevrey spaces magneto hydrodynamics of ternary nanofluids with heat transfer effects vortex nerve complexes in video frame shape approximation hybrid schemes for computing hyperbolic conservation laws and solutions to new fractional differential equations Additionally the book examines dynamics of Leslie Gower type predator prey models and models for the dynamics of generic crop and water availability Readers will find diverse approaches techniques and applications needed for modeling

various physical and natural systems Each chapter is self contained encouraging independent study and application of the modeling examples to individual research projects This book serves as a valuable resource for researchers students educators scientists and practitioners involved in different aspects of modeling Provides new mathematical methods and techniques for modeling various physical and natural systems Includes new hybrid computational schemes and procedures for handling wave interactions Includes advanced level convergence analysis and generalized Navier Stokes equations Provides readers with the dynamics of predator prey generic crop and water availability models **Mathematical**

Modeling Guidebook Celesta Mease,2021-04 This is a good book to read for technicians after you have been in the field for a while to transition from being equipment oriented to system oriented The author s framework and modeling approach are practical and are a good first step into the rough waters of trying to model problems in the industry This guidebook goes right to the heart of engineering teaching you how to Understand and use the three basic types of engineering building blocks Recognize the analogies that can be drawn between the fundamental elements of electrical mechanical fluid and thermal systems Develop math models for first and higher order systems using four fundamental methods Analyze the models you develop Perform frequency analysis and plot frequency responses **Mathematical Modeling** Ludmilla A.

Uvarova,Anatolii V. Latyshev,2013-03-14 This volume contains review articles and original results obtained in various fields of modern science using mathematical simulation methods The basis of the articles are the plenary and some section reports that were made and discussed at the Fourth International Mathematical Simulation Conference held in Moscow on June 27 through July 1 2000 The conference was devoted to the following scientific areas mathematical and computer discrete systems models non linear excitation in condensed media complex systems evolution mathematical models in economics non equilibrium processes kinematics dynamics and structure of the molecular and biomolecular systems mathematical transfer models in non linear systems numerical simulation and algorithms turbulence and determined chaos chemical physics of polymer This conference was supported by the Russian Ministry of Education Russian foundation for Basic Research and Federal Program Integration This volume contains the following sections 1 models of non linear phenomena in physics 2 numerical methods and computer simulations 3 mathematical computer models of discrete systems 4 mathematical models in economics 5 non linear models in chemical physics and physical chemistry 6 mathematical models of transport processes in complex systems In Sections One and Five a number of fundamental and sufficiently general problems concerning real physical and physical chemical systems simulation is discussed An Introduction to Mathematical Modeling Edward A.

Bender,2012-05-23 Employing a practical learn by doing approach this first rate text fosters the development of the skills beyond the pure mathematics needed to set up and manipulate mathematical models The author draws on a diversity of fields including science engineering and operations research to provide over 100 reality based examples Students learn from the examples by applying mathematical methods to formulate analyze and criticize models Extensive documentation

consisting of over 150 references supplements the models encouraging further research on models of particular interest The lively and accessible text requires only minimal scientific background Designed for senior college or beginning graduate level students it assumes only elementary calculus and basic probability theory for the first part and ordinary differential equations and continuous probability for the second section All problems require students to study and create models encouraging their active participation rather than a mechanical approach Beyond the classroom this volume will prove interesting and rewarding to anyone concerned with the development of mathematical models or the application of modeling to problem solving in a wide array of applications

Mathematical Modeling and Applications in Nonlinear Dynamics Albert C.J. Luo,Hüseyin Merdan,2016-01-28 The book covers nonlinear physical problems and mathematical modeling including molecular biology genetics neurosciences artificial intelligence with classical problems in mechanics and astronomy and physics The chapters present nonlinear mathematical modeling in life science and physics through nonlinear differential equations nonlinear discrete equations and hybrid equations Such modeling can be effectively applied to the wide spectrum of nonlinear physical problems including the KAM Kolmogorov Arnold Moser KAM theory singular differential equations impulsive dichotomous linear systems analytical bifurcation trees of periodic motions and almost or pseudo almost periodic solutions in nonlinear dynamical systems

Methods of Mathematical Modelling and Computation for Complex Systems Jagdev Singh,Hemen Dutta,Devendra Kumar,Dumitru Baleanu,Jordan Hristov,2021-08-26 This book contains several contemporary topics in the areas of mathematical modelling and computation for complex systems The readers find several new mathematical methods mathematical models and computational techniques having significant relevance in studying various complex systems The chapters aim to enrich the understanding of topics presented by carefully discussing the associated problems and issues possible solutions and their applications or relevance in other scientific areas of study and research The book is a valuable resource for graduate students researchers and educators in understanding and studying various new aspects associated with complex systems

