Relaxation Oscillations in Mathematical Models of Ecology

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Subbarao Varigonda

Relaxation Oscillations In Mathematical Models Of Ecology:

Relaxation Oscillations in Mathematical Models of Ecology A. I︠U︡ Kolesov,I︠U︡riĭ Serafimovich Kolesov,1995 This book presents for the first time a systematic exposition of techniques for constructing relaxation oscillations and methods for investigating stability properties of certain classes of systems with delay The authors bring out some of the distinctive features that have no analogues in relaxation systems of ordinary differential equations The exposition provides analysis of significant examples from biophysics mathematical ecology and quantum physics that elucidate important patterns Many unsolved problems are posed The book would appeal to researchers and specialists interested in the theory and applications of relaxation oscillations   **Relaxation Oscillations in Mathematical Models of Ecology** A. Yu Kolesov,Yu. S. Kolesov,1995   **Multiple Time Scale Dynamics** Christian Kuehn,2015-02-25 This book provides an introduction to dynamical systems with multiple time scales The approach it takes is to provide an overview of key areas particularly topics that are less available in the introductory form The broad range of topics included makes it accessible for students and researchers new to the field to gain a quick and thorough overview The first of its kind this book merges a wide variety of different mathematical techniques into a more unified framework The book is highly illustrated with many examples and exercises and an extensive bibliography The target audience of this book are senior undergraduates graduate students as well as researchers interested in using the multiple time scale dynamics theory in nonlinear science either from a theoretical or a mathematical modeling perspective   **Asymptotic Representation of Relaxation Oscillations in Lasers** Elena V. Grigorieva,Sergey A. Kaschenko,2016-11-09 In this book we analyze relaxation oscillations in models of lasers with nonlinear elements controlling light dynamics The models are based on rate equations taking into account periodic modulation of parameters optoelectronic delayed feedback mutual coupling between lasers intermodal interaction and other factors With the aim to study relaxation oscillations we present the special asymptotic method of integration for ordinary differential equations and differential difference equations As a result they are reduced to discrete maps Analyzing the maps we describe analytically such nonlinear phenomena in lasers as multistability of large amplitude relaxation cycles bifurcations of cycles controlled switching of regimes phase synchronization in an ensemble of coupled systems and others The book can be fruitful for students and technicians in nonlinear laser dynamics and in differential equations   **Asymptotic Methods for Relaxation Oscillations and Applications** Johan Grasman,2012-12-06 In various fields of science notably in physics and biology one is con fronted with periodic phenomena having a remarkable temporal structure it is as if certain systems are periodically reset in an initial state A paper of Van der Pol in the Philosophical Magazine of 1926 started up the investigation of this highly nonlinear type of oscillation for which Van der Pol coined the name relaxation oscillation The study of relaxation oscillations requires a mathematical analysis which differs strongly from the well known theory of almost linear oscillations In this monograph the method of matched asymptotic expansions is employed to approximate the periodic orbit of a

