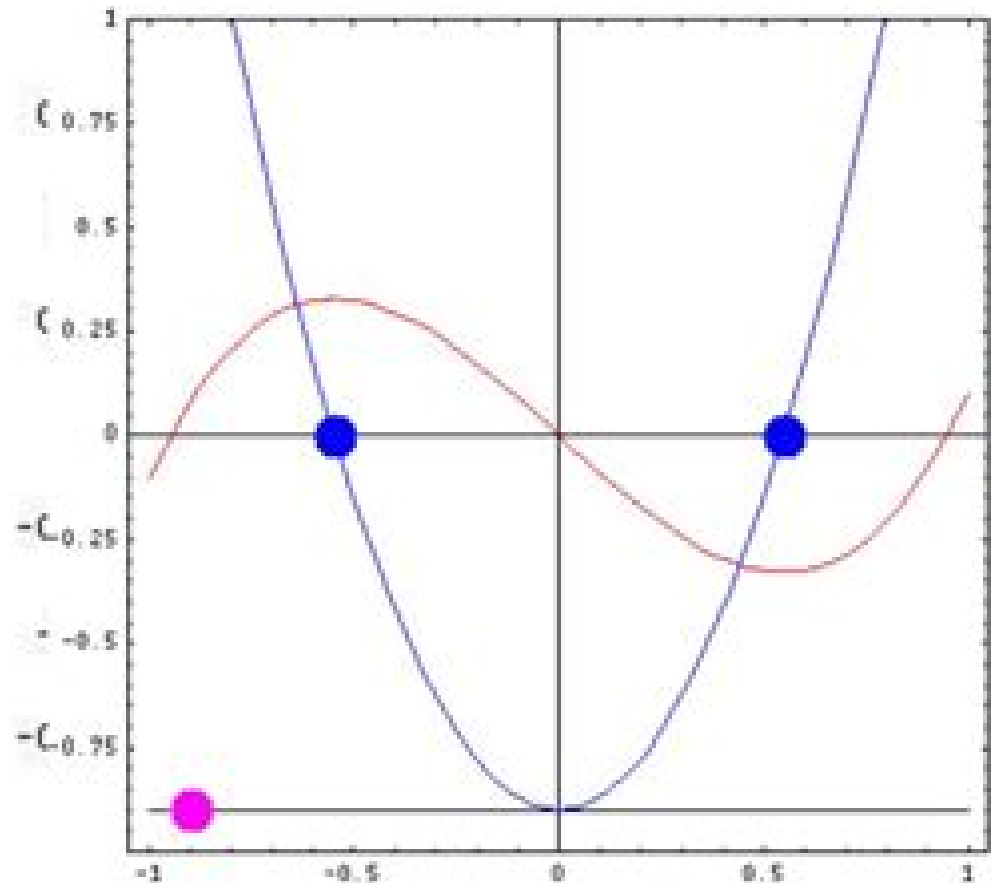


Bifurcation theory

- Bifurcation:
Small change of evolution rule causes big change in qualitative behaviour of the system.



Dynamical Systems And Bifurcation Theory

Wei-Bin Zhang



Dynamical Systems And Bifurcation Theory:

Bifurcation Theory And Methods Of Dynamical Systems Maoan Han, Dingjun Luo, Xian Wang, Deming Zhu, 1997-11-29

Dynamical bifurcation theory is concerned with the changes that occur in the global structure of dynamical systems as parameters are varied. This book makes recent research in bifurcation theory of dynamical systems accessible to researchers interested in this subject. In particular, the relevant results obtained by Chinese mathematicians are introduced, as well as some of the works of the authors which may not be widely known. The focus is on the analytic approach to the theory and methods of bifurcations. The book prepares graduate students for further study in this area and it serves as a ready reference for researchers in nonlinear sciences and applied mathematics.

Dynamical Systems and Bifurcation Theory M. I. Camacho, M. J. Pacifico, Floris Takens, 1987

Bifurcation Theory of Impulsive Dynamical Systems Kevin E.M. Church, Xinzhi Liu, 2021-03-24. This monograph presents the most recent progress in bifurcation theory of impulsive dynamical systems with time delays and other functional dependence. It covers not only smooth local bifurcations but also some non-smooth bifurcation phenomena that are unique to impulsive dynamical systems. The monograph is split into four distinct parts independently addressing both finite and infinite dimensional dynamical systems before discussing their applications. The primary contributions are a rigorous nonautonomous dynamical systems framework and analysis of nonlinear systems stability and invariant manifold theory. Special attention is paid to the centre manifold and associated reduction principle as these are essential to the local bifurcation theory. Specifying to periodic systems, the Floquet theory is extended to impulsive functional differential equations and this permits an exploration of the impulsive analogues of saddle node, transcritical, pitchfork, and Hopf bifurcations. Readers will learn how techniques of classical bifurcation theory extend to impulsive functional differential equations and as a special case, impulsive differential equations without delays. They will learn about stability for fixed points, periodic orbits, and complete bounded trajectories and how the linearization of the dynamical system allows for a suitable definition of hyperbolicity. They will see how to complete a centre manifold reduction and analyze a bifurcation at a nonhyperbolic steady state.