Key Feature The chapters include theory and application in a mix and balanced way Readers find reasonable details of developments concerning a topic included in this book The text is emphasized to present in self contained manner with inclusion of new research problems and questions

Mathematical Modeling with Modern Applications Khalide Jbilou,Mustapha Hached,Lahcen Maniar,Ahmed Ratnani,2025-08-10 his book contains selected peer reviewed articles presented at the International Conference on Mathematical Modeling and Modern Applications M3A_24 held in Istanbul Türkiye on June 4-6 2024 The selected articles are all real life problem oriented and present numerical methods from the following fields partial differential equations approximation applied linear and multilinear algebra probability and statistics artificial intelligence and deep learning The developed tools are of special interest for understanding and taking an active part into the challenges posed by the increasing needs of the industry A special focus is given to the large scale methods in response to massive amount of data to process in many problems Each

article contains an initial section enabling non specialists to grasp the issues at stake in the problem under consideration as well as theoretical reminders and references enabling readers to deepen their understanding This will enable researchers to present their advances while at the same time allowing them to be disseminated to industry and students

Computational Methods and Mathematical Modeling in Cyberphysics and Engineering Applications 1 Dmitri Koroliouk,Sergiy Lyashko,Nikolaos Limnios,2024-04-16 Mathematical methods in engineering are characterized by a wide range of techniques for approaching various problems Moreover completely different analysis techniques can be applied to the same problem which is justified by the difference in specific applications Therefore the study of the analyses and solutions of specific problems leads the researcher to generate their own techniques for the analysis of similar problems continuously arising in the process of technical development Computational Methods and Mathematical Modeling in Cyberphysics and Engineering Applications contains solutions to specific problems in current areas of computational engineering and cyberphysics

Analytic Hierarchy Process - Models, Methods, Concepts, and Applications Antonella Petrillo,Fabio De Felice,2023-07-12 Analytic Hierarchy Process is one of the most widely known and applied multi criteria decision making methodologies worldwide Its potential to analyze complex decision making problems is enormous This makes the methodology a very flexible tool that can be applied in various scenarios social engineering economic political environmental location market share etc The idea of the book is to present examples and case studies based on a rigorous scientific approach to Analytic Hierarchy Process This book is intended to be a useful resource for anyone who deals with this issue

Modeling and Simulation of Systems Using MATLAB and Simulink Devendra K. Chaturvedi,2017-12-19 Not only do modeling and simulation help provide a better understanding of how real world systems function they also enable us to predict system behavior before a system is actually built and analyze systems accurately under varying operating conditions Modeling and Simulation of Systems Using MATLAB and Simulink provides comprehensive state of the art coverage of all the important aspects of modeling and simulating both physical and conceptual systems Various real life examples show how simulation plays a key role in understanding real world systems The author also explains how to effectively use MATLAB and Simulink software to successfully apply the modeling and simulation techniques presented After introducing the underlying philosophy of systems the book offers step by step procedures for modeling different types of systems using modeling techniques such as the graph theoretic approach interpretive structural modeling and system dynamics modeling It then explores how simulation evolved from pre computer days into the current science of today The text also presents modern soft computing techniques including artificial neural networks fuzzy systems and genetic algorithms for modeling and simulating complex and nonlinear systems The final chapter addresses discrete systems modeling Preparing both undergraduate and graduate students for advanced modeling and simulation courses this text helps them carry out effective simulation studies In addition graduate students should be able to comprehend and conduct simulation research after completing this book

MATHEMATICAL MODELS OF LIFE SUPPORT SYSTEMS - Volume II Valeri I. Agoshko , Jean-Pierre

Puel,2009-10-10 Mathematical Models of Life Support Systems is a component of Encyclopedia of Mathematical Sciences in which is part of the global Encyclopedia of Life Support Systems EOLSS an integrated compendium of twenty one Encyclopedias The Theme is organized into several topics which represent the main scientific areas of the theme The first topic Introduction to Mathematical Modeling discusses the foundations of mathematical modeling and computational experiments which are formed to support new methodologies of scientific research The succeeding topics are Mathematical Models in Water Sciences Climate Environmental Pollution and Degradation Energy Sciences Food and Agricultural Sciences Population Immunology Medical Sciences and Control of Catastrophic Processes These two volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs

