Optimal Control Applied To Biological Models Chapman Hallcrc Mathematical And Computational Biology

Optimal Control Applied to Biological ModelsDynamical Models of Biology and MedicineMathematical Modeling in BiologyGame-Theoretical Models in BiologyMathematical Methods in BiologyDynamic Systems Biology Modeling and SimulationMath and Bio 2010Game-Theoretical Models in BiologyGame-Theoretical Models in BiologyModels and Analogues in BiologyDynamics and Control of the Activated Sludge ProcessSystems BiologySystems BiologyMathematical Models in BiologyJournal of Mathematical BiologyTrees and Networks in Biological ModelsModelling in Applied BiologyBiology, Management, and Protection of Catadromous EelsCompartmental Analysis in Biology and MedicineProceedings of Forest Resource Inventory, Growth Models, Management Planning, and Remote Sensing Suzanne Lenhart Yang Kuang Shandelle M. Henson Mark Broom J. David Logan Joseph DiStefano III Lynn Arthur Steen Mark Broom Mark Broom Society for Experimental Biology (Great Britain) Paul Bishop Andreas Kremling Olaf Wolkenhauer Leah Edelstein-Keshet N. MacDonald Douglas A. Dixon John Alfred Jacquez International Union of Forestry Research Organizations

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Organizations

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

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 modeling in biology a research methods approach is a textbook written primarily for advanced mathematics and science undergraduate students and graduate level biology students although the applications center on ecology the expertise of the authors the methodology can be imported to any other science including social science and economics the aim of the book beyond being a useful aid to teaching and learning the core modeling

skills needed for mathematical biology is to encourage students to think deeply and clearly about the meaning of mathematics in science and to learn significant research methods most importantly it is hoped that students will experience some of the excitement of doing research features minimal pre requisites beyond a solid background in calculus such as a calculus i course suitable for upper division mathematics and sciences students and graduate level biology students provides sample matlab codes and instruction in appendices along with datasets available on bit ly 3fclf3d

covering the major topics of evolutionary game theory game theoretical models in biology second edition presents both abstract and practical mathematical models of real biological situations it discusses the static aspects of game theory in a mathematically rigorous way that is appealing to mathematicians in addition the authors explore many applications of game theory to biology making the text useful to biologists as well the book describes a wide range of topics in evolutionary games including matrix games replicator dynamics the hawk dove game and the prisoner s dilemma it covers the evolutionarily stable strategy a key concept in biological games and offers in depth details of the mathematical models most chapters illustrate how to use python to solve various games important biological phenomena such as the sex ratio of so many species being close to a half the evolution of cooperative behaviour and the existence of adornments for example the peacock s tail have been explained using ideas underpinned by game theoretical modelling suitable for readers studying and working at the interface of mathematics and the life sciences this book shows how evolutionary game theory is used in the modelling of these diverse biological phenomena in this thoroughly revised new edition the authors have added three new chapters on the evolution of structured populations biological signalling games and a topical new chapter on evolutionary models of cancer there are also new sections on games with time constraints that convert simple games to potentially complex nonlinear ones new models on extortion strategies for the iterated prisoner s dilemma and on social dilemmas and on evolutionary models of vaccination a timely section given the current covid pandemic features presents a wide range of biological applications of game theory suitable for researchers and professionals in mathematical biology and the life sciences and as a text for postgraduate courses in mathematical biology provides numerous examples exercises and python code

