

**F. C. Hoppensteadt**

*Cambridge Studies in Mathematical Biology*

# **Mathematical methods of population biology**



# Mathematical Methods Of Population Biolo

**Byron K. Williams, James D.  
Nichols, Michael James Conroy, Michael  
J. Conroy**



## **Mathematical Methods Of Population Biolo:**

**Mathematical Methods of Population Biology** Frank Charles Hoppensteadt, 1982-02-26 An introduction to mathematical methods used in the study of population phenomena including models of total population and population age structure models of random population events presented in terms of Markov chains and methods used to uncover qualitative behavior of more complicated difference equations

**Mathematical Methods of Population Biology** William Brandon, 1976 [Introduction to Mathematical Methods in Population Theory](#) Jacek Banasiak, 2024-12-20 This textbook provides an introduction to the mathematical methods used to analyse deterministic models in life sciences including population dynamics epidemiology and ecology The book covers both discrete and continuous models The presentation emphasises the solvability of the equations appearing in the mathematical modelling of natural phenomena and in the absence of solutions the analysis of their relevant properties Of particular interest are methods that allow for determining the long term behaviour of solutions Thus the book covers a range of techniques from the classical Lyapunov theorems and positivity methods based on the Perron Frobenius theorem to the more modern monotone dynamical system approach The book offers a comprehensive presentation of the Lyapunov theory including the inverse Lyapunov theorems with applications to perturbed equations and Vidyasagar theorem Furthermore it provides a coherent presentation of the foundations of the theory of monotone dynamical systems with its applications to epidemiological models Another feature of the book is the derivation of the McKendrick von Foerster equation from the discrete Leslie model and the analysis of the long term behaviour of its solutions Designed for upper undergraduate courses and beyond this textbook is written for students and researchers looking to master the mathematics of the tools commonly used to analyse life science models It therefore goes somewhat deeper into mathematics than typical books at this level but should be accessible to anyone with a good command of calculus with elements of real and complex analysis and linear algebra the necessary concepts are collected in the appendices

*Statistical and Mathematical Methods in Population Dynamics* R. Cavalloro, 1984-06-01 Modelling and estimation of pest population Data collection and analysis in pest control Methods for pest control Pest management systems

*Advanced Mathematical Methods in Biosciences and Applications* Faina Berezovskaya, Bourama Toni, 2019-09-19 Featuring contributions from experts in mathematical biology and biomedical research this edited volume covers a diverse set of topics on mathematical methods and applications in the biosciences Topics focus on advanced mathematical methods with chapters on the mathematical analysis of the quasispecies model Arnold's weak resonance equation bifurcation analysis and the Tonnelier Gerstner model Special emphasis is placed on applications such as natural selection population heterogeneity polyvariant ontogeny in plants cancer dynamics and analytical solutions for traveling pulses and wave trains in neural models A survey on quasiperiodic topology is also presented in this book Carefully peer reviewed this volume is suitable for students interested in interdisciplinary research Researchers in applied mathematics and the biosciences will

find this book an important resource on the latest developments in the field In keeping with the STEAM H series the editors hope to inspire interdisciplinary understanding and collaboration

### **An Introduction to Structured Population**

**Dynamics** J. M. Cushing,1998-01-01 This monograph introduces the theory of structured population dynamics and its applications focusing on the asymptotic dynamics of deterministic models

### **Mathematical Methods in Medical and**

**Biological Sciences** Harendra Singh,Hari M Srivastava,2024-11-05 Mathematical Methods in Medical and Biological Sciences presents mathematical methods for computational models arising in the medical and biological sciences The book presents several real life medical and biological models such as infectious and non infectious diseases that can be modeled mathematically to accomplish profound research in virtual environments when the cost of laboratory expenses is relatively high It focuses on mathematical techniques that provide global solutions for models arising in medical and biological sciences by considering their long term benefits In addition the book provides leading edge developments and insights for a range of applications including epidemiological modeling of pandemic dynamics viral infection developments cancer developments blood oxygen dynamics HIV infection spread reaction diffusion models polio infection spread and chaos modeling with fractional order derivatives Presents the mathematical treatment of a wide range of real life medical and biological models including both infectious and non infectious diseases Provides in depth analysis of the spread of Covid 19 polio and HIV including discussion of computational methods and applications Includes computational modeling methods along with their practical applications providing the basis for further exploration and research in epidemiology and applied biomedical sciences

Integral Methods in Science and Engineering Barbara S Bertram,Christian Constanda,Allan A.

