Modeling The Dynamics Of Life Calculus And Probability For Life Scientists With Ilrntm Testing Available Titles Cengagenow

Introduction to modeling and simulation - Models for dynamic systems and systems similarity - Modeling of engineering systems - Mechanical systems - Electrical systems - Fluid systems - Thermal systems - Mixed discipline systems - System dynamic response analysis - Frequency response - Time response and digital simulation - Engineering applications - System design and selection of components.

In the process of building and using models to comprehend the dynamics of the atmosphere, ocean and climate, the reader will learn how the different components of climate systems function, interact with each other, and vary over time. Topics include the stability of climate, Earths energy balance, parcel dynamics in the atmosphere, the mechanisms of heat transport in the climate system, and mechanisms of climate variability. Special attention is given to the effects of climate change.

Quantifying and Modeling Soil Structure Dynamics emphasizes a systems approach to how soil structure changes in response to inputs and to the environment. Soil structure is a dynamic, complex system affected by tillage, wheel traffic, roots, soil life, shrink–swell, and freeze–thaw. In turn, soil structure affects root growth and function, soil fauna, solute transport, water infiltration, gas exchange, thermal and electrical conductivities, traffic bearing capacity, and more. Ignoring soil structure or viewing it as "static" can lead to poor predictions and management. Readers will especially appreciate the description of soil structure influence on endpoints, such as environmental contamination and efficient water use, and how models should be adjusted to include dynamic soil structure components for accurate outputs.

Thirty years ago, biologists could get by with a rudimentary grasp of mathematics and modeling. Not so today. In seeking to answer fundamental questions about how biological systems function and change over time, the modern biologist is as likely to rely on sophisticated mathematical and computer-based models as traditional fieldwork. In this book, Sarah Otto and Troy Day provide biology students with the tools necessary to both interpret models and to build their own. The book starts at an elementary level of mathematical modeling, assuming that the reader has had high school mathematics and first-year calculus. Otto and Day then gradually build in depth and complexity, from classic models in ecology and evolution to more intricate class-structured and probabilistic models. The authors provide primers with instructive exercises to introduce readers to the more advanced subjects of linear algebra and probability theory. Through examples, they describe how models have been used to understand such topics as the spread of HIV, chaos, the age structure of a country, speciation, and extinction. Ecologists and evolutionary biologists today need enough mathematical training to be able to assess the power and limits of biological models and to develop theories and models themselves. This innovative book will be an indispensable guide to the world of mathematical models for the next generation of biologists. A how-to guide for developing new mathematical models in biology Provides step-by-step recipes for constructing and analyzing models Interesting biological applications Explores classical models in ecology and evolution Questions at the end of every chapter Primers cover important mathematical topics Exercises with answers Appendixes summarize useful rules Labs and advanced material available

This book explores the dynamic processes in economic systems, concentrating on the extraction and use of the natural resources required to meet economic needs. Sections cover methods for dynamic modeling in economics, microeconomic models of firms, modeling optimal use of both nonrenewable and renewable resources, and chaos in economic models. This book does not require a substantial background in mathematics or computer science.

An overview of current models of biological systems, reflecting the major advances that have been made over the past decade.

Modelling, Dynamics and Control of Electrified Vehicles provides a systematic overview of EV-related key components, including batteries, electric motors, ultracapacitors and system-level approaches, such as energy management systems, multi-source energy optimization, transmission design and control, braking system control and vehicle dynamics control. In addition, the book covers selected advanced topics, including Smart Grid and connected vehicles. This book shows how EV work, how to design them, how to save energy with them, and how to maintain their safety. The book aims to be an all-in-one reference for readers who are interested in EVs, or those trying to understand its state-of-the-art technologies and future trends. Offers a comprehensive knowledge of the multidisciplinary research related to EVs and a system-level understanding of technologies Provides the state-of-the-art technologies and future trends Covers the fundamentals of EVs and their methodologies Written by successful researchers that show the deep understanding of EVs

MODELING OF DYNAMIC SYSTEMS takes a unique, up-to-date approach to systems dynamics and related controls coverage for undergraduate students and practicing engineers. It focuses on the model development of engineering problems rather than response analysis and simulation once a model is available, though these are also covered. Linear graphing and bond graph approaches are both discussed, and computational tools are integrated thoughout. Electrical, mechanical, fluid, and thermal domains are covered, as are problems of multiple domains (mixed systems); the unified and integrated approaches taken are rapidly becoming the standard in the modeling of mechatronic engineering systems.

