Equilibrium Solutions And Stability Differential Equations

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Stability of Linear Delay Differential Equations Courier Corporation
Stability conditions for functional differential equations can be obtained using Lyapunov functionals. Lyapunov Functionals and Stability of Stochastic Functional Differential Equations describes the general method of construction of Lyapunov functionals to investigate the stability of differential equations with delays. This work continues and complements the author’s previous book Lyapunov Functionals and Stability of Stochastic Difference Equations, where this method is described for difference equations with discrete and continuous time. The text begins with both a description and a delineation of the peculiarities of deterministic and stochastic functional differential equations. There follows basic definitions for stability theory of stochastic hereditary systems, and the formal procedure of Lyapunov functionals construction is presented. Stability investigation is conducted for stochastic linear and nonlinear differential equations with constant and distributed delays. The proposed method is used for stability investigation of different mathematical models such as: • inverted controlled pendulum; • Nicholson's blowflies equation; • predator-prey relationships; • epidemic development; and • mathematical models that describe human behaviours related to addictions and obesity. Lyapunov Functionals and Stability of Stochastic Functional Differential Equations is primarily addressed to experts in stability theory but will also be of interest to professionals and students in pure and computational mathematics, physics, engineering, medicine, and biology.

Stability of Dynamical Systems CRC Press
This volume contains the notes from five lecture courses devoted to nonautonomous differential systems, in which appropriate topological and dynamical techniques were described and applied to a variety of problems. The courses took place during the C.I.M.E. Session "Stability and Bifurcation Problems for Non-Autonomous Differential Equations," held in Cetraro, Italy, June 19-25 2011. Anna Capietto and Jean Mawhin lectured on nonlinear boundary value problems; they applied the Maslov index and degree-theoretic methods in this context. Rafael Ortega discussed the theory of twist maps with nonperiodic phase and presented applications. Peter Kloeden and Sylvia Novo showed how dynamical methods can be used to study the stability/bifurcation properties of bounded solutions and of attracting sets for nonautonomous differential and functional-differential equations. The volume will be of interest to all researchers working in these and related fields.

Ordinary Differential Equations Academic Press
This text, now in its second edition, presents the basic theory of ordinary differential equations and relates the topological theory used in differential equations to advanced applications in chemistry and biology. It provides new motivations for studying extension theorems and existence theorems, supplies real-world examples, gives an early introduction to the use of geometric methods and offers a novel treatment of the Sturm-Liouville theory.

A Stability Technique for Evolution Partial Differential Equations Alpha Science Int'l Ltd.
Suitable for advanced undergraduates and graduate students, this text introduces the stability theory and asymptotic behavior of solutions of linear and nonlinear differential equations. 1953 edition.

Nonlinear Dynamics CRC Press
Probably the first book to describe computational methods for numerically computing steady state and Hopf bifurcations. Requiring only a basic knowledge of calculus, and using detailed examples, problems, and figures, this is an ideal textbook for graduate students.

Advanced Differential Equations CRC Press
"Stability Problems in Applied Mechanics starts with the stability problems in statics. The example of buckling of columns is studed through Euler method followed by the Energy method, based on Lagrange-Dirichlet theorem. Snap buckling, instability of shape, buckling due to follower load are also discussed. Insufficiency of static analysis for instability is clearly brought out and buckling problems are revisited from the point of view of dynamics. The theory of Dynamical System and the foundations of bifurcation theory and Floquet theory are developed and used to revisit the stability problems in the light of these unified mathematical concepts. This mathematical basis is then applied to investigate the stability problems encountered in dynamics of particle, rigid and flexible bodies. Finally the emergence of length scale and pattern formation as a consequence of instability in fluid, thermal and diffusion systems are discussed through a number of real-life problems. Different notions of stability and the analysis of nonlinear states are briefly included in two appendices."--BOOK JACKET.

Elementary Differential Equations Routledge
Ordinary Differential Equations is an outgrowth of courses taught for a number of years at Iowa State University in the mathematics and the electrical engineering departments. It is intended as a text for a first graduate course in differential equations for students in mathematics, engineering, and the sciences. Although differential equations is an old, traditional, and well-established subject, the diverse backgrounds and interests of the students in a typical modern-day course cause problems in the selection and method of presentation of material.

In order to compensate for this diversity, prerequisites have been kept to a minimum and the material is covered in such a way as to be appealing to a wide audience. The book contains eight chapters and begins with an introduction the subject and a discussion of some important examples of differential equations that arise in science and engineering. Separate chapters follow on the fundamental theory of linear and nonlinear differential equations; linear boundary value problems; Lyapunov stability theory; and perturbations of linear systems. Subsequent chapters deal with the Poincare-Bendixson theory and with two-dimensional van der Pol type equations; and periodic solutions of general order systems.

