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Multiple-Time-Scale Dynamical Systems

Multiple Time Scale Dynamical Systems

Jeremiah U. Brackbill,Bruce Ira Cohen

Multiple Time Scale Dynamical Systems:

   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

   Multiple-Time-Scale Dynamical Systems Christopher K.R.T. Jones,Alexander I. Khibnik,2012-12-06 Systems with sub processes evolving on many different time scales are ubiquitous in applications chemical reactions electro optical and neuro biological systems to name just a few This volume contains papers that expose the state of the art in mathematical techniques for analyzing such systems Recently developed geometric ideas are highlighted in this work that includes a theory of relaxation oscillation phenomena in higher dimensional phase spaces Subtle exponentially small effects result from singular perturbations implicit in certain multiple time scale systems Their role in the slow motion of fronts bifurcations and jumping between invariant tori are all explored here Neurobiology has played a particularly stimulating role in the development of these techniques and one paper is directed specifically at applying geometric singular perturbation theory to reveal the synchrony in networks of neural oscillators   Nonlinear Dynamics and Chaos J Hogan,A.R Krauskopf,Mario di Bernado,R. Eddie Wilson,Hinke. M Osinga,Martin. E Homer,Alan. R Champneys,2002-08-01 Nonlinear dynamics has been successful in explaining complicated phenomena in well defined low dimensional systems Now it is time to focus on real life problems that are high dimensional or ill defined for example due to delay spatial extent stochasticity or the limited nature of available data How can one understand the dynamics of such sys   *Control and Dynamic Systems V30: Advances in Algorithms and Computational Techniques in Dynamic System Control Part 3 of 3* C.T. Leonides,2012-12-02 Control and Dynamic Systems Advances in Theory in Applications Volume 30 Advances in Algorithms and Computational Techniques in Dynamic Systems Control Part 3 of 3 discusses developments in algorithms and computational techniques for control and dynamic systems This volume begins with the issue of decision making or optimal control in the natural environment It then discusses large scale systems composed of multiple sensors algorithms for systems with multiplicative noise stochastic differential games Markovian targets low cost microcomputer and true digital control systems and algorithms for the design of teleoperated systems This book is an important reference for practitioners in the field who want a comprehensive source of techniques with significant applied implications   *Studies of Multiple-time-scale Phenomena in Control Systems* Shahram Mojaddad-Shahruz,1988   *Control and Dynamic Systems V27* C.T. Leonides,2012-12-02 Control and Dynamic Systems

Advances in Theory and Application Volume 27 System Identification and Adaptive Control Part 3 of 3 deals with system parameter identification and adaptive control It presents useful techniques for adaptive control systems This volume begins by presenting a powerful approach to multivariable model reference adaptive control based on the ideas and techniques of disturbance accommodating control theory It then discusses the modeling of biological systems optimal control for air conditioning systems linear programming for constrained multivariable process control finite element approximation development of irreducible state space singular systems and discrete systems with multiple time scales This book is an important reference for practitioners in the field who want a comprehensive source of techniques with significant applied implications **Dislocations in Solids** ,2007-05-16 Dislocations are lines of irregularity in the structure of a solid analogous to the bumps in a badly laid carpet Like these bumps they can be easily moved and they provide the most important mechanism by which the solid can be deformed They also have a strong influence on crystal growth and on the electronic properties of semiconductors Influence of dislocations on piezoelectric behavior New mechanisms for hardening in twinned crystals Bringing theories of martensite transformation into agreement Atomic scale motion of dislocations in electron microscopy Dislocation patterns deduced from X ray diffraction Role of dislocations in friction Dislocation motion in quasicrystals *Nonlinear Time Scale Systems in Standard and Nonstandard Forms* Anshu Narang-Siddarth,John Valasek,2014-04-22 This book introduces key concepts for systematically controlling engineering systems that possess interacting phenomena occurring at widely different speeds The aim is to present the reader with control techniques that extend the benefits of model reduction of singular perturbation theory to a larger class of nonlinear dynamical systems New results and relevant background are presented through insightful examples that cover a wide range of applications from different branches of engineering This book is unique because it presents a new perspective on existing control methods and thus broadens their application to a larger class of nonlinear dynamical systems It also discusses general rather than problem specific developments to certain applications or disciplines in order to provide control engineers with useful analytical tools and it addresses new control problems using singular perturbation methods including closed form results for control of nonminimum phase systems *Control and dynamic systems* C... T. Leondes,1988 Geometric Singular Perturbation Theory Beyond the Standard Form Martin Wechselberger,2020-02-21 This volume provides a comprehensive review of multiple scale dynamical systems Mathematical models of such multiple scale systems are considered singular perturbation problems and this volume focuses on the geometric approach known as Geometric Singular Perturbation Theory GSPT It is the first of its kind that introduces the GSPT in a coordinate independent manner This is motivated by specific examples of biochemical reaction networks electronic circuit and mechanic oscillator models and advection reaction diffusion models all with an inherent non uniform scale splitting which identifies these examples as singular perturbation problems beyond the standard form The contents cover a general framework for this GSPT beyond the standard form including canard theory

concrete applications and instructive qualitative models It contains many illustrations and key pointers to the existing literature The target audience are senior undergraduates graduate students and researchers interested in using the GSPT toolbox in nonlinear science either from a theoretical or an application point of view Martin Wechselberger is Professor at the School of Mathematics Statistics University of Sydney Australia He received the J D Crawford Prize in 2017 by the Society for Industrial and Applied Mathematics SIAM for achievements in the field of dynamical systems with multiple time scales   Improving Design Assessment and Simulation of Large-scale Dynamic Systems Tong Zhou,1988   Discrete and Continuous Dynamical Systems ,2004   **Multiple Time Scales** Jeremiah U. Brackbill,Bruce Ira Cohen,1985   **Multiple Time Scale Dynamics with Two Fast Variables and One Slow Variable** Christian Kuehn,2010 This thesis considers dynamical systems that have multiple time scales The focus lies on systems with two fast variables and one slow variable The twoparameter bifurcation structure of the FitzHugh Nagumo FHN equation is analyzed in detail A singular bifurcation diagram is constructed and invariant manifolds of the problem are computed A boundary value approach to compute slow manifolds of saddle type is developed Interactions of classical invariant manifolds and slow manifolds explain the exponentially small turning of a homoclinic bifurcation curve in parameter space Mixed mode oscillations and maximal canards are detected in the FHN equation An asymptotic formula to find maximal canards is proved which is based on the first Lyapunov coefficient at a singular Hopf bifurcation   **Stability of Power Systems Coupled with Market Dynamics** Jianping Meng,2001   *A Bridge Between Control Science and Technology: Large-scale systems, decision-making, mathematics of control* International Federation of Automatic Control. World Congress,1985   Large Scale Systems ,1983   **Proceedings of the 21st IEEE Conference on Decision & Control, December 8-10, 1982, Holiday Inn-International Drive, Orlando, Florida** ,1982   Proceedings of the ... American Control Conference ,1988   **Mathematical Reviews** ,2003

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