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[Research Advances in Rabies - 2011-07-13](#)

Volume 79 of *Advances in Virus Research* focuses on developments surrounding rabies, an ancient disease that remains a prominent public health problem for humans. This volume highlights important research advances extending from our understanding of how the rabies virus replicates and assembles to how the disease can be prevented and treated in humans and how rabies can be controlled in wildlife hosts. Experts in the field provide insightful and up-to-date chapters that summarize our current state of knowledge in diverse aspects of this very interesting and important viral disease. Contributions from leading authorities and industry experts informs and updates on all the latest developments in the field

[BIOMAT 2013 - Rubem P Mondaini 2014-03-18](#)

This is a book of a series on interdisciplinary topics on the Biological and Mathematical Sciences. The chapters correspond to selected papers on special research themes, which have been presented at BIOMAT 2013 International Symposium on Mathematical and Computational Biology which was held in the Fields Institute for Research in Mathematical Sciences, Toronto, Ontario, Canada, on November 04 – 08, 2013. The treatment is both pedagogical and advanced in order to motivate research students as well as to fulfill the requirements of professional practitioners. There are comprehensive reviews written by prominent scientific leaders of famous research groups. Contents: Population Dynamics: The Princess and the Pea: The Unexpected Importance of Movement Algorithms (Rebecca Tyson) Plankton Nutrient Interaction Model with Harvesting under Constant Environment (Samares Pal and A Chatterjee) Traveling Wave Solutions for a Chemotaxis System (F Catrina and V M Reyes G) Dynamics of a General Stage Structured N Parallel Food Chains (Isam Al-Darabsah and Yuan Yuan) Pattern Recognition of Biological Phenomena: Complex Data Clustering: From Neural Network Architecture to Theory and Applications of Nonlinear Dynamics of Pattern

Recognition (Guojun Gan, Jialun Yin, Yulia Wang and Jianhong Wu) Dynamic and Geometric Modelling of Biomolecular Structures: A Two-Step Kinetic Model of Insulin Aggregation with a Competitive Inhibitor (Mark Whidden, Allison Ho and Santiago Schnell) Optimal Control Techniques in Mathematical Modelling of Biological Phenomena: Optimal Control of Resource Coefficient in a Parabolic Population Model (J Bintz, H Finotti and S Lenhart) Optimization of Costs for Combating *Aedes Aegypti* in Optimal Time-Windows (W O Dias, G A Xavier, D A P Lima, E F Wanner and R T N Cardoso) Dynamics of a Varroa-Infested Honey Bee Colonies Model (K O Okosun) Computational Biology: Probability Distributions of GC Content Reflect the Evolution of Primate Species (Marco V José, Qi Lu and Juan R Bobadilla) Mining the Constraints of Protein Evolution (Fernando Encinas and Antonio Basilio de Miranda) Entropy Measures Based Methods for the Classification of Protein Domains into Families and Clans (Nicolas Carels, Cecilia F Mondaini and Rubem P Mondaini) Modelling Physiological Disorders: Modelling of Porous Elastic and Viscoelastic Media and Its Application to the Brain (R Begg, J Murley, M. Kohandel and S Sivaloganathan) The Mathematics of Liver Transplantation (F A B Coutinho, E Chaib, M Amaku, M M Burattini and E Massad) Complexity of Molecular Signaling Networks for Various Types of Cancer and Neurological Diseases Correlates with Patient Survivability (D Breikreutz, E A Rietman, P Hinow, M Healey and J A Tuszynski) Mathematical Modelling of Infectious Diseases: Modelling Malaria Dynamics in Temperate Regions with Long Term Incubation Period (Kyeongah Nah, Gergely Röst and Yongkuk Kim) A Simulation of the U S Influenza Outbreak in 2009–2010 Using a Patch SIR Model based on Airport Transportation Data (D L Wallace and M Chen) Modelling Directly Transmitted Infections considering Age-structured Contact Rate and Vaccination (H M Yang and C H Dezotti) A General Framework for Agent-Based Modelling with Applications to Infectious Disease Dynamics (Marek Laskowski and Seyed M Moghadas) Analysis of the Basic Reproduction Number from the Initial

Growth Phase of the Outbreak in Diseases Caused by Vectors (R P Sanches and E Massad)Parameter Estimation of a Tuberculosis Model in a Patchy Environment: Case of Cameroon (D P Moualeu, S Bowong and J Kürts)An Agent-Based Modelling Framework for Tuberculosis Infection with Drug-Resistance (Aquino L Espindola, A S Martinez and Seyed M Moghadas)Some Extensions of the Classical Epidemic Models (Fred Brauer) Readership: Undergraduates, graduates, researchers and all practitioners on the interdisciplinary fields of Mathematical Biology, Biological Physics and Mathematical Modelling of Biosystems.