Struthers,2019-05-20 Based on proceedings of the International Conference on Integral Methods in Science and Engineering this collection of papers addresses the solution of mathematical problems by integral methods in conjunction with approximation schemes from various physical domains Topics and applications include wavelet expansions reaction diffusion systems variational methods fracture theory boundary value problems at resonance micromechanics fluid mechanics combustion problems nonlinear problems elasticity theory and plates and shells

### *Positive Dynamical Systems in Discrete*

*Time* Ulrich Krause,2015-11-27 This book provides a systematic rigorous and self contained treatment of positive dynamical systems A dynamical system is positive when all relevant variables of a system are nonnegative in a natural way This is in biology demography or economics where the levels of populations or prices of goods are positive The principle also finds application in electrical engineering physics and computer sciences The author has greatly expanded the field of positive systems in surprising ways Prof Dr David G Luenberger Stanford University USA

### **Mathematical Modeling**

Ellis Cumberbatch,Alistair Fitt,2001-10 This volume presents thirteen different case studies ranging from cooking of cereal to the analysis of epidemic waves in animal populations

Quantitative Ecological Theory M.R. Rose,2012-12-06 This is an

inadvertent book though it did arise naturally enough from a course I give in theoretical ecology But I wouldn't have given

the course at all if one colleague in my department hadn't left for a leave of absence while another abruptly resigned. This propelled me to the fore where this teaching responsibility was concerned. One I had never had any intention of discharging. Then it turned out that one of my students was regularly unable to make half the classes. As a result I began giving him my lecture notes each week. As I knew that someone else would be reading them I began to write my notes more carefully. Naturally enough the other students soon began to demand the notes too. Eventually they were indulged. Thus I found myself writing a textbook manuscript. By the next year the students were handed all their notes in one package at the outset. But these were still just hand written. Inevitably the demand that they be typed arose. This I didn't want to do until I found a publisher. As it turned out Tim Hardwick of Croom Helm was willing to have his firm fill this role to my great satisfaction and his considerable frustration. I have been a desultory author about producing this final text and can only express my gratitude for his enduring patience over more than 18 months of delays.

Biological Invasions: Theory and Practice Nanako Shigesada, Kohkichi Kawasaki, 1997-02-06 This book deals with the ecological effect a species can have when it moves into an environment that it has not previously occupied commonly referred to as an Invasion. It is unique in presenting a clear and accessible introduction to a highly complex area the modelling of biological invasions. The book presents the latest theories and models developed from studies into this crucial area. It includes data and examples from biological case studies showing how the models can be applied to the study of invasions whether dealing with AIDS the European rabbit or prickly pear cactuses. In nature all organisms migrate or disperse to some extent either by walking swimming flying or being transported by wind or water. When a species succeeds in colonising an area that it has not previously inhabited this is referred to as an invasion. Humans can precipitate biological invasions often spreading disease or pests by their travels around the world. Using the large amount of data that has been collected from studies worldwide ranging from pest control to epidemiology it has been possible to construct mathematical models that can predict which species will become an invader what kind of habitat is susceptible to invasion by a particular species and how fast an invasion will spread if it occurs. This book presents a clear and accessible introduction to this highly complex area. Included are data and examples from biological case studies showing how these models can be applied to the study of invasions whether dealing with AIDS the European rabbit or prickly pear cactuses.

**Population Ecology** Michael Begon, Martin Mortimer, David J. Thompson, 2009-07-15 Worldwide Population Ecology is the leading textbook on this titled subject. Written primarily for students it describes the present state of population ecology in terms that can be readily understood by undergraduates with little or no background in the subject. Carefully chosen experimental examples illustrate each topic and studies of plants and animals are combined to show how fundamental principles can be derived that apply to both species. Use of complex mathematics is avoided throughout the book and what math is necessary is dealt with by examination of real experimental data rather than dull theory. The latest edition of this leading textbook. Adopted as an Open University set text.

