



LECTURE NOTES IN CONTROL
AND INFORMATION SCIENCES

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Fritz Colonius
Lars Grüne (Eds.)

Dynamics, Bifurcations and Control



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Fritz Colonius, Wolfgang Kliemann



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Dynamics, Bifurcations and Control Fritz Colonius, Lars Grüne, 2003-07-01 This volume originates from the Third Nonlinear Control Workshop Dynamics Bifurcations and Control held in Kloster Irsee April 1-3 2001 As the preceding workshops held in Paris 2000 and in Ghent 1999 it was organized within the framework of Nonlinear Control Network funded by the European Union <http://www.supelec.fr/lss/NCN> The papers in this volume center around those control problems where phenomena and methods from dynamical systems theory play a dominant role Despite the large variety of techniques and methods present in the contributions a rough subdivision can be given into three areas Bifurcation problems stabilization and robustness and global dynamics of control systems A large part of the fascination in nonlinear control stems from the fact that it is deeply rooted in engineering and mathematics alike The contributions to this volume reflect this double nature of nonlinear control We would like to take this opportunity to thank all the contributors and the referees for their careful work Furthermore it is our pleasure to thank Franchise Lamnabhi Lagarrigue the coordinator of our network for her support in organizing the workshop and the proceedings and for the tremendous efforts she puts into this network bringing the cooperation between the different groups to a new level In particular the exchange and the active participation of young scientists also reflected in the Pedagogical Schools within the Network is an asset for the field of nonlinear control

Mathematical Reviews, 2005 **Books in Print Supplement**, 2002 **The Dynamics of Control** Fritz Colonius, Wolfgang Kliemann, 2000-04-20 This new text reference is an excellent resource for the foundations and applications of control theory and nonlinear dynamics All graduates practitioners and professionals in control theory dynamical systems perturbation theory engineering physics and nonlinear dynamics will find the book a rich source of ideas methods and applications With its careful use of examples and detailed development it is suitable for use as a self study reference guide for all scientists and engineers **Bifurcation and Chaos** Jan Awrejcewicz, 2012-12-06 Bifurcation and Chaos presents a collection of especially written articles describing the theory and application of nonlinear dynamics to a wide variety of problems encountered in physics and engineering Each chapter is self contained and includes an elementary introduction an exposition of the present state of the art and details of recent theoretical computational and experimental results Included among the practical systems analysed are hysteretic circuits Josephson circuits magnetic systems railway dynamics rotor dynamics and nonlinear dynamics of speech This book contains important information and ideas for all mathematicians physicists and engineers whose work in R D or academia involves the practical consequences of chaotic dynamics **Dynamics and Bifurcations** Jack K. Hale, Hüseyin Kocak, 2012-12-06 The subject of differential and difference equations is an old and much honored chapter in science one which germinated in applied fields such as celestial mechanics nonlinear oscillations and fluid dynamics In recent years due primarily to the proliferation of computers dynamical systems has once more turned to its roots in applications with perhaps a more mature look Many of the available books and

expository narratives either require extensive mathematical preparation or are not designed to be used as textbooks The authors have filled this void with the present book Bifurcation Theory And Applications Shouhong Wang,Tian Ma,2005-06-27 This book covers comprehensive bifurcation theory and its applications to dynamical systems and partial differential equations PDEs from science and engineering including in particular PDEs from physics chemistry biology and hydrodynamics The book first introduces bifurcation theories recently developed by the authors on steady state bifurcation for a class of nonlinear problems with even order nondegenerate nonlinearities regardless of the multiplicity of the eigenvalues and on attractor bifurcations for nonlinear evolution equations a new notion of bifurcation With this new notion of bifurcation many longstanding bifurcation problems in science and engineering are becoming accessible and are treated in the second part of the book In particular applications are covered for a variety of PDEs from science and engineering including the Kuramoto Sivashinsky equation the Cahn Hillard equation the Ginzburg Landau equation reaction diffusion equations in biology and chemistry the Benard convection problem and the Taylor problem The applications provide on the one hand general recipes for other applications of the theory addressed in this book and on the other full classifications of the bifurcated attractor and the global attractor as the control parameters cross certain critical values dictated usually by the eigenvalues of the linearized problems It is expected that the book will greatly advance the study of nonlinear dynamics for many problems in science and engineering Bifurcations And Chaos In Piecewise-smooth Dynamical Systems: Applications To Power Converters, Relay And Pulse-width Modulated Control Systems, And Human Decision-making Behavior Zhanybai T Zhusubaliyev,Erik Mosekilde,2003-06-25 Technical problems often lead to differential equations with piecewise smooth right hand sides Problems in mechanical engineering for instance violate the requirements of smoothness if they involve collisions finite clearances or stick slip phenomena Systems of this type can display a large variety of complicated bifurcation scenarios that still lack a detailed description This book presents some of the fascinating new phenomena that one can observe in piecewise smooth dynamical systems The practical significance of these phenomena is demonstrated through a series of well documented and realistic applications to switching power converters relay systems and different types of pulse width modulated control systems Other examples are derived from mechanical engineering digital electronics and economic business cycle theory The topics considered in the book include abrupt transitions associated with modified period doubling saddle node and Hopf bifurcations the interplay between classical bifurcations and border collision bifurcations truncated bifurcation scenarios period tripling and quadrupling bifurcations multiple choice bifurcations new types of direct transitions to chaos and torus destruction in nonsmooth systems In spite of its orientation towards engineering problems the book addresses theoretical and numerical problems in sufficient detail to be of interest to nonlinear scientists in general