relaxation oscillator As an introduction in chapter 2 the asymptotic analysis of Van der Pol s equation is carried out in all detail The problem exhibits all features characteristic for a relaxation oscillation From this case study one may learn how to handle other or more generally formulated relaxation oscillations In the survey special attention is given to biological and chemical relaxation oscillators In chapter 2 a general definition of a relaxation oscillation is formulated *Some Questions in the Theory of Oscillations and the Theory of Optimal Control* R. V. Gamkrelidze,1993 This book contains two fundamental papers The first is in essence a short monograph devoted to the theory of periodic motions in singularly perturbed systems The second deals with structural properties of the solutions of a system having infinitely many switchings on a finite time interval to Hamiltonian systems with discontinuous right hand side Analysis and Optimality of Oscillations Subbarao Varigonda,2001 Stability and Complexity in Model Ecosystems ,2001-03-18 What makes populations stabilize What makes them fluctuate Are populations in complex ecosystems more stable than populations in simple ecosystems In 1973 Robert May addressed these questions in this classic book May investigated the mathematical roots of population dynamics and argued counter to most current biological thinking that complex ecosystems in themselves do not lead to population stability Stability and Complexity in Model Ecosystems played a key role in introducing nonlinear mathematical models and the study of deterministic chaos into ecology a role chronicled in James Gleick s book Chaos In the quarter century since its first publication the book s message has grown in power Nonlinear models are now at the center of ecological thinking and current threats to biodiversity have made questions about the role of ecosystem complexity more crucial than ever In a new introduction the author addresses some of the changes that have swept biology and the biological world since the book s first publication Mathematical Reviews ,1996 **Advances in Mathematical and Computational Modeling of Engineering Systems** Mukesh Kumar Awasthi,Maitri Verma,Mangey Ram,2023-02-20 The text covers a wide range of topics such as mathematical modeling of crop pest control management water resources management impact of anthropogenic activities on atmospheric carbon dioxide concentrations impact of climate changes on melting of glaciers and polar bear populations dynamics of slow fast predator prey system and spread and control of HIV epidemic It emphasizes the use of mathematical modeling to investigate the fluid flow problems including the breaking of viscoelastic jet instability arising in nanofiber flow in an annulus channel and thermal instability in nano fluids in a comprehensive manner This book will be a readily accessible source of information for the students researchers and policymakers interested in the application of mathematical and computational modeling techniques to investigate various biological and engineering phenomena Features Focuses on the current modeling and computational trends to investigate various ecological epidemiological and engineering systems Presents the mathematical modeling of a wide range of ecological and environmental issues including crop pest control management water resources management the effect of anthropogenic activities on atmospheric carbon dioxide concentrations and impact of climate changes on melting of glaciers and polar bear population Covers a wide range of topics

including the breaking of viscoelastic jet instability arising in nanofiber flow in an annulus channel and thermal instability in nano fluids Examines evolutionary models i e models of time varying processes Highlights the recent developments in the analytical methods to investigate the nonlinear dynamical systems Showcases diversified applications of computational techniques to solve practical biological and engineering problems The book focuses on the recent research developments in the mathematical modeling and scientific computing of biological and engineering systems It will serve as an ideal reference text for senior undergraduate graduate students and researchers in diverse fields including ecological engineering environmental engineering computer engineering mechanical engineering mathematics and fluid dynamics *Stability and Complexity in Model Ecosystems* Robert M May,2019-12-31 What makes populations stabilize What makes them fluctuate Are populations in complex ecosystems more stable than populations in simple ecosystems In 1973 Robert May addressed these questions in this classic book May investigated the mathematical roots of population dynamics and argued counter to most current biological thinking that complex ecosystems in themselves do not lead to population stability Stability and Complexity in Model Ecosystems played a key role in introducing nonlinear mathematical models and the study of deterministic chaos into ecology a role chronicled in James Gleick s book Chaos In the quarter century since its first publication the book s message has grown in power Nonlinear models are now at the center of ecological thinking and current threats to biodiversity have made questions about the role of ecosystem complexity more crucial than ever In a new introduction the author addresses some of the changes that have swept biology and the biological world since the book s first publication **Dynamical Systems and Related Topics** Evgeniĭ Frolovich Mishchenko,1997 **Bursting** Stephen Coombes,Paul C. Bressloff,2005 Neurons in the brain communicate with each other by transmitting sequences of electrical spikes or action potentials One of the major challenges in neuroscience is to understand the basic physiological mechanisms underlying the complex spatiotemporal patterns of spiking activity observed during normal brain functioning and to determine the origins of pathological dynamical states such as epileptic seizures and Parkinsonian tremors A second major challenge is to understand how the patterns of spiking activity provide a substrate for the encoding and transmission of information that is how do neurons compute with spikes It is likely that an important element of both the dynamical and computational properties of neurons is that they can exhibit bursting which is a relatively slow rhythmic alternation between an active phase of rapid spiking and a quiescent phase without spiking This book provides a detailed overview of the current state of the art in the mathematical and computational modelling of bursting with contributions from many of the leading researchers in the field Diffusion and Ecological Problems: Modern Perspectives Akira Okubo,Smon A. Levin,2013-04-17 Surveying a wide variety of mathematical models of diffusion in the ecological context this book is written with the primary intent of providing scientists particularly physicists but also biologists with some background of the mathematics and physics of diffusion and how they can be applied to ecological problems Equally this is a specialized text book for graduates

