

# Dynamics of Cyclic Feedback Systems

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July 7, 1994

## Abstract

The dynamics of cyclic feedback systems are described. The emphasis is both in showing the diversity of possible dynamics in these systems and in showing that there is a underlying dynamic structure possessed by all these systems. In particular, for the special class of monotone cyclic feedback systems, the dynamics is fairly simple; the recurrent sets can only consist of fixed points or periodic orbits and in many cases can be shown to be Morse-Smale. This is contrasted with the general cyclic feedback systems for which chaotic dynamics can occur.

The general properties which large subclasses of these systems have in common include periodic orbits and a semi-conjugacy onto a simple,

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†Research was supported in part by NSF Grant DMS-9101412. Part of this paper was written while the author was visiting the Instituto de Ciências Matemáticas de São Carlo of the Universidade de São Paulo. He would like to take this opportunity to thank the members of the institute for their warm hospitality.

# Cyclic Feedback Systems

**Lauren Gardner**



## **Cyclic Feedback Systems:**

**Cyclic Feedback Systems** Tomáš Gedeon, 1998 Explores the global dynamics of a class of ordinary differential equations called cyclic feedback systems The global dynamics is described by a Morse decomposition of the global attractor defined with the help of a discrete Lyapunov function A three dimensional system of ODEs with two linear equations is constructed such that the invariant set is at least as complicated as a suspension of a full shift on two symbols No index Annotation copyrighted by Book News Inc Portland OR

**Integer-Valued Lyapunov Function and Its Application to Monotone Cyclic Feedback Systems** Ligen Tian, 2011

**The Poincaré-Bendixson Theorem for Monotone Cyclic Feedback Systems with Delay** John Mallet-Paret, George R. Sell, Lefschetz Center for Dynamical Systems, Brown University. Center for Control Sciences, Brown University. Division of Applied Mathematics, 1994

*The Control Systems Handbook* William S. Levine, 2018-10-03 At publication The Control Handbook immediately became the definitive resource that engineers working with modern control systems required Among its many accolades that first edition was cited by the AAP as the Best Engineering Handbook of 1996 Now 15 years later William Levine has once again compiled the most comprehensive and authoritative resource on control engineering He has fully reorganized the text to reflect the technical advances achieved since the last edition and has expanded its contents to include the multidisciplinary perspective that is making control engineering a critical component in so many fields Now expanded from one to three volumes The Control Handbook Second Edition organizes cutting edge contributions from more than 200 leading experts The third volume Control System Advanced Methods includes design and analysis methods for MIMO linear and LTI systems Kalman filters and observers hybrid systems and nonlinear systems It also covers advanced considerations regarding Stability Adaptive controls System identification Stochastic control Control of distributed parameter systems Networks and networked controls As with the first edition the new edition not only stands as a record of accomplishment in control engineering but provides researchers with the means to make further advances Progressively organized the first two volumes in the set include Control System Fundamentals Control System Applications

Time Delay Systems Tamás Insperger, Tulga Ersal, Gábor Orosz, 2017-03-30 This volume collects contributions related to selected presentations from the 12th IFAC Workshop on Time Delay Systems Ann Arbor June 28 30 2015 The included papers present novel techniques and new results of delayed dynamical systems The topical spectrum covers control theory numerical analysis engineering and biological applications as well as experiments and case studies The target audience primarily comprises research experts in the field of time delay systems but the book may also be beneficial for graduate students alike

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Differential Equations And Applications To Biology And To Industry - Proceedings Of The Claremont International Conference Dedicated To The Memory Of Stavros Busenberg (1941 - 1993) Kenneth Cooke, Ellis Cumberbatch, Mario Martelli, Betty Tang, Horst Thieme, 1995-12-08 This volume is dedicated to the memory of Professor Stavros Busenberg of Harvey Mudd College who contributed so greatly to this field during 25 years prior to his untimely death It contains about 60 invited papers by leading researchers in the areas of dynamical systems mathematical studies in ecology epidemics and physiology and industrial mathematics Anyone interested in these areas will find much of value in these contributions