Suitable as a text for Chemical Process Dynamics or Introductory Chemical Process Control courses at the junior/senior level. This book aims to provide an introduction to the modeling, analysis, and simulation of the dynamic behavior of chemical processes.

Modeling Biomolecular Networks in Cells shows how the interaction between the molecular components of basic living organisms can be modelled mathematically and the models used to create artificial biological entities within cells. Such forward engineering is a difficult task but the nonlinear dynamical methods espoused in this book simplify the biology so that it can be successfully understood and the

synthesis of simple biological oscillators and rhythm-generators made feasible. Such simple units can then be co-ordinated using intercellular signal biomolecules. The formation of such man-made multicellular networks with a view to the production of biosensors, logic gates, new forms of integrated circuitry based on "gene-chips" and even biological computers is an important step in the design of faster and more flexible "electronics". The book also provides theoretical frameworks and tools with which to analyze the nonlinear dynamical phenomena which arise from the connection of building units in a biomolecular network.

What every neuroscientist should know about the mathematical modeling of excitable cells. Combining empirical physiology and nonlinear dynamics, this text provides an introduction to the simulation and modeling of dynamic phenomena in cell biology and neuroscience. It introduces mathematical modeling techniques alongside cellular electrophysiology. Topics include membrane transport and diffusion, the biophysics of excitable membranes, the gating of voltage and ligand-gated ion channels, intracellular calcium signalling, and electrical bursting in neurons and other excitable cell types. It introduces mathematical modeling techniques such as ordinary differential equations, phase plane, and bifurcation analysis of single-compartment neuron models. With analytical and computational problem sets, this book is suitable for life sciences majors, in biology to neuroscience, with one year of calculus, as well as graduate students looking for a primer on membrane excitability and calcium signalling.

The book uses STELLA software to develop simulation models, thus allowing readers to convert their understanding of a phenomenon to a computer model, and then run it to yield the inevitable dynamic consequences built into the structure. Part I provides an introduction to modeling dynamic systems, while Part II offers general modeling methods. Parts III through VIII then apply these methods to model real-world phenomena from chemistry, genetics, ecology, economics, and engineering. A clear, approachable introduction to the modeling process, of interest in any field where real problems can be illuminated by computer simulation.

This book develops the mathematical tools essential for students in the life sciences to describe interacting systems and predict their behavior. From predator-prey populations in an ecosystem, to hormone regulation within the body, the natural world abounds in dynamical systems that affect us profoundly. Complex feedback relations and counter-intuitive responses are common in nature; this book develops the quantitative skills needed to explore these interactions. Differential equations are the natural mathematical tool for quantifying change, and are the driving force throughout this book. The use of Euler's method makes nonlinear examples tractable and accessible to a broad spectrum of early-stage undergraduates, thus providing a practical alternative to the procedural approach of a traditional Calculus curriculum. Tools are developed within numerous, relevant examples, with an emphasis on the construction, evaluation, and interpretation of mathematical models throughout. Encountering these concepts in context, students learn not only quantitative techniques, but how to bridge between biological and mathematical ways of thinking. Examples range broadly, exploring the dynamics of neurons and the immune system, through to population dynamics and the Google PageRank algorithm. Each scenario relies only on an interest in the natural world; no biological expertise is assumed of student or instructor. Building on a single prerequisite of Precalculus, the book suits a two-quarter sequence for first or second year undergraduates, and meets the mathematical requirements of medical school entry. The later material provides opportunities for more advanced students in both mathematics and life sciences to revisit theoretical knowledge in a rich, real-world framework. In all cases, the focus is clear: how does the math help us understand the science?