Dynamical Systems V.V.I. Arnold, V.S. Afraimovich, Yu.S. Il'yashenko, L.P. Shil'nikov, 2013-12-01. Bifurcation theory and catastrophe theory are two well-known areas within the field of dynamical systems. Both are studies of smooth systems focusing on properties that seem to be manifestly non-smooth. Bifurcation theory is concerned with the sudden changes that occur in a system when one or more parameters are varied. Examples of such are familiar to students of differential equations from phase portraits. Understanding the bifurcations of the differential equations that describe real physical systems provides important information about the behavior of the systems. Catastrophe theory became quite famous during the 1970s, mostly because of the sensation caused by the usually less than rigorous applications of its principal ideas to hot topics such as the characterization of personalities and the difference between a genius and a maniac. Catastrophe theory is accurately described as singularity theory and its genuine applications.

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theory is concerned with the changes that occur in the global structure of dynamical systems as parameters are varied This book makes recent research in bifurcation theory of dynamical systems accessible to researchers interested in this subject In particular the relevant results obtained by Chinese mathematicians are introduced as well as some of the works of the authors which may not be widely known The focus is on the analytic approach to the theory and methods of bifurcations The book prepares graduate students for further study in this area and it serves as a ready reference for researchers in nonlinear sciences and applied mathematics **Dynamical Systems V** V.I. Arnold, V.S. Afrajmovich, Yu.S. Il'yashenko, L.P.

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sudden changes that occur in a system when one or more parameters are varied. Examples of such are familiar to students of differential equations from phase portraits. Understanding the bifurcations of the differential equations that describe real physical systems provides important information about the behavior of the systems. Catastrophe theory became quite famous during the 1970s mostly because of the sensation caused by the usually less than rigorous applications of its principal ideas to hot topics such as the characterization of personalities and the difference between a genius and a maniac. Catastrophe theory is accurately described as singularity theory and its genuine applications. The authors of this book previously published as Volume 5 of the Encyclopaedia have given a masterly exposition of these two theories with penetrating insight.

Fundamentals of Dynamical Systems and Bifurcation Theory Milan Medved, 1992-05-21. This graduate level text explains the fundamentals of the theory of dynamical systems. After reading it you will have a good enough understanding of the area to study the extensive literature on dynamical systems. The book is self contained as all the essential definitions and proofs are supplied as are useful references all the reader needs is a knowledge of basic mathematical analysis algebra and topology. However the first chapter contains an explanation of some of the methods of differential topology an understanding of which is essential to the theory of dynamical systems. A clear introduction to the field which is equally useful for postgraduates in the natural sciences engineering and economics.

Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields John Guckenheimer, Philip Holmes, 2013-11-21. From the reviews. This book is concerned with the application of methods from dynamical systems and bifurcation theories to the study of nonlinear oscillations. Chapter 1 provides a review of basic results in the theory of dynamical systems covering both ordinary differential equations and discrete mappings. Chapter 2 presents 4 examples from nonlinear oscillations. Chapter 3 contains a discussion of the methods of local bifurcation theory for flows and maps including center manifolds and normal forms. Chapter 4 develops analytical methods of averaging and perturbation theory. Close analysis of geometrically defined two dimensional maps with complicated invariant sets is discussed in chapter 5. Chapter 6 covers global homoclinic and heteroclinic bifurcations. The final chapter shows how the global bifurcations reappear in degenerate local bifurcations and ends with several more models of physical problems which display these behaviors.

Book Review Engineering Societies Library New York 1. An attempt to make research tools concerning strange attractors developed in the last 20 years available to applied scientists and to make clear to research mathematicians the needs in applied works. Emphasis on geometric and topological solutions of differential equations. Applications mainly drawn from nonlinear oscillations. American Mathematical Monthly 2.