interested in mathematical ecology assuming no more than a basic knowledge of probability and differential equations Each chapter in this new edition has been substantially updated by appopriate leading researchers in the field and contains much new material covering recent developments *Insect Ecology* Peter W. Price,1997-08-12 Insect Ecology is the world s foremost reference to the never ending and crucial interactions of the richest taxon of organisms on this earth with perhaps some 8 million extant species Now in its Third Edition and twentieth year of publication Insect Ecology has endured as an unparalleled classic Taking the reader from an explanation of the science to its significance as a discipline Insect Ecology is a meticulous systematic examination of the underlying dynamics of plant insect interactions predation parasites and hosts and mutualistic relationships including pollination ecology that are central to understanding the insects role in nature Viewing the largely invisible drama of natural protagonists and antagonists hidden in the lush foliage of a tropical rain forest or temperate woody vegetation Peter Price details the unique traits behaviors and functions of insects while placing them in the broader contexts of their places in food webs ecosystem function population dynamics and community interactions The author also describes the various levels of insect interaction from trophic relationships Part II populations Part III and communities Part IV while unfolding the infinite variety of insect species and their visible legacy in the fossil record Full of fascinating details Ants are everywhere but only occasionally noticed They run much of the terrestrial world as the premier soil turners Insect galls provide tanning acids and the basis for inks Insect Ecology offers detail and breadth while providing timely discussion on the conservation of biodiversity the existence and study of vacant ecological niches latitudinal gradients in species richness and evolutionary perspectives on population dynamics The book also examines the development of theory in insect ecology and how it is advanced Novel features in the Third Edition include four new chapters covering the importance of insect ecology the development of theory in the science hypotheses on plant and herbivore interactions and a synthesis chapter on population dynamics Subheadings within chapters provide easier subject access and many new figures contribute to the book s aesthetic appeal Clearly organized and with a bibliography of 2 000 references to up to date and classic literature the Third Edition of Insect Ecology is a practical well formatted resource Also copiously illustrated with over 350 figures many new to this edition Insect Ecology is a lush graphic tour of the minute often startling universe of insects in their native habitat With a history in geologic time much older than the terrestrial vertebrates insects speak to us the scarab beetle encased in amber or New Zealand s endangered large Wellington speargrass weevil of a resilience and ingenuity oddly reflective of our own Insect Ecology has let generations of agriculturalists ecologists entomologists environmental scientists foresters professionals and students understand the insects world and ours With unerring detail and breadth Insect Ecology has described for generations of professionals the interactions and dynamics of the world s richest group of species the insects whose wildly various 8 million forms have been the source of endless fascination and study From caterpillars to the goliath beetle from the adult copper butterfly to the agromyzid fly the insect universe is at once ordinary and exotic

capturing in microcosm nature s complexity and beauty **U.S. Government Research Reports** ,1964 **Chaos in Hydrology** Bellie Sivakumar,2016-11-16 This authoritative book presents a comprehensive account of the essential roles of nonlinear dynamic and chaos theories in understanding modeling and forecasting hydrologic systems This is done through a systematic presentation of 1 information on the salient characteristics of hydrologic systems and on the existing theories for their modeling 2 the fundamentals of nonlinear dynamic and chaos theories methods for chaos identification and prediction and associated issues 3 a review of the applications of chaos theory in hydrology and 4 the scope and potential directions for the future This book bridges the divide between the deterministic and the stochastic schools in hydrology and is well suited as a textbook for hydrology courses Asymptotic Analysis II F. Verhulst,2006-11-15 *Functional Differential Equations* ,1997 Scientific and Technical Aerospace Reports ,1991

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