Inspired by the leading authority in the field, the Centre for Process Systems Engineering at Imperial College London, this book includes theoretical developments, algorithms, methodologies and tools in process systems engineering and applications from the chemical, energy, molecular, biomedical and other areas. It spans a whole range of length scales seen in manufacturing industries, from molecular and nanoscale phenomena to enterprise-wide optimization and control. As such, this will appeal to a broad readership, since the topic applies not only to all technical processes but also due to the interdisciplinary expertise required to solve the challenge. The ultimate reference work for years to come.

A Comprehensive Physically Based Approach to Modeling in Bioengineering and Life Sciences provides a systematic methodology to the formulation of problems in biomedical engineering and the life sciences through the adoption of mathematical models based on physical principles, such as the conservation of mass, electric charge, momentum, and energy. It then teaches how to translate the mathematical formulation into a numerical algorithm that is implementable on a computer. The book employs computational models as synthesized tools for the investigation, quantification, verification, and comparison of different conjectures or scenarios of the behavior of a given compartment of the human body under physiological and pathological conditions. Presents theoretical (modeling), biological (experimental), and computational (simulation) perspectives Features examples, exercises, and MATLAB codes for further reader involvement Covers basic and advanced functional and computational techniques throughout the book

Modeling of Microscale Transport in Biological Processes provides a compendium of recent advances in theoretical and computational modeling of biotransport phenomena at the microscale. The simulation strategies presented range from molecular to continuum models and consider both numerical and exact solution method approaches to coupled systems of equations. The biological processes covered in this book include digestion, molecular transport, microbial swimming, cilia mediated flow, microscale heat transfer, micro-vascular flow, vesicle dynamics, transport through bio-films and bio-membranes, and microscale growth dynamics. The book is written for an advanced academic research audience in the fields of engineering (encompassing biomedical, chemical, biological, mechanical, and electrical), biology and mathematics. Although written for, and by, expert researchers, each chapter provides a strong introductory section to ensure accessibility to readers at all levels. Features recent developments in theoretical and computational modeling for clinical researchers and engineers Furthers researcher understanding of fluid flow in biological media and focuses on biofluidics at the microscale Includes chapters expertly authored by internationally recognized authorities in the fundamental and applied fields that are associated with microscale transport in living media

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; PLUS .... 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

Modeling is now one of the most efficient methodologies in life sciences. From practice to theory, this book develops this approach illustrated by many examples; general concepts and the current state of the art are also presented and discussed. An historical and general introduction informs the reader how mathematics and formal tools are used to solve biological problems at all levels of the organization of life. The core of this book explains how this is done, based on practical examples coming, for the most part, from the author's personal experience. In most cases, data are included so that the reader can follow the reasoning process and even reproduce calculus. The final chapter is devoted to essential concepts and current developments. The main mathematical tools are presented in an appendix to the book and are written in an adapted language readable by scientists, professionals or students, with a basic knowledge of mathematics.

At a time of unprecedented expansion in the life sciences, evolution is the one theory that transcends all of biology. Any observation of a living system must ultimately be interpreted in the context of its evolution. Evolutionary change is the consequence of mutation and natural selection, which are two concepts that can be described by mathematical equations. Evolutionary Dynamics is concerned with these equations of life. In this book, Martin A. Nowak draws on the languages of biology and mathematics to outline the mathematical principles according to which life evolves. His work introduces readers to the powerful yet simple laws that govern the evolution of living systems, no matter how complicated they might seem. Evolution has become a mathematical theory, Nowak suggests, and any idea of an evolutionary process or mechanism should be studied in the context of the mathematical equations of evolutionary dynamics. His book presents a range of analytical tools that can be used to this end: fitness landscapes, mutation matrices, genomic sequence space, random drift, quasispecies, replicators, the Prisoner's Dilemma, games in finite and infinite populations, evolutionary graph theory, games on grids, evolutionary kaleidoscopes, fractals, and spatial chaos. Nowak then shows how evolutionary dynamics applies to critical real-world problems, including the progression of viral diseases such as AIDS, the virulence of infectious agents, the unpredictable mutations that lead to cancer, the evolution of altruism, and even the evolution of human language. His book makes a clear and compelling case for understanding every living system—and everything that arises as a consequence of living systems—in terms of evolutionary dynamics.