Keywords:Mathematical Biology;Biomathematics;Mathematical Modelling of Biosystems;Biological Physics;Biophysics;Computational Biology;Bioinformatics

Optimal Control Applied to Biological Models - Suzanne Lenhart 2007-05-07

From economics and business to the biological sciences to physics and engineering, professionals successfully use the powerful mathematical tool of optimal control to make management and strategy decisions. *Optimal Control Applied to Biological Models* thoroughly develops the mathematical aspects of optimal control theory and provides insight into the application of this theory to biological models. Focusing on mathematical concepts, the book first examines the most basic problem for continuous time ordinary differential equations (ODEs) before discussing more complicated problems, such as variations of the initial conditions, imposed bounds on the control, multiple states and controls, linear dependence on the control, and free terminal time. In addition, the authors introduce the optimal control of discrete systems and of partial differential equations (PDEs). Featuring a user-friendly interface, the book contains fourteen interactive sections of various applications, including immunology and epidemic disease models, management decisions in harvesting, and resource allocation models. It also develops the underlying numerical methods of the applications and includes the MATLAB® codes on which the applications are based. Requiring only basic knowledge of multivariable calculus, simple ODEs, and mathematical models, this text shows how to adjust controls in biological systems in order to achieve proper outcomes.

Cancer, Complexity, Computation - Igor Balaz 2022-08-11

This book presents unique compendium of groundbreaking ideas where scientists from many different backgrounds are united in their interest in interdisciplinary approaches towards origins and development of cancers, innovative ways of searching for cancer treatment and the role of cancer in the evolution. Chapters give an unequivocal slice of all areas that relate to a quest for understanding cancer and its origin as many-fold nonlinear system, complexity of the cancer developments, a search for cancer treatment using artificial intelligence and evolutionary optimisation, novel modelling techniques, molecular origin of cancer, the role of cancer in evolution of species, interpretation of cancer in terms of artificial life and artificial immune systems,

swarm intelligence, cellular automata, computational systems biology, genetic networks, cellular computing, validation through in vitro/vivo tumour models and tumour on chip devices. The book is an inspiring blend of theoretical and experimental results, concepts and paradigms. Distinctive features The book advances widely popular topics of cancer origin, treatment and understanding of its progress The book is comprised of unique chapters written by world top experts in theoretical and applied oncology, complexity theory, mathematics, computer science. The book illustrates attractive examples of mathematical and computer models and experimental setups.

Modeling, Stochastic Control, Optimization, and Applications - George Yin 2019-07-16

This volume collects papers, based on invited talks given at the IMA workshop in Modeling, Stochastic Control, Optimization, and Related Applications, held at the Institute for Mathematics and Its Applications, University of Minnesota, during May and June, 2018. There were four week-long workshops during the conference. They are (1) stochastic control, computation methods, and applications, (2) queueing theory and networked systems, (3) ecological and biological applications, and (4) finance and economics applications. For broader impacts, researchers from different fields covering both theoretically oriented and application intensive areas were invited to participate in the conference. It brought together researchers from multi-disciplinary communities in applied mathematics, applied probability, engineering, biology, ecology, and networked science, to review, and substantially update most recent progress. As an archive, this volume presents some of the highlights of the workshops, and collect papers covering a broad range of topics.

Ranaviruses - Matthew J. Gray 2015-04-27

This is the first book on ranaviruses. Ranaviruses are double-stranded DNA viruses that cause hemorrhagic disease in amphibians, reptiles, and fish. They have caused mass die-offs of ectothermic vertebrates in wild and captive populations around the globe. There is evidence that this pathogen is emerging and responsible for population declines in certain locations. Considering that amphibians and freshwater turtles are suitable hosts and the most imperiled vertebrate taxa in the world, ranaviruses can have significant impacts on biodiversity and ecosystem function. Additionally, many fish that are raised in aquaculture facilities and traded internationally are suitable hosts; thus, the potential economic impact of ranaviruses is significant.

Ranaviruses also serve as a model for replication and gene function of large double-stranded DNA viruses. There is an urgent need to assemble the contemporary information on ranaviruses and provide guidance on how to assess their threats in populations. Through the Global Ranavirus Consortium, 24 experts from six countries were organized to write this volume, the first book on ranaviruses. The book begins with a discussion on the global extent of ranaviruses, case histories of infection and disease in ectothermic vertebrates, and

current phylogeny. Basic principles of ranavirus ecology and evolution are covered next, with a focus on host-pathogen interactions and how the virus emerges in its environment. There are two chapters that will discuss the molecular biology of ranaviruses, host response to infection, and the genes responsible for immune system evasion. One chapter establishes standards for testing for infection and diagnosing ranaviral disease. The book ends by providing guidance on how to design ranavirus surveillance studies and analyze data to determine risk, and discussing the role of the Global Ranavirus Consortium in organizing research and outreach activities.

The Sequential Quadratic Hamiltonian Method - Alfio Borzi 2023-05-26

The sequential quadratic hamiltonian (SQH) method is a novel numerical optimization procedure for solving optimal control problems governed by differential models. It is based on the characterisation of optimal controls in the framework of the Pontryagin maximum principle (PMP). The SQH method is a powerful computational methodology that is capable of development in many directions. The Sequential Quadratic Hamiltonian Method: Solving Optimal Control Problems discusses its analysis and use in solving nonsmooth ODE control problems, relaxed ODE control problems, stochastic control problems, mixed-integer control problems, PDE control problems, inverse PDE problems, differential Nash game problems, and problems related to residual neural networks. This book may serve as a textbook for undergraduate and graduate students, and as an introduction for researchers in sciences and engineering who intend to further develop the SQH method or wish to use it as a numerical tool for solving challenging optimal control problems and for investigating the Pontryagin maximum principle on new optimisation problems. Features Provides insight into mathematical and computational issues concerning optimal control problems, while discussing many differential models of interest in different disciplines. Suitable for undergraduate and graduate students and as an introduction for researchers in sciences and engineering. Accompanied by codes which allow the reader to apply the SQH method to solve many different optimal control and optimisation problems.