Elementary Differential Equations with Boundary Value Problems SIAM

This book presents the authors' recent work on the numerical methods for the stability analysis of linear autonomous and periodic delay differential equations, which consist in applying pseudospectral techniques to discretize either the solution operator or the infinitesimal generator and in using the eigenvalues of the resulting matrices to approximate the exact spectra. The purpose of the book is to provide a complete and self-contained treatment, which includes the basic underlying mathematics and numerics, examples from population dynamics and engineering applications, and Matlab programs implementing the proposed numerical methods. A number of proofs is given to furnish a solid foundation, but the emphasis is on the (unifying) idea of the pseudospectral technique for the stability analysis of DDEs. It is aimed at advanced students and researchers in applied mathematics, in dynamical systems and in various fields of science and engineering, concerned with delay systems. A relevant feature of the book is that it also provides the Matlab codes to encourage the readers to experience the practical aspects. They could use the codes to test the theory and to analyze the performances of the methods on the given examples. Moreover, they could easily modify them to tackle the numerical stability analysis of their own delay models.

Magnetohydrodynamic Equilibrium and Stability of Stellarators Oxford University Press

This book is a mathematically rigorous introduction to the beautiful subject of ordinary differential equations for beginning graduate or advanced undergraduate students. Students should have a solid background in analysis and linear algebra. The presentation emphasizes commonly used techniques without necessarily striving for completeness or for the treatment of a large number of topics. The first half of the book is devoted to the development of the basic theory: linear systems, existence and uniqueness of solutions to the initial value problem, flows, stability, and smooth dependence of solutions upon initial conditions and parameters. Much of this theory also serves as the paradigm for evolutionary partial differential equations. The second half of the book is devoted to geometric theory: topological conjugacy, invariant manifolds, existence and stability of periodic solutions, bifurcations, normal forms, and the existence of transverse homoclinic points and their link to chaotic dynamics. A common thread throughout the second part is the use of the implicit function theorem in Banach space. Chapter 5, devoted to this topic, the serves as the bridge between the two halves of the book.

Differential Equations, Mechanics, and Computation Elsevier

For briefer traditional courses in elementary differential equations that science, engineering, and mathematics students take following calculus. The Sixth Edition of this widely adopted book remains the same classic differential equations text it's always been, but has been polished and sharpened to serve both instructors and students even more effectively.Edwards and Penney teach students to first solve those differential equations that have the most frequent and interesting applications. Precise and clear-cut statements of fundamental existence and uniqueness theorems allow understanding of their role in this subject. A strong numerical approach emphasizes that the effective and reliable use of numerical methods often requires preliminary analysis using standard elementary techniques.

Introduction to Hamiltonian Fluid Dynamics and Stability Theory Morgan & Claypool Publishers

Designed for a rigorous first course in ordinary differential equations, Ordinary Differential Equations: Introduction and Qualitative Theory, Third Edition includes basic material such as the existence and properties of solutions, linear equations, autonomous equations, and stability as well as more advanced topics in periodic solutions of

Nonlinear Differential Equations Springer Science & Business Media

In qualitative theory of differential equations, an important role is played by special classes of solutions, like periodic solutions or solutions to some boundary value problems. When a system of ordinary differential equations has equilibria, i.e. constant solutions, whose stability properties are known, it is significant to search for connections between them by trajectories of solutions of the given system. These are called homoclinic or heteroclinic, according to whether they describe a loop based at one single equilibrium or they "start" and "end" at two distinct equilibria. This thesis is devoted to the study of heteroclinic solutions for a specific class of ordinary differential equations related to the Extended Fisher-Kolmogorov equation and the Swift-Hohenberg equation. These are semilinear fourth order bi-stable evolution equations which appear as mathematical models for problems arising in Mechanics, Chemistry and Biology. For such equations, the set of bounded stationary solutions is of great interest. These solve an autonomous fourth order equation. In this thesis, we focus on such equations having a variational structure. In that case, the solutions are critical points of an associated action functional defined in convenient functional spaces. We then look for heteroclinic solutions as minimizers of the action functional. Our main contributions concern existence and multiplicity results of such global and local minimizers in the case where the functional is defined from sign changing Lagrangians. The underlying idea is to impose conditions which imply a lower bound on the action over all admissible functions. We then combine classical arguments of the Calculus of Variations with careful estimates on minimizing sequences to prove the existence of a minimum.

A Study of Heteroclinic Orbits for a Class of Fourth Order Ordinary Differential Equations Springer Science & Business Media

* Introduces a state-of-the-art method for the study of the asymptotic behavior of solutions to evolution partial differential equations. * Written by established mathematicians at the forefront of their field, this blend of delicate analysis and broad application is ideal for a course or seminar in asymptotic analysis and nonlinear PDEs. * Well-organized text with detailed index and bibliography, suitable as a course text or reference volume.

Notes on Diffy Qs CRC Press

For ordinary differential equations it is well known that an equilibrium solution is stable if the linearized equation has only exponentially decaying solutions. The differential-difference equation u' (t+s) - u' (t) + au (t +)s) = g (t, u (t), u (t+ s)), a> O, s> O, when linearized, also has decaying exponentials exp (st), but the characteristic roots s approach the imaginary axis. The problem arises -- do solutions of this equation decay. An affirmative answer is obtained for this problem, the rate of decay depending upon the smoothness of the initial data and nonlinear term and the rate of approach of the characteristic roots to the imaginary axis. Then this result is applied to a transmission line problem. Also, an example is given of a homogeneous linear ordinary differential-difference equation with constant coefficients, whose characteristic roots all lie in the left half plane, having an unbounded solution. (Author).