Bifurcation and Chaos in Complex Systems ,2006-06-30 The book presents the recent achievements on bifurcation studies of nonlinear dynamical systems The contributing authors of the book are all distinguished researchers in this

interesting subject area The first two chapters deal with the fundamental theoretical issues of bifurcation analysis in smooth and non smooth dynamical systems The cell mapping methods are presented for global bifurcations in stochastic and deterministic nonlinear dynamical systems in the third chapter The fourth chapter studies bifurcations and chaos in time varying parametrically excited nonlinear dynamical systems The fifth chapter presents bifurcation analyses of modal interactions in distributed nonlinear dynamical systems of circular thin von Karman plates The theories methods and results presented in this book are of great interest to scientists and engineers in a wide range of disciplines This book can be adopted as references for mathematicians scientists engineers and graduate students conducting research in nonlinear dynamical systems New Views for Difficult Problems Novel Ideas and Concepts Hilbert s 16th Problem Normal Forms in Polynomial Hamiltonian Systems Grazing Flow in Non smooth Dynamical Systems Stochastic and Fuzzy Nonlinear Dynamical Systems Fuzzy Bifurcation Parametrical Nonlinear Systems Mode Interactions in nonlinear dynamical systems

Bifurcation and Stability in Nonlinear Dynamical Systems Albert C. J. Luo, 2020-01-30 This book systematically presents a fundamental theory for the local analysis of bifurcation and stability of equilibriums in nonlinear dynamical systems Until now one does not have any efficient way to investigate stability and bifurcation of dynamical systems with higher order singularity equilibriums For instance infinite equilibrium dynamical systems have higher order singularity which dramatically changes dynamical behaviors and possesses the similar characteristics of discontinuous dynamical systems The stability and bifurcation of equilibriums on the specific eigenvector are presented and the spiral stability and Hopf bifurcation of equilibriums in nonlinear systems are presented through the Fourier series transformation The bifurcation and stability of higher order singularity equilibriums are presented through the $2m$ th and $2m - 1$ th degree polynomial systems From local analysis dynamics of infinite equilibrium systems is discussed The research on infinite equilibrium systems will bring us to the new era of dynamical systems and control Presents an efficient way to investigate stability and bifurcation of dynamical systems with higher order singularity equilibriums Discusses dynamics of infinite equilibrium systems Demonstrates higher order singularity *Dynamics and Bifurcations* Jack K. Hale, Hüseyin Koçak, 1991-01 Lectures on Bifurcations, Dynamics and Symmetry Michael Field, 2020-02-17 This book is an expanded version of a Master Class on the symmetric bifurcation theory of differential equations given by the author at the University of Twente in 1995 The notes cover a wide range of recent results in the subject and focus on the dynamics that can appear in the generic bifurcation theory of symmetric differential equations This text covers a wide range of current results in the subject of bifurcations dynamics and symmetry The style and format of the original lectures has largely been maintained and the notes include over 70 exercises Control theory and dynamical systems Fritz Colonius, Wolfgang Kliemann, 1991 **Bifurcation and Chaos in Fractional-Order Systems** Marius-F. Danca, Guanrong Chen, 2021-01-19 This book presents a collection of seven technical papers on fractional order complex systems especially chaotic systems with hidden attractors and symmetries in

the research front of the field which will be beneficial for scientific researchers graduate students and technical professionals to study and apply It is also suitable for teaching lectures and for seminars to use as a reference on related topics