Age Structured Epidemic Modeling - Xue-Zhi Li 2020-05-28

This book introduces advanced mathematical methods and techniques for analysis and simulation of models in mathematical epidemiology. Chronological age and class-age play an important role in the description of infectious diseases and this text provides the tools for the analysis of this type of partial differential equation models. This book presents general theoretical tools as well as large number of specific examples to guide the reader to develop their own tools that they may then apply to study structured models in mathematical epidemiology. The book will be a valuable addition to the arsenal of all researchers interested in developing theory or studying specific models with age structure.

Mathematical modeling in energy homeostasis, appetite control and food intake with a special attention to ghrelin - Jorge Guerra Pires 2017-03-18

The elegant ‘interconnected mechanisms’ by which the gastrointestinal (GI) tract regulates food intake are a marvel of biology, but the redundancy (e.g., several hormones seem to have effects in food intake) of both GI (by means of hormones) and central nervous system (CNS, by means of satiety/satiation signals) pathways governing energy homeostasis poses formidable challenges for scientists trying to take a clear glimpse of this machinery, e.g. for designing anti-obesity and alike pharmaceuticals. In essence, notwithstanding the astonishing advancements made over the past few decades in unscrambling many of the molecular pathways involved in energy (homeostasis) regulation, a rather cloudy understanding of “how all the pieces fit together to function as an integrated system” is what can be found for the most part in the scientific community; we discuss that in part II of the work, in a single chapter divided in several sections for numerous imperative hormones, e.g. cholecystokinin. The current work is divided into three parts: part I is regarding fundamentals of physiology and mathematical modeling employed all over the work; part II is more generic and concerns several hormones (what we have called a “web of hormones”) and part III (divided into three chapters) is more specific, concerning a single hormone (i.e., ghrelin). The core of the work is part III, and to a certain extent part II, bearing mind we provide a literature review based on papers scattered/dispersed all over the medical science literature. The main objective of this work is proposing a mathematical model for ghrelin dynamics (Figure 70), a model centered on the gastrointestinal tract (stomach + small intestine, a two-compartment model), with daily-like dynamics, short-term dynamics; and, simultaneously, proposing a prototype for a systems biology like model (igure 40), a model based on numerous hormones, for understanding mathematically food intake/bodyweight control. Ghrelin is a quite powerful orexigenic hormone discovered in the late 1990s that controls appetite and energy homeostasis, alongside leptin and other hormones still to be investigated in depth by the medical sciences literature. Accordingly, we provide a (simple) mathematical model, consisting of a set of ordinary differential equations detailing ghrelin dynamics combined to gastrointestinal signals due to meals. Numerical simulations are able to replicate in silico available data from the literature; additionally, we were able to fit a reduced version of the basal model to experimental data. The model is developed as a module for a bigger potential multi-compartmental structure, detailing food and energy homeostasis within a sort of "a web of hormones" (see part II and the last chapter of part III). The present contribute is to recommend a primary mathematical model for ghrelin dynamics centered in the gastrointestinal tract, with potentiality to be applied also for postabsorptive states, left mainly as future works. We go on with the model by presenting mainly two variations, further unfolding is left as

future endeavor: tastants and stochastic version. We test several optimization routines for the parameter estimation procedure, hybrid algorithms (global + local search), for parameter estimation, based on data published for humans (three meals a day). For all the routines, the best is a hybrid composed of simulating annealing as global search and pattern search as local search. In the objective function (sum of the squared errors, SSE), we apply artificial neural networks (a two-layer feedforward neural network) for generating new data from the data already published, a strategy adopted to increase the data set. In the last part of the chapter about ghrelin modeling (part III), we propose several prototypes for future works based on the basal models; the model used for parameter estimation is a “minimal/reduced” model; we also provide discussions and future works for the minimal model and parameter estimation. Key-words. Ghrelin; leptin; mathematical modelling; food intake; appetite; parameter estimation.

Advances in Computational Biology - Luis F. Castillo 2013-08-04

This volume compiles accepted contributions for the 2nd Edition of the Colombian Computational Biology and Bioinformatics Congress CCBCOL, after a rigorous review process in which 54 papers were accepted for publication from 119 submitted contributions. Bioinformatics and Computational Biology are areas of knowledge that have emerged due to advances that have taken place in the Biological Sciences and its integration with Information Sciences. The expansion of projects involving the study of genomes has led the way in the production of vast amounts of sequence data which needs to be organized, analyzed and stored to understand phenomena associated with living organisms related to their evolution, behavior in different ecosystems, and the development of applications that can be derived from this analysis.

Mathematics Across Contemporary Sciences - Taher Abualrub 2017-01-22

This work presents invited contributions from the second "International Conference on Mathematics and Statistics" jointly organized by the AUS (American University of Sharjah) and the AMS (American Mathematical Society). Addressing several research fields across the mathematical sciences, all of the papers were prepared by faculty members at universities in the Gulf region or prominent international researchers. The current volume is the first of its kind in the UAE and is intended to set new standards of excellence for collaboration and scholarship in the region.