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

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

Dynamical Systems V V.I. Arnold, V.S. Afraimovich, Yu.S. Il'yashenko, L.P. Shil'nikov, 1994-06-06 Bifurcation theory and catastrophe theory are two well known areas within the field of dynamical systems Both are studies of smooth systems focusing on properties that seem to be manifestly non smooth Bifurcation theory is concerned with the sudden changes that occur in a system when one or more parameters are varied Examples of such are familiar to students of differential equations from phase portraits Understanding the bifurcations of the differential equations that describe real physical systems provides important information about the behavior of the systems Catastrophe theory became quite famous during the 1970 s mostly because of the sensation caused by the usually less than rigorous applications of its principal ideas to hot topics such as the characterization of personalities and the difference between a genius and a maniac Catastrophe theory is accurately described as singularity theory and its genuine applications The authors of this book previously published as Volume 5 of the Encyclopaedia have given a masterly exposition of these two theories with penetrating insight

Bifurcation Theory and Applications Tian Ma, Shouhong Wang, 2005 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-Oscillator-Sivashinsky equation, the Cahn-Hilliard equation, the Ginzburg-Landau equation, reaction-diffusion equations in biology and chemistry, the Bénard 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.

Bifurcation and Chaos in Discontinuous and Continuous Systems Michal Fečkan, 2011-05-30. Bifurcation and Chaos in Discontinuous and Continuous Systems provides rigorous mathematical functional analytical tools for handling chaotic bifurcations along with precise and complete proofs together with concrete applications presented by many stimulating and illustrating examples. A broad variety of nonlinear problems are studied involving difference equations, ordinary and partial differential equations, differential equations with impulses, piecewise smooth differential equations, differential and difference inclusions and differential equations on infinite lattices as well. This book is intended for mathematicians, physicists, theoretically inclined engineers and postgraduate students either studying oscillations of nonlinear mechanical systems or investigating vibrations of strings and beams and electrical circuits by applying the modern theory of bifurcation methods in dynamical systems. Dr Michal Fečkan is a Professor at the Department of Mathematical Analysis and Numerical Mathematics on the Faculty of Mathematics, Physics and Informatics at the Comenius University in Bratislava, Slovakia. He is working on nonlinear functional analysis, bifurcation theory and dynamical systems with applications to mechanics and vibrations.

Attractivity and Bifurcation for Nonautonomous Dynamical Systems Martin Rasmussen, 2007-05-26. Although bifurcation theory of equations with autonomous and periodic time dependence is a major object of research in the study of dynamical systems since decades, the notion of a nonautonomous bifurcation is not yet established. In this book two different approaches are developed which are based on special definitions of local attractivity and repulsivity. It is shown that these notions lead to nonautonomous Morse decompositions.

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'Études Scientifiques de Cluses, 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 EBGT 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 dynam ics 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 suc cess of this conference

Bifurcation in Autonomous and Nonautonomous Differential Equations with Discontinuities Marat Akhmet,Ardak Kashkynbayev,2017-01-23 This book focuses on bifurcation theory for autonomous and nonautonomous differential equations with discontinuities of different types those with jumps present either in the right hand side or in trajectories or in the arguments of solutions of equations The results obtained can be applied to various fields such as neural networks brain dynamics mechanical systems weather phenomena and population dynamics Developing bifurcation theory for various types of differential equations the book is pioneering in the field It presents the latest results and provides a practical guide to applying the theory to differential equations with various types of discontinuity Moreover it offers new ways to analyze nonautonomous bifurcation scenarios in these equations As such it shows undergraduate and graduate students how bifurcation theory can be developed not only for discrete and continuous systems but also for those that combine these systems in very different ways At the same time it offers specialists several powerful instruments developed for the theory of discontinuous dynamical systems with variable moments of impact differential equations with piecewise constant arguments of generalized type and Filippov systems

Dynamical Systems V ,1990 **Discrete Dynamical Systems, Bifurcations and Chaos in Economics** Wei-Bin Zhang,2006-01-05 This book is a unique blend of difference equations theory and its exciting applications to economics It deals with not only theory of linear and linearized difference equations but also nonlinear dynamical systems which have been widely applied to economic analysis in recent years It studies most important concepts and theorems in difference equations theory in a way that can be understood by anyone who has basic knowledge of calculus and linear algebra It contains well known applications and many recent developments in different fields of economics The book also simulates many models to illustrate paths of economic dynamics A unique book concentrated on theory of discrete dynamical systems and its traditional as well as advanced applications to economics Mathematical definitions and theorems are introduced in a systematic and easily accessible way Examples are from almost all fields of economics technically proceeding from basic to advanced topics Lively illustrations with numerous figures Numerous simulation to see paths of economic dynamics Comprehensive treatment of the subject with a comprehensive and easily accessible approach

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