*Hyperbolic Partial Differential Equations* Matthew

Witten,2014-05-17 *Hyperbolic Partial Differential Equations Volume 1 Population Reactors Tides and Waves Theory and Applications* covers three general areas of hyperbolic partial differential equation applications These areas include problems related to the McKendrick Von Foerster population equations other hyperbolic form equations and the numerical solution This text is composed of 15 chapters and begins with surveys of age specific population interactions populations models of diffusion nonlinear age dependent population growth with harvesting local and global stability for the nonlinear renewal equation in the Von Foerster model and nonlinear age dependent population dynamics The next chapters deal with various applications of hyperbolic partial differential equations to such areas as age structured fish populations density dependent growth in a cell colony boll weevil cotton crop modeling age dependent predation and cannibalism parasite populations growth of microorganisms and stochastic perturbations in the Von Foerster model These topics are followed by discussions of bifurcation of time periodic solutions of the McKendrick equation the periodic solution of nonlinear hyperbolic problems and semigroup theory as applied to nonlinear age dependent population dynamics Other chapters explore the stability of biochemical reaction tanks an ADI model for the Laplace tidal equations the Carleman equation the nonequilibrium behavior of solids that transport heat by second sound and the nonlinear hyperbolic partial differential equations and dynamic programming The final chapters highlight two explicitly numerical applications a predictor convex corrector method and the Galerkin approximation in hyperbolic partial differential equations This book will prove useful to practicing engineers population researchers physicists and mathematicians      Mathematical Methods for Engineering Applications Deolinda M. L. D. Rasteiro,Fatih Yilmaz,Araceli Queiruga-Dios,Jesús Martín Vaquero,Ion Mierlus Mazilu,2025-08-02 This proceedings volume compiles papers presented at the 5th International Conference on Mathematics and its Applications in Science and Engineering ICMASE 2024 held on September 16 18 2024 by the Polytechnic Institute of Coimbra Portugal The ICMASE 2024 was a hybrid conference featuring both in person and virtual attendance The works in this volume explore recent developments in the application of mathematics to science and engineering focusing on mathematical and computational modeling of real world problems Topics include algebra and number theory analysis geometry statistics computational and discrete mathematics as well as their intersections with engineering applications Additionally educational aspects of mathematics in engineering fields are addressed This volume is intended for researchers practitioners and graduate students particularly those interested in advanced methods for applying mathematics across various contexts and fields      *Catalog of Copyright Entries. Third Series* Library of Congress. Copyright Office,1979      Historically Black Colleges and Universities Fact Book: Public colleges ,1983      **Modeling and Simulation in Medicine and the Life Sciences** Frank C. Hoppensteadt,Charles S. Peskin,2012-12-06 *Mathematics in Medicine and the Life Sciences* grew from 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 but 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 and solutions to selected exercises are included Numerous illustrations depict physiological processes population biology phenomena models of them and the results of computer simulations Mathematical models and methods are becoming increasingly important in medicine and the life sciences This book provides an introduction to a wide diversity of problems ranging 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 Materials that deal with the same topics but in greater depth are included later Finally exercises and some solutions are given to test the reader on important parts of the material in the text or to lead the reader to the discovery of interesting extensions of that material

**Analysis and Management of Animal Populations** Byron K. Williams, James D. Nichols, Michael James Conroy, Michael J. Conroy, 2002-04-17 Analysis and Management of Animal Populations deals with the processes involved in making informed decisions about the management of animal populations It covers the modeling of population responses to management actions the estimation of quantities needed in the modeling effort and the application of these estimates and models to the development of sound management decisions The book synthesizes and integrates in a single volume the methods associated with these themes as they apply to ecological assessment and conservation of animal populations Integrates population modeling parameter estimation and decision theoretic approaches to management in a single cohesive framework Provides authoritative state of the art descriptions of quantitative approaches to modeling estimation and decision making Emphasizes the role of mathematical modeling in the conduct of science and management Utilizes a unifying biological context consistent mathematical notation and numerous biological examples

**Evolutionary Ecology of Plant-Plant Interactions** Christian Damgaard, 2005-06-01 Concepts and simple empirical models that are useful in the study of the quantitative aspects of evolutionary ecology of plant plant interactions is discussed and developed and the use of simple empirical models in the statistical analysis of plant ecological data is exemplified Special attention is paid to the consequences of the sedentary life form of adult plants and the subsequent strong interactions between neighbouring plants The monograph provides an overview of different evolutionary and ecological empirical plant population models and conceptual links between different modelling approaches e g spatial individual based or plant size explicit modelling and the equilibrium conditions of mean field models The biological information underlying the discussed models is only briefly discussed Christian Damgaard is Senior Scientist at the Department of Terrestrial Ecology the National Environmental Research Institute

## The Enigmatic Realm of **Mathematical Methods Of Population Biolo**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing lacking extraordinary. Within the captivating pages of **Mathematical Methods Of Population Biolo** a literary masterpiece penned by a renowned author, readers set about a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book is core themes, assess its distinct writing style, and delve into its lasting effect on the hearts and minds of those who partake in its reading experience.

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