Numerical and Symbolic Computation - Maria Amélia Ramos Loja 2020-12-29

This book is a comprehensive set of articles reflecting on the application of symbolic and/or numerical computation in a range of scientific areas within the fields of engineering and science. These articles constitute extended versions of communications presented at the 4th International Conference on Numerical and Symbolic Computation—SYMCOMP 2019—that took place in Porto, Portugal, from 11 to 12 April 2019

The different chapters present diverse perspectives on the existing effective connections between mathematical methods and procedures and other knowledge areas. The intrinsic multidisciplinary character is visible throughout the whole book as a result of the applicability of the scope and the applications considered. The reader will find this book to be a useful resource for identifying problems of interest in different engineering and science areas, and in the development of mathematical models and procedures used in the context of prediction or verification computational tools as well as in the aided-learning/teaching context. This book is a must-read for anyone interested in the recent developments and applications of symbolic and numerical computation for a number of multidisciplinary engineering and science problems.

A Primer on the Calculus of Variations and Optimal Control Theory - Mike Mesterton-Gibbons 2009

The calculus of variations is used to find functions that optimize quantities expressed in terms of integrals. Optimal control theory seeks to find functions that minimize cost integrals for systems described by differential equations. This book is an introduction to both the classical theory of the calculus of variations and the more modern developments of optimal control theory from the perspective of an applied mathematician. It focuses on understanding concepts and how to apply them. The range of potential applications is broad: the calculus of variations and optimal control theory have been widely used in numerous ways in biology, criminology, economics, engineering, finance, management science, and physics. Applications described in this book include cancer chemotherapy, navigational control, and renewable resource harvesting. The prerequisites for the book are modest: the standard calculus sequence, a first course on ordinary differential equations, and some facility with the use of mathematical software. It is suitable for an undergraduate or beginning graduate course, or for self study. It provides excellent preparation for more advanced books and courses on the calculus of variations and optimal control theory.

Closed Loop Neuroscience - Ahmed El Hady 2016-09-08

Closed Loop Neuroscience addresses the technical aspects of closed loop neurophysiology, presenting the implementation of these approaches spanning several domains of neuroscience, from cellular and network neurophysiology, through sensory and motor systems, and then clinical therapeutic devices. Although closed-loop approaches have long been a part of the neuroscientific toolbox, these techniques are only now gaining popularity in research and clinical applications. As there is not yet a comprehensive methods book addressing the topic as a whole, this volume fills that gap, presenting state-of-the-art approaches and the technical advancements that enable their application to different scientific problems in neuroscience. Presents the first volume to offer researchers a comprehensive overview of the technical realities of employing closed loop techniques in their work Offers application to in-vitro, in-vivo, and hybrid systems Contains an emphasis on

the actual techniques used rather than on specific results obtained Includes exhaustive protocols and descriptions of software and hardware, making it easy for readers to implement the proposed methodologies Encompasses the clinical/neuroprosthetic aspect and how these systems can also be used to contribute to our understanding of basic neurophysiology Edited work with chapters authored by leaders in the field from around the globe – the broadest, most expert coverage available

Modeling Paradigms and Analysis of Disease Transmission Models - Abba B. Gumel 2010

This volume stems from two DIMACS activities, the U.S.-Africa Advanced Study Institute and the DIMACS Workshop, both on Mathematical Modeling of Infectious Diseases in Africa, held in South Africa in the summer of 2007. It contains both tutorial papers and research papers. Students and researchers should find the papers on modeling and analyzing certain diseases currently affecting Africa very informative. In particular, they can learn basic principles of disease modeling and stability from the tutorial papers where continuous and discrete time models, optimal control, and stochastic features are introduced.

Operational Research - João Paulo Almeida 2023-02-08

This book provides the current status of research on the application of OR methods to solve emerging and relevant operations management problems. Each chapter is a selected contribution of the IO2021 - XXI Congress of APDIO, the Portuguese Association of Operational Research, held in Figueira da Foz from 7 to 8 November 2021. Under the theme of analytics for a better world, the book presents interesting results and applications of OR cutting-edge methods and techniques to various real-world problems. Of particular importance are works applying nonlinear, multi-objective optimization, hybrid heuristics, multicriteria decision analysis, data envelopment analysis, simulation, clustering techniques and decision support systems, in different areas such as supply chain management, production planning and scheduling, logistics, energy, telecommunications, finance and health. All chapters were carefully reviewed by the members of the scientific program committee.

Control Theory for Physicists - John Bechhoefer 2021-03-31

Control theory, an interdisciplinary concept dealing with the behaviour of dynamical systems, is an important but often overlooked aspect of physics. This is the first broad and complete treatment of the topic tailored for physicists, one which goes from the basics right through to the most recent advances. Simple examples develop a deep understanding and intuition for the systematic principles of control theory, beyond the recipes given in standard engineering-focused texts. Up-to-date coverage of control of networks and complex systems, and a thorough discussion of the fundamental limits of control, including the limitations placed by causality, information theory, and thermodynamics are included. In addition it explores important recent

advances in stochastic thermodynamics on the thermodynamic costs of information processing and control. For all students of physics interested in control theory, this classroom-tested, comprehensive approach to the topic with online solutions and further materials delivers both fundamental principles and current developments.