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 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

dynamic systems biology modeling and simuation consolidates and unifies classical and contemporary multiscale methodologies for mathematical modeling and computer simulation of dynamic biological systems from molecular cellular organ system on up to population levels the book pedagogy is developed as a well annotated systematic tutorial with clearly spelled out and unified nomenclature derived from the author s own modeling efforts publications and teaching over half a century ambiguities in some concepts and tools are clarified and others are rendered more accessible and practical the latter include novel qualitative theory and methodologies for recognizing dynamical signatures in data using structural multicompartmental and network models and graph theory and analyzing structural and measurement data models for quantification feasibility the level is basic to intermediate with much emphasis on biomodeling from real biodata for use in real applications introductory coverage of core mathematical concepts such as linear and nonlinear differential and difference equations laplace transforms linear algebra probability statistics and stochastics topics the pertinent biology biochemistry biophysics or pharmacology for

modeling are provided to support understanding the amalgam of math modeling with life sciences strong emphasis on quantifying as well as building and analyzing biomodels includes methodology and computational tools for parameter identifiability and sensitivity analysis parameter estimation from real data model distinguishability and simplification and practical bioexperiment design and optimization companion website provides solutions and program code for examples and exercises using matlab simulink vissim simbiology saamii amigo copasi and sbml coded models a full set of powerpoint slides are available from the author for teaching from his textbook he uses them to teach a 10 week quarter upper division course at ucla which meets twice a week so there are 20 lectures they can easily be augmented or stretched for a 15 week semester course importantly the slides are editable so they can be readily adapted to a lecturer s personal style and course content needs the lectures are based on excerpts from 12 of the first 13 chapters of dsbms they are designed to highlight the key course material as a study guide and structure for students following the full text content the complete powerpoint slide package 25 mb can be obtained by instructors or prospective instructors by emailing the author directly at joed cs ucla edu

math and bio 2010 grew out of meeting the challenges education across the biological mathematical and computer sciences a joint project of the mathematical association of america maa the national science foundation division of undergraduate education nsf due the national institute of general medical sciences nigms the american association for the advancement of science aaas and the american society for microbiology asm foreword p vi

covering the major topics of evolutionary game theory game theoretical models in biology second edition presents both abstract and practical mathematical models of real biological situations it discusses the static aspects of game theory in a mathematically rigorous way that is appealing to mathematicians in addition the authors explore many applications of game theory to biology making the text useful to biologists as well the book describes a wide range of topics in evolutionary games including matrix games replicator dynamics the hawk dove game and the prisoner s dilemma it covers the evolutionarily stable strategy a key concept in biological games and offers in depth details of the mathematical models most chapters illustrate how to use python to solve various games important biological phenomena such as the sex ratio of so many species being close to a half the evolution of cooperative behaviour and the existence of adornments for example the peacock s tail have been explained using ideas underpinned by game theoretical modelling suitable for readers studying and working at the interface of mathematics and the life sciences this book shows how evolutionary game theory is used in the modelling of these diverse biological phenomena in this thoroughly revised new edition the authors have added three new chapters on the evolution of structured

populations biological signalling games and a topical new chapter on evolutionary models of cancer there are also new sections on games with time constraints that convert simple games to potentially complex nonlinear ones new models on extortion strategies for the iterated prisoner s dilemma and on social dilemmas and on evolutionary models of vaccination a timely section given the current covid pandemic features presents a wide range of biological applications of game theory suitable for researchers and professionals in mathematical biology and the life sciences and as a text for postgraduate courses in mathematical biology provides numerous examples exercises and python code

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drawing on the latest research in the field systems biology mathematical modeling and model analysis presents many methods for modeling and analyzing biological systems in particular cellular systems it shows how to use predictive mathematical models to acquire and analyze knowledge about cellular systems it also explores how the models are sy

contains topics including modelling the dynamics of signalling pathways modelling metabolic networks using power laws and s systems modelling reaction kinetics in cells the regulatory design of cellular processes metabolomics and fluxomics modelling cellular signalling systems and systems analysis of mapk signal transduction

the major aim of this book is to present instances of interaction between two major disciplines biology and mathematics the goal has been that of addressing a fairly wide audience biology students will find this text useful as a summary of modern mathematical methods currently

used in modelling and furthermore applied mathematics students may benefit from examples of applications of mathematics to real life problems as little background as possible has been assumed throughout the book prerequisites are basic calculus so that undergraduate students as well as beginning graduate students will find most of the material accessible

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