Intelligent Systems in Operations: Methods, Models and Applications in the Supply Chain Nag, Barin,2010-03-31 This book provides knowledge and insights on present and future AI applications in Operations Management presenting tools and decisions in terms of theoretical and empirical models methods and proposed applications Provided by publisher

Finite Difference Methods,Theory and Applications Ivan Dimov,István Faragó,Lubin Vulkov,2015-06-16 This book constitutes the thoroughly refereed post conference proceedings of the 6th International Conference on Finite Difference Methods FDM 2014 held in Lozenetz Bulgaria in June 2014 The 36 revised full papers were carefully reviewed and selected from 62 submissions These papers together with 12 invited papers cover topics such as finite difference and combined finite difference methods as well as finite element methods and their various applications in physics chemistry biology and finance

Mathematical Modeling and Numerical Methods in Chemical Physics and Mechanics Ali V. Aliev,Olga V. Mishchenkova,Alexey M.

Liparov,2016-04-27 The use of mathematical modeling in engineering allows for a significant reduction of material costs associated with design production and operation of technical objects but it is important for an engineer to use the available computational approaches in modeling correctly Taking into account the level of modern computer technology this new vo

Applications of Differential Transform to Real World Problems Yogeshwari F Patel,Jayesh M Dhodiya,2022-08-08 This book is an invaluable resource for applied researchers to find the analytical solution of differential equations describing the dynamical system with less computational effort and time It describes the basic concepts of the differential transform method and solution of various real world problems described by simple to complicated differential equations It provides a computational technique that is not only conceptually simple and easy to use but also readily adaptable for computer coding Different chapters of the book deal with the basic differential equations involved in the physical phenomena as well as a complicated system of differential equations described by the mathematical model The book offers comprehensive coverage of the most essential topics including Basic concepts and fundamental properties of the proposed technique with proof The

solution of linear nonlinear homogeneous and nonhomogeneous ordinary differential equations ODEs and partial differential equations PDEs The initial and boundary value problems Real world ODE and PDE problems are also discussed Applications of Differential Transform to Real World Problems is primarily aimed at undergraduates graduates and researchers studying differential equations Scientists dealing with complicated differential equations or systems of differential equations will also find this book useful

The Virtual Element Method and its Applications Paola F. Antonietti, Lourenço Beirão da Veiga, Gianmarco Manzini, 2022-10-08 The purpose of this book is to present the current state of the art of the Virtual Element Method VEM by collecting contributions from many of the most active researchers in this field and covering a broad range of topics from the mathematical foundation to real life computational applications The book is naturally divided into three parts The first part of the book presents recent advances in theoretical and computational aspects of VEMs discussing the generality of the meshes suitable to the VEM the implementation of the VEM for linear and nonlinear PDEs and the construction of discrete hessian complexes The second part of the volume discusses Virtual Element discretization of paradigmatic linear and non linear partial differential problems from computational mechanics fluid dynamics and wave propagation phenomena Finally the third part contains challenging applications such as the modeling of materials with fractures magneto hydrodynamics phenomena and contact solid mechanics The book is intended for graduate students and researchers in mathematics and engineering fields interested in learning novel numerical techniques for the solution of partial differential equations It may as well serve as useful reference material for numerical analysts practitioners of the field

Information Computing and Applications Chunfeng Liu, Jincai Chang, Aimin Yang, 2011-12-05 The two volume set CCIS 243 and CCIS 244 constitutes the refereed proceedings of the Second International Conference on Information Computing and Applications ICICA 2010 held in Qinhuangdao China in October 2011 The 191 papers presented in both volumes were carefully reviewed and selected from numerous submissions They are organized in topical sections on computational statistics social networking and computing evolutionary computing and applications information education and application internet and web computing scientific and engineering computing system simulation computing bio inspired and DNA computing internet and Web computing multimedia networking and computing parallel and distributed computing

Artificial Intelligence for Smart Manufacturing Kim Phuc Tran, 2023-06-01 This book provides readers with a comprehensive overview of the latest developments in the field of smart manufacturing exploring theoretical research technological advancements and practical applications of AI approaches With Industry 4.0 paving the way for intelligent systems and innovative technologies to enhance productivity and quality the transition to Industry 5.0 has introduced a new concept known as augmented intelligence AuI combining artificial intelligence AI with human intelligence HI As the demand for smart manufacturing continues to grow this book serves as a valuable resource for professionals and practitioners looking to stay up to date with the latest advancements in Industry 5.0 Covering a range of important topics such as product design

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