**An Introduction to Delay Differential Equations with Applications to the Life Sciences** hal smith, 2010-09-29 This book is intended to be an introduction to Delay Differential Equations for upper level undergraduates or beginning graduate mathematics students who have a reasonable background in ordinary differential equations and who would like to get to the applications quickly The author has used preliminary notes in teaching such a course at Arizona State University over the past two years This book focuses on the key tools necessary to understand the applications literature involving delay equations and to construct and analyze mathematical models involving delay differential equations The book begins with a survey of mathematical models involving delay equations

**A Systems Theoretic Approach to Systems and Synthetic Biology II: Analysis and Design of Cellular Systems** Vishwesh V. Kulkarni, Guy-Bart Stan, Karthik Raman, 2014-07-03 The complexity of biological systems has intrigued scientists from many disciplines and has given birth to the highly influential field of systems biology wherein a wide array of mathematical techniques such as flux balance analysis and technology platforms such as next generation sequencing is used to understand elucidate and predict the functions of complex biological systems More recently the field of synthetic biology i e de novo engineering of biological systems has emerged Scientists from various fields are focusing on how to render this engineering process more predictable reliable

scalable affordable and easy Systems and control theory is a branch of engineering and applied sciences that rigorously deals with the complexities and uncertainties of interconnected systems with the objective of characterising fundamental systemic properties such as stability robustness communication capacity and other performance metrics Systems and control theory also strives to offer concepts and methods that facilitate the design of systems with rigorous guarantees on these properties Over the last 100 years it has made stellar theoretical and technological contributions in diverse fields such as aerospace telecommunication storage automotive power systems and others Can it have or evolve to have a similar impact in biology The chapters in this book demonstrate that indeed systems and control theoretic concepts and techniques can have a significant impact in systems and synthetic biology Volume II contains chapters contributed by leading researchers in the field of systems and synthetic biology that concern modeling physiological processes and bottom up constructions of scalable biological systems The modeling problems include characterisation and synthesis of memory understanding how homoeostasis is maintained in the face of shocks and relatively gradual perturbations understanding the functioning and robustness of biological clocks such as those at the core of circadian rhythms and understanding how the cell cycles can be regulated among others Some of the bottom up construction problems investigated in Volume II are as follows How should biomacromolecules platforms and scalable architectures be chosen and synthesised in order to build programmable de novo biological systems What are the types of constrained optimisation problems encountered in this process and how can these be solved efficiently As the eminent computer scientist Donald Knuth put it biology easily has 500 years of exciting problems to work on This edited book presents but a small fraction of those for the benefit of 1 systems and control theorists interested in molecular and cellular biology and 2 biologists interested in rigorous modelling analysis and control of biological systems

Resenhas IME-USP ,1993     *Stochastic and Spatial Structures of Dynamical Systems* Sebastian van Strien,Sjoerd M. Verduyn Lunel,1996 Paperback Recently great progress has been made in the field of dynamical systems Several new developments in dynamical systems are important or will become so in the near future The areas that are covered are close to the applications and related to noise randomness and spatial structures This book comprises of articles by most of the speakers at the meeting and is divided into three parts I the effect of noise on data generated by dynamical systems and testing whether these dynamical systems adequately model reality II spatial structures which can be generated by dynamical systems and which act on a network of coupled systems coupled lattice maps III random differential equations and applications to biology     Physical Review ,1911 Vols for 1903 include Proceedings of the American Physical Society  
Mathematical Reviews ,2005     Electrical Review ,1894     **Introduction to a Biological Systems Science** Edward H. Bloch,United States. National Aeronautics and Space Administration,1971     **INIS Atomindex** ,1985     Proceedings ,1956     **Chemical Engineering and Mining Review** ,1924     **The physical review : a journal of experimental and theoretical physics** ,1894     **The Younger Dryas** ,1995

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