Mathematical Methods in Biology - J. David Logan 2009-08-17

A one-of-a-kind guide to using deterministic and probabilistic methods for solving problems in the biological sciences Highlighting the growing relevance of quantitative techniques in scientific research, *Mathematical Methods in Biology* provides an accessible presentation of the broad range of important mathematical methods for solving problems in the biological sciences. The book reveals the growing connections between mathematics and biology through clear explanations and specific, interesting problems from areas such as population dynamics, foraging theory, and life history theory. The authors begin with an introduction and review of mathematical tools that are employed in subsequent chapters, including biological modeling, calculus, differential equations, dimensionless variables, and descriptive statistics. The following chapters examine standard discrete and continuous models using matrix algebra as well as difference and differential equations. Finally, the book outlines probability, statistics, and stochastic methods as well as material on bootstrapping and stochastic differential equations, which is a unique approach that is not offered in other literature on the topic. In order to demonstrate the application of mathematical methods to the biological sciences, the authors provide focused examples from the field of theoretical ecology, which serve as an accessible context for study while also demonstrating mathematical skills that are applicable to many other areas in the life sciences. The book's algorithms are illustrated using MATLAB®, but can also be replicated using other software packages, including R, Mathematica®, and Maple; however, the text does not require any single computer algebra package. Each chapter contains numerous exercises and problems that range in difficulty, from the basic to more challenging, to assist readers with building their problem-solving skills. Selected solutions are included at the back of the book, and a related Web site features supplemental material for further study. Extensively class-tested to ensure an easy-to-follow format, *Mathematical Methods in Biology* is an excellent book for mathematics and biology courses at the upper-undergraduate and graduate levels. It also serves as a valuable reference for researchers and professionals working in the fields of biology, ecology, and biomathematics.

[An Introduction to Mathematical Epidemiology](#) - Maia Martcheva 2015-10-20

The book is a comprehensive, self-contained introduction to the mathematical modeling and analysis of infectious diseases. It includes model building, fitting to data, local and global analysis techniques. Various

types of deterministic dynamical models are considered: ordinary differential equation models, delay-differential equation models, difference equation models, age-structured PDE models and diffusion models. It includes various techniques for the computation of the basic reproduction number as well as approaches to the epidemiological interpretation of the reproduction number. MATLAB code is included to facilitate the data fitting and the simulation with age-structured models.

Mathematical Modeling and Soft Computing in Epidemiology - Jyoti Mishra 2020-12-28

This book describes the uses of different mathematical modeling and soft computing techniques used in epidemiology for experiential research in projects such as how infectious diseases progress to show the likely outcome of an epidemic, and to contribute to public health interventions. This book covers mathematical modeling and soft computing techniques used to study the spread of diseases, predict the future course of an outbreak, and evaluate epidemic control strategies. This book explores the applications covering numerical and analytical solutions, presents basic and advanced concepts for beginners and industry professionals, and incorporates the latest methodologies and challenges using mathematical modeling and soft computing techniques in epidemiology. Primary users of this book include researchers, academicians, postgraduate students, and specialists.

Dynamics of Cancer - Dominik Wodarz 2014-04-24

The book aims to provide an introduction to mathematical models that describe the dynamics of tumor growth and the evolution of tumor cells. It can be used as a textbook for advanced undergraduate or graduate courses, and also serves as a reference book for researchers. The book has a strong evolutionary component and reflects the viewpoint that cancer can be understood rationally through a combination of mathematical and biological tools. It can be used both by mathematicians and biologists. Mathematically, the book starts with relatively simple ordinary differential equation models, and subsequently explores more complex stochastic and spatial models. Biologically, the book starts with explorations of the basic dynamics of tumor growth, including competitive interactions among cells, and subsequently moves on to the evolutionary dynamics of cancer cells, including scenarios of cancer initiation, progression, and treatment. The book finishes with a discussion of advanced topics, which describe how some of the mathematical concepts can be used to gain insights into a variety of questions, such as epigenetics, telomeres, gene therapy, and social interactions of cancer cells. Contents: Teaching Guide Cancer and Somatic Evolution Mathematical Modeling of Tumorigenesis Basic Growth Dynamics and Deterministic Models: Single Species Growth Two-Species Competition Dynamics Competition Between Genetically Stable and Unstable Cells Chromosomal Instability and Tumor Growth Angiogenesis Inhibitors, Promoters, and Spatial Growth Evolutionary Dynamics and