This interdisciplinary volume features contributions from researchers in the fields of psychology, neuroscience, statistics, computer science, and physics. State-of-the-art techniques and applications used to analyze data obtained from studies in cognition, emotion, and electrophysiology are reviewed along with techniques for modeling in real time and for examining lifespan cognitive changes, for conceptualizing change using item response, nonparametric and hierarchical models, and control theory-inspired techniques for deriving diagnoses in medical and psychotherapeutic settings. The syntax for running the analyses presented in the book is provided on the Psychology Press site. Most of the programs are written in R while others are for Matlab, SAS, Win-BUGS, and DyFA. Readers will appreciate a review of the latest methodological techniques developed in the last few years. Highlights include an examination of: Statistical and mathematical modeling techniques for the analysis of brain imaging such as EEGs, fMRIs, and other neuroscience data Dynamic modeling techniques for intensive repeated measurement data Panel modeling techniques for fewer time points data State-space modeling techniques for psychological data Techniques used to analyze reaction time data. Each chapter features an introductory overview of the techniques needed to understand the chapter, a summary, and numerous examples. Each self-contained chapter can be read on its own and in any order. Divided into three major sections, the book examines techniques for examining within-person derivations in change patterns, intra-individual change, and inter-individual differences in change and interpersonal dynamics. Intended for advanced students and researchers, this book will appeal to those interested in applying state-of-the-art dynamic modeling techniques to the the study of neurological, developmental, cognitive, and social/personality psychology, as well as neuroscience, computer science, and engineering.

Designed to help life sciences students understand the role mathematics has played in breakthroughs in epidemiology, genetics, statistics, physiology, and other biological areas, this text provides students with a thorough grounding in mathematics, the language, and 'the technology of thought' with which these developments are created and controlled.

Designed to help life sciences students understand the role mathematics has played in breakthroughs in epidemiology, genetics, statistics, physiology, and other biological areas, MODELING THE DYNAMCICS OF LIFE: CALCULUS AND PROBABILTY FOR LIFE SCIENTISTS, Third Edition, provides students with a thorough grounding in mathematics, the language, and 'the technology of thought'

with which these developments are created and controlled. The text teaches the skills of describing a system, translating appropriate aspects into equations, and interpreting the results in terms of the original problem. The text helps unify biology by identifying dynamical principles that underlie a great diversity of biological processes. Standard topics from calculus courses are covered, with particular emphasis on those areas connected with modeling such as discrete-time dynamical systems, differential equations, and probability and statistics. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Mortality improvements, uncertainty in future mortality trends and the relevant impact on life annuities and pension plans constitute important topics in the field of actuarial mathematics and life insurance techniques. In particular, actuarial calculations concerning pensions, life annuities and other living benefits (provided, for example, by long-term care insurance products and whole life sickness covers) are based on survival probabilities which necessarily extend over a long time horizon. In order to avoid underestimation of the related liabilities, the insurance company (or the pension plan) must adopt an appropriate forecast of future mortality. Great attention is currently being devoted to the management of life annuity portfolios, both from a theoretical and a practical point of view, because of the growing importance of annuity benefits paid by private pension schemes. In particular, the progressive shift from defined benefit to defined contribution pension schemes has increased the interest in life annuities with a guaranteed annual amount. This book provides a comprehensive and detailed description of methods for projecting mortality, and an extensive introduction to some important issues concerning longevity risk in the area of life annuities and pension benefits. It relies on research work carried out by the authors, as well as on a wide teaching experience and in CPD (Continuing Professional Development) initiatives. The following topics are dealt with: life annuities in the framework of post-retirement income strategies; the basic mortality model; recent mortality trends that have been experienced; general features of projection models; discussion of stochastic projection models, with numerical illustrations; measuring and managing longevity risk.