Stability Analysis of Impulsive Functional Differential Equations American Mathematical Soc.

This book is devoted to impulsive functional differential equations which are a natural generalization of impulsive ordinary differential equations (without delay) and of functional differential equations (without impulses). At the present time the qualitative theory of such equations is under rapid development. After a presentation of the fundamental theory of existence, uniqueness and continuability of solutions, a systematic development of stability theory for that class of problems is given which makes the book unique. It addresses to a wide audience such as mathematicians, applied researches and practitioners.

Stability of Critical Equilibrium States Princeton University Press

This book provides a conceptual introduction to the theory of ordinary differential equations, concentrating on the initial value problem for equations of evolution and with applications to the calculus of variations and classical mechanics, along with a discussion of chaos theory and ecological models. It has a unified and visual introduction to the theory of numerical methods and a novel approach to the analysis of errors and stability of various numerical solution algorithms based on carefully chosen model problems. While the book would be suitable as a textbook for an undergraduate or elementary graduate course in ordinary differential equations, the authors have designed the text also to be useful for motivated students wishing to learn the material on their own or desiring to supplement an ODE textbook being used in a course they are taking with a text offering a more conceptual approach to the subject.

Stability Theory of Differential Equations Manchester University Press

This self-contained book provides systematic instructive analysis of uncertain systems of the following types: ordinary differential equations, impulsive equations, equations on time scales, singularly perturbed differential equations, and set differential equations. Each chapter contains new conditions of stability of unperturbed motion of the abo

Elementary Stability and Bifurcation Theory Walter de Gruyter

In this book, we describe in detail a numerical method to study the equilibrium and stability of a plasma confined by a strong magnetic field in toroidal geometry without two-dimensional symmetry. The principal appli cation is to stellarators, which are currently of interest in thermonuclear fusion research. Our mathematical model is based on the partial differential equations of ideal magnetohydrodynamics. The main contribution is a computer code named BETA that is listed in the final chapter. This work is the natural continuation of an investigation that was presented in an early volume of the Springer Series in Computational Physics (cf. [3]). It has been supported over a period of years by the U.S. Department of Energy under Contract DE-AC02-76ER03077 with New York University. We would like to express our gratitude to Dr. Franz Herrnegger for the assistance he has given us with the preparation of the manuscript. We are especially indebted to Connie Engle for the high quality of the final typescript. New York F. BAUER October 1983 O. BETANCOURT P. GARABEDIAN Contents 1. Introduction 1 2. Synopsis of the Method 3 1. Variational principle 3 2. Coordinate system 6 3. Finite Difference Scheme 8 1. Difference equations .... " 8 2. Island structure .... 10 3. Accelerated iteration procedure .... 12 Nonlinear Stability 15 4. 1. Second minimization . . . . 15 . . . . . 2. Test functions and convergence studies . . . . 17 . 3. Comparison with exact solutions .... 19 5. The Mercier Criterion 22 1. Local mode analysis . . . . 22 . . . . . 2. Computational method . . . . 23 . . . .

Dynamics of Third-Order Rational Difference Equations with Open Problems and Conjectures Springer Science & Business Media

This book uses a hands-on approach to nonlinear dynamics using commonly available software, including the free dynamical systems software Xppaut, Matlab (or its free cousin, Octave) and the Maple symbolic algebra system. Detailed instructions for various common procedures, including bifurcation analysis using the version of AUTO embedded in Xppaut, are provided. This book also provides a survey that can be taught in a single academic term covering a greater variety of dynamical systems (discrete versus continuous time, finite versus infinite-dimensional, dissipative versus conservative) than is normally seen in introductory texts. Numerical computation and linear stability analysis are used as unifying themes throughout the book. Despite the emphasis on computer calculations, theory is not neglected, and fundamental concepts from the field of nonlinear dynamics such as solution maps and invariant manifolds are presented.

Stability Problems in Applied Mechanics Springer Science & Business Media

The main purpose of developing stability theory is to examine dynamic responses of a system to disturbances as the time approaches infinity. It has been and still is the object of intense investigations due to its intrinsic interest and its relevance to all practical systems in engineering, finance, natural science and social science. This monograph provides some state-of-the-art expositions of major advances in fundamental stability theories and methods for dynamic systems of ODE and DDE types and in limit cycle, normal form and Hopf bifurcation control of nonlinear dynamic systems. Presents comprehensive theory and methodology of stability analysis Can be used as textbook for graduate students in applied mathematics, mechanics, control theory, theoretical physics, mathematical biology, information theory, scientific computation Serves as a comprehensive handbook of stability theory for practicing aerospace, control, mechanical, structural, naval and civil engineers