Stochastic Models: Evolutionary Dynamics of Tumor Initiation Through Oncogenes: The Gain-of-Function Model Evolutionary Dynamics of Tumor Initiation Through Tumor-Suppressor Genes: The Loss-of-Function Model and Stochastic Tunneling Microsatellite and Chromosomal Instability in Sporadic and Familial Colorectal Cancers Evolutionary Dynamics in Hierarchical Populations Spatial Evolutionary Dynamics of Tumor Initiation Complex Tumor Dynamics in Space Stochastic Modeling of Cellular Growth, Treatment, and Resistance Generation Evolutionary Dynamics of Drug Resistance in Chronic Myeloid Leukemia Advanced Topics: Evolutionary Dynamics of Stem-Cell Driven Tumor Growth Tumor Growth Kinetics and Disease Progression Epigenetic Changes and the Rate of DNA Methylation Telomeres and Cancer Protection Gene Therapy and Oncolytic Virus Therapy Immune Responses, Tumor Growth, and Therapies Towards Higher Complexities: Social Interactions Readership: Researchers in mathematical biology, mathematical modeling, biology, mathematical oncology. Keywords: Mathematical Oncology; Dynamics; Evolution; Evolutionary Dynamics; Cancer; Mathematical Models; Somatic Evolution; Teaching Key Features: Both a reference book for the topic, and provides material for undergraduate and graduate courses Tries to bridge the divide between mathematicians and biologists, which is also reflected in the backgrounds of the two authors Shows how mathematical concepts can be translated into experimentally and clinically useful insights Rooted in evolutionary biology, the book handles this very complex phenomenon in an intuitive and mathematically elegant way Contains problems and research projects for each topic 10 pages of figures in color

Australian Island Arks - Dorian Moro 2018-02-01

Australia is the custodian of a diverse range of continental and oceanic islands. From Heard and Macquarie in the sub-Antarctic, to temperate Lord Howe and Norfolk, to the tropical Cocos (Keeling) Islands and the islands of the Great Barrier Reef, Australia's islands contain some of the nation's most iconic fauna, flora and ecosystems. They are a refuge for over 35% of Australia's threatened species and for many others declining on mainland Australia. They also have significant cultural value, especially for Indigenous communities, and economic value as centres for tourism. Australian Island Arks presents a compelling case for restoring and managing islands to conserve our natural heritage. With contributions from island practitioners, researchers and policy-makers, it reviews current island management practices and discusses the need and options for future conservation work. Chapters focus on the management of invasive species, threatened species recovery, conservation planning, Indigenous cultural values and partnerships, tourism enterprises, visitor management, and policy and legislature. Case studies show how island restoration and conservation approaches are working in Australia and what the emerging themes are for the future. Australian Island Arks will help island communities, managers, visitors and decision-makers to understand the current status of

Australia's islands, their management challenges, and the opportunities that exist to make best use of these iconic landscapes.

Nonlinear Systems of Partial Differential Equations -

Biomat 2011 - International Symposium On Mathematical And Computational Biology - Rubem P Mondaini
2012-03-14

The book contains a selection of articles on special research topics on Mathematical Biology and the interdisciplinary fields of mathematical modelling of biosystems. The treatment is both pedagogical and advanced to enhance future scientific research. We include comprehensive reviews written by prominent leaders of scientific research groups, new results on Population Dynamics such as Hybrid Discrete-Continuous Models of Cell Populations and the Hopf bifurcation on Predator-Prey Models, and some state of the art research on Medical Physics such as Optimization Methods applied to Raman Spectroscopy. Other topics covered focus on evolution biology, infectious diseases, DNA structure and many more.

Science and Technologies for Smart Cities - Henrique Santos 2020-07-27

This book constitutes the refereed proceedings of the 5th Annual Smart City 360° Summit, held in Braga, Portugal, in December 2019. The volume combines selected papers of four conferences, namely IoT in Urban Space, Urb-IoT 2019, Smart Governance for Sustainable Smart Cities, SmartGov 2019, Sensor Systems and Software, S-Cube 2019, and Intelligent Technologies for Interactive Entertainment, Intetain 2019. The 5 keynote and 32 conference papers presented were carefully reviewed and selected from 113 submissions and present results of multidisciplinary scientific and industry collaboration to solve complex societal, technological and economic problems Smart Cities. As such, the main goals are to promote quality of life, work conditions, mobility and sustainability.

Optimization, Learning Algorithms and Applications - Ana I. Pereira 2021-12-02

This book constitutes selected and revised papers presented at the First International Conference on Optimization, Learning Algorithms and Applications, OL2A 2021, held in Bragança, Portugal, in July 2021. Due to the COVID-19 pandemic the conference was held online. The 39 full papers and 13 short papers were thoroughly reviewed and selected from 134 submissions. They are organized in the topical sections on optimization theory; robotics; measurements with the internet of things; optimization in control systems design; deep learning; data visualization and virtual reality; health informatics; data analysis; trends in engineering education.

Control Systems and Mathematical Methods in Economics - Gustav Feichtinger 2018-06-08

Since the days of Lev Pontryagin and his associates, the discipline of Optimal Control has enjoyed a tremendous upswing – not only in terms of its mathematical foundations, but also with regard to numerous fields of application, which have given rise to highly active research areas. Few scholars, however, have been able to make contributions to both the mathematical developments and the (socio-)economic applications; Vladimir Veliov is one of them. In the course of his scientific career, he has contributed highly influential research on mathematical aspects of Optimal Control Theory, as well as applications in Economics and Operations Research. One of the hallmarks of his research is its impressive breadth. This volume, published on the occasion of his 65th birthday, accurately reflects that diversity. The mathematical aspects covered include stability theory for difference inclusions, metric regularity, generalized duality theory, the Bolza problem from a functional analytic perspective, and fractional calculus. In turn, the book explores various applications of control theory, such as population dynamics, population economics, epidemiology, optimal growth theory, resource and energy economics, environmental management, and climate change. Further topics include optimal liquidity, dynamics of the firm, and wealth inequality.