Dynamics, Bifurcation and Symmetry Pascal Chossat, 2012-12-06 This book collects contributions to the conference Dynamics Bifurcation and Symmetry new trends and new tools which was held at the Institut d Etudes Scientifiques de Cargese France September 3-9 1993 The first aim of this conference was to gather and summarize the work of the European Bifurcation Theory Group after two years of existence the EBTG links European laboratories in five countries via an EC grant Thanks to a NATO ARW grant the conference developed into an international meeting on bifurcation theory and dynamical systems with the participation of leading specialists not only from Europe but also from overseas countries Canada USA South America It was a great satisfaction to notice the active and quite enthusiastic participation of many young scientists This is reflected in the present book for which many contributors are PhD students or post doc researchers Although several big themes bifurcation with symmetry low dimensional dynamics dynamics in EDP s applications are present in these proceedings we have divided the book into corresponding parts In fact these themes overlap in most contributions which seems to reflect a general tendency in nonlinear science I am very pleased to thank for their support the NATO International Exchange Scientific Program as well as the EEC Science Program which made possible the success of this conference

Elements of Differentiable Dynamics and Bifurcation Theory David Ruelle, 2014-05-10 Elements of Differentiable Dynamics and Bifurcation Theory provides an introduction to differentiable dynamics with emphasis on bifurcation theory and hyperbolicity that is essential for the understanding of complicated time evolutions occurring in nature This book discusses the differentiable dynamics vector fields fixed points and periodic orbits and stable and unstable manifolds The bifurcations of fixed points of a map and periodic orbits case of semiflows and saddle node and Hopf bifurcation are also elaborated This text likewise covers the persistence of normally hyperbolic manifolds hyperbolic sets homoclinic and heteroclinic intersections and global bifurcations This publication is suitable for mathematicians and mathematically inclined students of the natural sciences

Sliding Modes in Control and Optimization Vadim Ivanovich Utkin, 1992 The purpose of this book is to describe a new approach for the design of high efficiency control of multi dimensional systems operating under uncertainty conditions It covers mathematical control and technological aspects of discontinuous control systems The generation of sliding modes is the basic design idea resulting in decomposition of system motion and invariance to uncertainties in plant behaviour Implementation of discontinuous control is natural for widely used electronic power converters with key operation

Bifurcation Control Guanrong Chen, David John Hill, Xinghuo Yu, 2003-08-26 Bifurcation control refers to the task of designing a controller that can modify the bifurcation properties of a given nonlinear system so as to achieve some desirable dynamical behaviors There exists no similar control theory oriented book available in the market that is devoted to the subject of bifurcation control written by control engineers for control engineers World

renowned leading experts in the field provide their state of the art survey about the extensive research that has been done over the last few years in this subject The book is not only aimed at active researchers in the field of bifurcation control and its applications but also at a general audience in related fields

Dynamics and bifurcations Jack K. Hale,Hüseyin Koçak,1996

Methods In Equivariant Bifurcations And Dynamical Systems Pascal Chossat,Reiner Lauterbach,2000-02-28 This invaluable book presents a comprehensive introduction to bifurcation theory in the presence of symmetry an applied mathematical topic which has developed considerably over the past twenty years and has been very successful in analysing and predicting pattern formation and other critical phenomena in most areas of science where nonlinear models are involved like fluid flow instabilities chemical waves elasticity and population dynamics The book has two aims One is to expound the mathematical methods of equivariant bifurcation theory Beyond the classical bifurcation tools such as center manifold and normal form reductions the presence of symmetry requires the introduction of the algebraic and geometric formalism of Lie group theory and transformation group methods For the first time all these methods in equivariant bifurcations are presented in a coherent and self consistent way in a book The other aim is to present the most recent ideas and results in this theory in relation to applications This includes bifurcations of relative equilibria and relative periodic orbits for compact and noncompact group actions heteroclinic cycles and forced symmetry breaking perturbations Although not all recent contributions could be included and a choice had to be made a rather complete description of these new developments is provided At the end of every chapter exercises are offered to the reader

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