Explorations Of Mathematical Models In Biology With Matlab

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Explorations Of Mathematical Models In
Explorations of mathematical models in biology with MATLAB. As biology increasingly depends on data, algorithms, and models, it has become necessary to use a computing language, such as the user-friendly MATLAB, to focus more on building and analyzing models as opposed to configuring tedious calculations. "Explorations of Mathematical Models in Biology with MATLAB "provides an introduction to model creation using MATLAB, followed by the translation, analysis, interpretation, and ...

Explorations of mathematical models in biology with MATLAB ...
Explorations of Mathematical Models in Biology with Maple provides an introduction to model creation using Maple, followed by the translation, analysis, interpretation, and observation of the models. With an integrated and interdisciplinary approach that embeds mathematical modeling into biological applications, the book illustrates numerous applications of mathematical techniques within biology, ecology, and environmental sciences.

Explorations Of Mathematical Models In Biology With Maple PDF
A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modeling. Mathematical models are used in the natural sciences (such as physics, biology, earth science, chemistry) and engineering disciplines (such as computer science, electrical engineering), as well as in non-physical systems such as the social sciences (such as economics, psychology, sociology, political science). Mathematical mod

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to be extended to mechanistic mathematical models. These models serve as working hypotheses: they help us to understand and predict the behaviour of complex systems. The application of mathematical modelling to molecular cell biology is not a new endeavour; there is a long history of mathematical descriptions of biochemical and genetic networks.

Mathematical Modelling in Systems Biology: An Introduction
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Explorations of Mathematical Models in Biology with MATLAB is an ideal textbook for upper-undergraduate courses in mathematical models in biology, theoretical ecology, bioeconomics, forensic science, applied mathematics, and environmental science. The book is also an excellent reference for biologists, ecologists, mathematicians, biomathematicians, and environmental and resource economists.

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The mathematical models not only help us to understand the system, but also are instrumental to yield insight into the complex processes involved in biological systems by extracting the essential meaning of the hypotheses (Wimsatt, 1987; Bedau, 1999; Schank, 2008) and allows to study the effects of changes in its components and/or environmental conditions on the system's behavior; that is, they allow the control and optimization of the system.

Explore and analyze the solutions of mathematical models from diverse disciplines As biology increasingly depends on data, algorithms, and models, it has become necessary to use a computing language, such as the user-friendly MATLAB, to focus more on building and analyzing models as opposed to configuring tedious calculations. Explorations of Mathematical Models in Biology with MATLAB provides an introduction to model creation using MATLAB, followed by the translation, analysis, interpretation, and observation of the models. With an integrated and interdisciplinary approach that embeds mathematical modeling into biological applications, the book illustrates numerous applications of mathematical techniques within biology, ecology, and environmental sciences. Featuring a quantitative, computational, and mathematical approach, the book includes: Examples of real-world applications, such as population dynamics, genetics, drug administration, interacting species, and the spread of contagious diseases, to showcase the relevancy and wide applicability of abstract mathematical techniques Discussion of various mathematical concepts, such as Markov chains, matrix algebra, eigenvalues, eigenvectors, first-order linear difference equations, and nonlinear first-order difference equations Coverage of difference equations to model a wide range of real-life discrete time situations in diverse areas as well as discussions on matrices to model linear problems Solutions to selected exercises and additional MATLAB codes Explorations of Mathematical Models in Biology with MATLAB is an ideal textbook for upper-undergraduate courses in mathematical models in biology, theoretical ecology, bioeconomics, forensic science, applied mathematics, and environmental science. The book is also an excellent reference for biologists, ecologists, mathematicians, biomathematicians, and environmental and resource economists.

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Linear and non-linear models of populations, molecular evolution, phylogenetic tree construction, genetics, and infectious diseases are presented with minimal prerequisites.

Mathematical modelling is a subject without boundaries. It is the means by which mathematics becomes useful to virtually any subject. Moreover, modelling has been and continues to be a driving force for the development of mathematics itself. This book explains the process of modelling real situations to obtain mathematical problems that can be analyzed, thus solving the original problem. In this book the authors have succeeded in demonstrating just how enjoyable this subject can be. Each chapter ends with a set of exercises and some suggestions for class projects. Some projects are extensive; others are more modest. The text was designed to be suitable for a one-term course for advanced undergraduates on modelling. It can also be used in seminars or as preparation for mathematical modelling competitions.

An introduction to the mathematical concepts and techniques needed for the construction and analysis of models in molecular systems biology. Systems techniques are integral to current research in molecular cell biology, and system-level investigations are often accompanied by mathematical models. These models serve as working hypotheses: they help us to understand and predict the behavior of complex systems. This book offers an introduction to mathematical concepts and techniques needed for the construction and interpretation of models in molecular systems biology. It is accessible to upper-level undergraduate or graduate students in life science or engineering who have some familiarity with calculus, and will be a useful reference for researchers at all levels. The first four chapters cover the basics of mathematical modeling in molecular systems biology. The last four chapters address specific biological domains, treating modeling of metabolic networks, of signal transduction pathways, of gene regulatory networks, and of electrophysiology and neuronal action potentials. Chapters 3–8 end with optional sections that address more specialized modeling topics. Exercises, solvable with pen-and-paper calculations, appear throughout the text to encourage interaction with the mathematical techniques. More involved end-of-chapter problem sets require computational software. Appendixes provide a review of basic concepts of molecular biology, additional mathematical background material, and tutorials for two computational software packages (XPPAUT and MATLAB) that can be used for model simulation and analysis.

This introduces some of the most important and widespread environmental issues with the emphasis throughout on fundamental principles and concepts.

The subject of the book is the "know-how" of applied mathematical modelling: how to construct specific models and adjust them to a new engineering environment or more precise realistic assumptions; how to analyze models for the purpose of investigating real life phenomena; and how the models can extend our knowledge about a specific engineering process. Two major sources of the book are the stock of classic models and the authors' wide experience in the field. The book provides a theoretical background to guide the development of practical models and their investigation. It considers general modelling techniques, explains basic underlying physical laws and shows how to transform them into a set of mathematical equations. The emphasis is placed on common features of the modelling process in various applications as well as on complications and generalizations of models. The book covers a variety of applications: mechanical, acoustical, physical and electrical, water transportation and contamination processes; bioengineering and population control; production systems and technical equipment renovation. Mathematical tools include partial and ordinary differential equations, difference and integral equations, the calculus of variations, optimal control, bifurcation methods, and related subjects.