Partial Differential Equations in Ecology - Sergei Petrovski 2021-03-17

Partial differential equations (PDEs) have been used in theoretical ecology research for more than eighty years. Nowadays, along with a variety of different mathematical techniques, they remain as an efficient, widely used modelling framework; as a matter of fact, the range of PDE applications has even become broader. This volume presents a collection of case studies where applications range from bacterial systems to population dynamics of human riots.

Applied Mathematics - J. David Logan 2013-05-28

Praise for the Third Edition “Future mathematicians, scientists, and engineers should find the book to be an excellent introductory text for coursework or self-study as well as worth its shelf space for reference.” –MAA Reviews Applied Mathematics, Fourth Edition is a thoroughly updated and revised edition on the applications of modeling and analyzing natural, social, and technological processes. The book covers a wide range of key topics in mathematical methods and modeling and highlights the connections between mathematics and the applied and natural sciences. The Fourth Edition covers both standard and modern topics, including scaling and dimensional analysis; regular and singular perturbation; calculus of variations; Green's functions and integral equations; nonlinear wave propagation; and stability and bifurcation. The book provides extended coverage of mathematical biology, including biochemical kinetics, epidemiology, viral dynamics, and parasitic disease. In addition, the new edition features: Expanded coverage on orthogonality, boundary value problems, and distributions, all of which are motivated by solvability and eigenvalue problems in elementary linear

algebra Additional MATLAB® applications for computer algebra system calculations Over 300 exercises and 100 illustrations that demonstrate important concepts New examples of dimensional analysis and scaling along with new tables of dimensions and units for easy reference Review material, theory, and examples of ordinary differential equations New material on applications to quantum mechanics, chemical kinetics, and modeling diseases and viruses Written at an accessible level for readers in a wide range of scientific fields, Applied Mathematics, Fourth Edition is an ideal text for introducing modern and advanced techniques of applied mathematics to upper-undergraduate and graduate-level students in mathematics, science, and engineering. The book is also a valuable reference for engineers and scientists in government and industry.

Numerical Mathematics and Advanced Applications ENUMATH 2019 - Fred J. Vermolen 2021-04-30

This book gathers outstanding papers presented at the European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 2019). The conference was organized by Delft University of Technology and was held in Egmond aan Zee, the Netherlands, from September 30 to October 4, 2019. Leading experts in the field presented the latest results and ideas regarding the design, implementation and analysis of numerical algorithms, as well as their applications to relevant societal problems. ENUMATH is a series of conferences held every two years to provide a forum for discussing basic aspects and new trends in numerical mathematics and scientific and industrial applications, all examined at the highest level of international expertise. The first ENUMATH was held in Paris in 1995, with successive installments at various sites across Europe, including Heidelberg (1997), Jyvaskyla (1999), Ischia Porto (2001), Prague (2003), Santiago de Compostela (2005), Graz (2007), Uppsala (2009), Leicester (2011), Lausanne (2013), Ankara (2015) and Bergen (2017).

Advances in Applied Mathematics - Ali R. Ansari 2014-08-04

This volume contains contributions from the Gulf International Conference in Applied Mathematics, held at the Gulf University for Science & Technology. The proceedings reflects the three major themes of the conference. The first of these was mathematical biology, including a keynote address by Professor Philip Maini. The second theme was computational science/numerical analysis, including a keynote address by Professor Grigori Shishkin. The conference also addressed more general applications topics, with papers in business applications, fluid mechanics, optimization, scheduling problems and engineering applications, as well as a keynote by Professor Ali Nayfeh.

Dynamical Models of Biology and Medicine - Yang Kuang 2019-10-04

Mathematical and computational modeling approaches in biological and medical research are experiencing rapid growth globally. This Special Issue Book intends to scratch the surface of this exciting phenomenon.

The subject areas covered involve general mathematical methods and their applications in biology and medicine, with an emphasis on work related to mathematical and computational modeling of the complex dynamics observed in biological and medical research. Fourteen rigorously reviewed papers were included in this Special Issue. These papers cover several timely topics relating to classical population biology, fundamental biology, and modern medicine. While the authors of these papers dealt with very different modeling questions, they were all motivated by specific applications in biology and medicine and employed innovative mathematical and computational methods to study the complex dynamics of their models. We hope that these papers detail case studies that will inspire many additional mathematical modeling efforts in biology and medicine

Mathematical Approach to Climate Change and its Impacts - Piermarco Cannarsa 2020-03-16

This book presents important recent applied mathematics research on environmental problems and impacts due to climate change. Although there are inherent difficulties in addressing phenomena that are part of such a complex system, exploration of the subject using mathematical modelling is especially suited to tackling poorly understood issues in the field. It is in this spirit that the book was conceived. It is an outcome of the International INDAM Workshop “Mathematical Approach to Climate Change Impacts – MAC2I”, held in Rome in March 2017. The workshop comprised four sessions, on Ecosystems, Hydrology, Glaciology, and Monitoring. The book includes peer-reviewed contributions on research issues discussed during each of these sessions or generated by collaborations among the specialists involved. Accurate parameter determination techniques are explained and innovative mathematical modelling approaches, presented. The book also provides useful material and mathematical problem-solving tools for doctoral programs dealing with the complexities of climate change.