This textbook is ideal for a course in engineering systems dynamics and controls. The work is a comprehensive treatment of the analysis of lumped parameter physical systems. Starting with a discussion of mathematical models in general, and ordinary differential equations, the book covers input/output and state space models, computer simulation and modeling methods and techniques in mechanical, electrical, thermal and fluid domains. Frequency domain methods, transfer functions and frequency response are covered in detail. The book concludes with a treatment of stability, feedback control (PID, lead-lag, root locus) and an introduction to discrete time systems. This new edition features many new and expanded sections on such topics as: solving stiff systems, operational amplifiers, electrohydraulic servovalves, using Matlab with transfer functions, using Matlab with frequency response, Matlab tutorial and an expanded Simulink tutorial. The work has 40% more end-of-chapter exercises and 30% more examples.

Model development is of vital importance for understanding and management of ecological processes. Identifying the complex relationships between ecological patterns and processes is a crucial task. Ecological modelling—both qualitatively and quantitatively—plays a vital role in analysing ecological phenomena and for ecological theory. This textbook provides a unique overview of modelling approaches. Representing the state-of-the-art in modern ecology, it shows how to construct and work with various different model types. It introduces the background of each approach and its application in ecology. Differential equations, matrix approaches, individual-based models and many other relevant modelling techniques are explained and demonstrated with their use. The authors provide links to software tools and course materials. With chapters written by leading specialists, "Modelling Complex Ecological Dynamics" is an essential contribution to expand the qualification of students, teachers and scientists alike.

Modeling the Dynamics of Life: Calculus and Probability for Life ScientistsCengage Learning

Using examples from finance and modern warfare to the flocking of birds and the swarming of bacteria, the collected research in this volume demonstrates the common methodological approaches and tools for modeling and simulating collective behavior. The topics presented point toward new and challenging frontiers of applied mathematics, making the volume a useful reference text for applied mathematicians, physicists, biologists, and economists involved in the modeling of socio-economic systems.

Dynamic Models in Biology offers an introduction to modern mathematical biology. This book provides a short introduction to modern mathematical methods in modeling dynamical phenomena and treats the broad topics of population dynamics, epidemiology, evolution, immunology, morphogenesis, and pattern formation. Primarily employing differential equations, the author presents accessible descriptions of difficult mathematical models. Recent mathematical results are included, but the author's presentation gives intuitive meaning to all the main formulae. Besides mathematicians who want to get acquainted with this relatively new field of applications, this book is useful for physicians, biologists, agricultural engineers, and environmentalists. Key Topics Include: Chaotic dynamics of populations The spread of sexually transmitted diseases Problems of the origin of life Models of immunology Formation of animal hide patterns The intuitive meaning of mathematical formulae explained with many figures Applying new mathematical results in modeling biological phenomena Miklos Farkas is a professor at Budapest University of Technology where he has researched and instructed mathematics for over thirty years. He has taught at universities in the former Soviet Union, Canada, Australia, Venezuela, Nigeria, India, and Columbia. Prof. Farkas received the 1999 Bolyai Award of the Hungarian Academy of Science and the 2001 Albert Szentgyorgyi Award of the Hungarian Ministry of Education. A 'down-to-earth' introduction to the growing field of modern mathematical biology Also includes appendices which provide background material that goes beyond advanced calculus and linear algebra

This book is published under a CC BY-NC 4.0 license. The editors present essential methods and tools to support a holistic approach to the challenge of system upgrades and innovation in the context of high-value products and services. The approach presented here is based on three main pillars: an adaptation mechanism based on a broad understanding of system dependencies; efficient use of system knowledge through involvement of actors throughout the process; and technological solutions to enable efficient actor communication and information handling. The book provides readers with a better understanding of the factors that influence decisions, and put forward solutions to facilitate the rapid adaptation to changes in the business environment and customer needs through intelligent upgrade interventions. Further, it examines a number of sample cases from various contexts including car manufacturing, utilities, shipping and the furniture industry. The book offers a valuable resource for both academics and practitioners interested in the upgrading of capital-intensive products and services. "The work performed in the project "Use-It-Wisely (UiW)" significantly contributes towards a collaborative way of working. Moreover, it offers comprehensive system modelling to identify business opportunities and develop technical solutions within industrial value networks. The developed UiW-framework fills a void and offers a great opportunity. The naval construction sector of small passenger vessels, for instance, is one industry that can benefit." Nikitas Nikitakos, Professor at University of the Aegean, Department of Shipping, Trade, and Transport, Greece. "Long-life assets are crucial for both the future competiveness and sustainability of society. Make wrong choices now and you are locked into a wrong system for a long time. Make the right choices now and society can prosper. This book gives important information about how manufacturers can make right choices." Arnold Tukker, Scientific director, Institute of Environmental Sciences (CML), Leiden University, and senior scientist, TNO.