Geometric Optimal Control - Heinz Schättler 2012-06-26

This book gives a comprehensive treatment of the fundamental necessary and sufficient conditions for optimality for finite-dimensional, deterministic, optimal control problems. The emphasis is on the geometric aspects of the theory and on illustrating how these methods can be used to solve optimal control problems. It provides tools and techniques that go well beyond standard procedures and can be used to obtain a full understanding of the global structure of solutions for the underlying problem. The text includes a large number and variety of fully worked out examples that range from the classical problem of minimum surfaces of revolution to cancer treatment for novel therapy approaches. All these examples, in one way or the other, illustrate the power of geometric techniques and methods. The versatile text contains material on different levels ranging from the introductory and elementary to the advanced. Parts of the text can be viewed as a

comprehensive textbook for both advanced undergraduate and all level graduate courses on optimal control in both mathematics and engineering departments. The text moves smoothly from the more introductory topics to those parts that are in a monograph style where advanced topics are presented. While the presentation is mathematically rigorous, it is carried out in a tutorial style that makes the text accessible to a wide audience of researchers and students from various fields, including the mathematical sciences and engineering. Heinz Schättler is an Associate Professor at Washington University in St. Louis in the Department of Electrical and Systems Engineering, Urszula Ledzewicz is a Distinguished Research Professor at Southern Illinois University Edwardsville in the Department of Mathematics and Statistics.

A Variational Approach to Optimal Control of ODEs - Pablo Pedregal 2022-07-26

This self-contained book presents in a unified, systematic way the basic principles of optimal control governed by ODEs. Using a variational perspective, the author incorporates important restrictions like constraints for control and state, as well as the state system itself, into the equivalent variational reformulation of the problem. The fundamental issues of existence of optimal solutions, optimality conditions, and numerical approximation are then examined from this variational viewpoint. Inside, readers will find a unified approach to all the basic issues of optimal control, academic and real-world examples testing the book's variational approach, and a rigorous treatment stressing ideas and arguments rather than the underlying mathematical formalism. *A Variational Approach to Optimal Control of ODEs* is mainly for applied analysts, applied mathematicians, and control engineers, but will also be helpful to other scientists and engineers who want to understand the basic principles of optimal control governed by ODEs. It requires no prerequisites in variational problems or expertise in numerical approximation. It can be used for a first course in optimal control.

***Optimization and Approximation* - Pablo Pedregal 2017-09-07**

This book provides a basic, initial resource, introducing science and engineering students to the field of optimization. It covers three main areas: mathematical programming, calculus of variations and optimal control, highlighting the ideas and concepts and offering insights into the importance of optimality conditions in each area. It also systematically presents affordable approximation methods. Exercises at various levels have been included to support the learning process.

***Analysis, Probability, Applications, and Computation* - Karl-Olof Lindahl 2019-04-29**

This book is a collection of short papers from the 11th International ISAAC Congress 2017 in Växjö, Sweden. The papers, written by the best international experts, are devoted to recent results in mathematics with a focus on analysis. The volume provides to both specialists and non-specialists an excellent source of

information on the current research in mathematical analysis and its various interdisciplinary applications.

***Advances in Evolutionary and Deterministic Methods for Design, Optimization and Control in Engineering and Sciences* - António Gaspar-Cunha 2020-11-23**

This book presents improved and extended versions of selected papers from EUROGEN 2019, a conference with interest on developing or applying evolutionary and deterministic methods in optimization of design and emphasizing on industrial and societal applications.

***Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy* - Manoj Sahni 2023-05-08**

The book is a collection of best selected research papers presented at the Third International Conference on "Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE 2022)," organized by the University of Technology Sydney, Australia, in association with the Department of Mathematics, Pandit Deendayal Energy University, India, and Forum for Interdisciplinary Mathematics. This book presents new knowledge and recent developments in all aspects of computational techniques, mathematical modeling, energy systems, applications of fuzzy sets and intelligent computing. The book provides innovative works of researchers, academicians and students in the area of interdisciplinary mathematics, statistics, computational intelligence and renewable energy.

***Advances in Applied Mathematics, Modeling, and Computational Science* - Roderick Melnik 2012-09-23**

The volume presents a selection of in-depth studies and state-of-the-art surveys of several challenging topics that are at the forefront of modern applied mathematics, mathematical modeling, and computational science. These three areas represent the foundation upon which the methodology of mathematical modeling and computational experiment is built as a ubiquitous tool in all areas of mathematical applications. This book covers both fundamental and applied research, ranging from studies of elliptic curves over finite fields with their applications to cryptography, to dynamic blocking problems, to random matrix theory with its innovative applications. The book provides the reader with state-of-the-art achievements in the development and application of new theories at the interface of applied mathematics, modeling, and computational science. This book aims at fostering interdisciplinary collaborations required to meet the modern challenges of applied mathematics, modeling, and computational science. At the same time, the contributions combine rigorous mathematical and computational procedures and examples from applications ranging from engineering to life sciences, providing a rich ground for graduate student projects.