This book is a "How To" guide for modeling population dynamics using Integral Projection Models (IPM) starting from observational data. It is written by a leading research team in this area and includes code in the R language (in the text and online) to carry out all computations. The intended audience are ecologists, evolutionary biologists, and mathematical biologists interested in developing data-driven models

for animal and plant populations. IPMs may seem hard as they involve integrals. The aim of this book is to demystify IPMs, so they become the model of choice for populations structured by size or other continuously varying traits. The book uses real examples of increasing complexity to show how the life-cycle of the study organism naturally leads to the appropriate statistical analysis, which leads directly to the IPM itself. A wide range of model types and analyses are presented, including model construction, computational methods, and the underlying theory, with the more technical material in Boxes and Appendices. Self-contained R code which replicates all of the figures and calculations within the text is available to readers on GitHub. Stephen P. Ellner is Horace White Professor of Ecology and Evolutionary Biology at Cornell University, USA; Dylan Z. Childs is Lecturer and NERC Postdoctoral Fellow in the Department of Animal and Plant Sciences at The University of Sheffield, UK; Mark Rees is Professor in the Department of Animal and Plant Sciences at The University of Sheffield, UK.

This book provides a systematic introduction to the fundamental methods and techniques and the frontiers of ? along with many new ideas and results on ? infectious disease modeling, parameter estimation and transmission dynamics. It provides complementary approaches, from deterministic to statistical to network modeling; and it seeks viewpoints of the same issues from different angles, from mathematical modeling to statistical analysis to computer simulations and finally to concrete applications.

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Today's leading authority on the subject of this text is the author, MIT Standish Professor of Management and Director of the System Dynamics Group, John D. Sterman. Sterman's objective is to explain, in a true textbook format, what system dynamics is, and how it can be successfully applied to solve business and organizational problems. System dynamics is both a currently utilized approach to organizational problem solving at the professional level, and a field of study in business, engineering, and social and physical sciences.

Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence, Second Edition, provides a synthesis of model-based approaches for analyzing presence-absence data, allowing for imperfect detection. Beginning from the relatively simple case of estimating the proportion of area or sampling units occupied at the time of surveying, the authors describe a wide variety of extensions that have been developed since the early 2000s. This provides an improved insight about species and community ecology, including, detection heterogeneity; correlated detections; spatial autocorrelation; multiple states or classes of occupancy; changes in occupancy over time; species co-occurrence; community-level modeling, and more. Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence, Second Edition has been greatly expanded and detail is provided regarding the estimation methods and examples of their application are given. Important study design recommendations are also covered to give a well rounded view of modeling. Provides authoritative insights into the latest in occupancy modeling Examines the latest methods in analyzing detection/no detection data surveys Addresses critical issues of imperfect detectability and its effects on species occurrence estimation Discusses important study design considerations such as defining sample units, sample size determination and optimal effort allocation

The result of lectures given by the authors at New York University, the University of Utah, and Michigan State University, the material is written for students who have had only one term of calculus, but it contains material that can be used in modeling courses in applied mathematics at all levels through early graduate courses. Numerous exercises are given as well as solutions to selected exercises, so as to lead readers to discover interesting extensions of that material. Throughout, illustrations depict physiological processes, population biology phenomena, corresponding models, and the results of computer simulations. Topics covered range from population phenomena to demographics, genetics, epidemics and dispersal; in physiological processes, including the circulation, gas exchange in the lungs, control of cell volume, the renal counter-current multiplier mechanism, and muscle mechanics; to mechanisms of neural control. Each chapter is graded in difficulty, so a reading of the first parts of each provides an elementary introduction to the processes and their models.