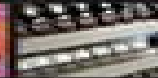


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Stability of Stationary Sets in Control Systems with Discontinuous Nonlinearities

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Stability Of Stationary Sets In Control Systems With Discontinuous Nonlinearities

Yury V. Orlov



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Stability of Stationary Sets in Control Systems with Discontinuous Nonlinearities Vladimir Andreevich I?A?kubovich, Gennadi? Alekseevich Leonov, Arkadi? Kha?movich Gelig, 2004 This book presents a development of the frequency domain approach to the stability study of stationary sets of systems with discontinuous nonlinearities The treatment is based on the theory of differential inclusions and the second Lyapunov method Various versions of the Kalman Yakubovich lemma on solvability of matrix inequalities are presented and discussed in detail It is shown how the tools developed can be applied to stability investigations of relay control systems gyroscopic systems mechanical systems with a Coulomb friction nonlinear electrical circuits cellular neural networks phase locked loops and synchronous machines

Stability of Stationary Sets in Control Systems with Discontinuous Nonlinearities Vladimir Andreevich I?A?kubovich, Arkadi? Kha?movich Gelig, Gennadi? Alekseevich Leonov, 2004 This book presents a development of the frequency domain approach to the stability study of stationary sets of systems with discontinuous nonlinearities The treatment is based on the theory of differential inclusions and the second Lyapunov method Various versions of the Kalman OCoYakubovich lemma on solvability of matrix inequalities are presented and discussed in detail It is shown how the tools developed can be applied to stability investigations of relay control systems gyroscopic systems mechanical systems with a Coulomb friction nonlinear electrical circuits cellular neural networks phase locked loops and synchronous machines Sample Chapter s Chapter 1 Foundations of Theory of Differential Equations with Discontinuous Right Hand Sides 455 KB Contents Foundations of Theory of Differential Equations with Discontinuous Right Hand Sides Auxiliary Algebraic Statements on Solutions of Matrix Inequalities of a Special Type Dichotomy and Stability of Nonlinear Systems with Multiple Equilibria Stability of Equilibria Sets of Pendulum Like Systems Readership Upper level undergraduates graduate students academics researchers and engineers involved with mechanics electrical science and power systems **Analysis and**

Control of Nonlinear Systems with Stationary Sets Jinzhi Wang, 2009 Nonlinear systems with stationary sets are important because they cover a lot of practical systems in engineering Previous analysis has been based on the frequency domain for this class of systems However few results on robustness analysis and controller design for these systems are easily available This book presents the analysis as well as methods based on the global properties of systems with stationary sets in a unified time domain and frequency domain framework The focus is on multi input and multi output systems compared to previous publications which considered only single input and single output systems The control methods presented in this book will be valuable for research on nonlinear systems with stationary sets Stability and Control of Nonlinear Time-varying Systems Shuli Guo, Lina Han, 2018-04-12 This book presents special systems derived from industrial models including the complex saturation nonlinear functions and the delay nonlinear functions It also presents typical methods such as the classical Liapunov and Integral Inequalities methods Providing constructive qualitative and stability

conditions for linear systems with saturated inputs in both global and local contexts it offers practitioners more concise model systems for modern saturation nonlinear techniques which have the potential for future applications This book is a valuable guide for researchers and graduate students in the fields of mathematics control and engineering *Discontinuous Systems* Yury V. Orlov, 2008-10-28 *Discontinuous Systems* develops nonsmooth stability analysis and discontinuous control synthesis based on novel modeling of discontinuous dynamic systems operating under uncertain conditions While being primarily a research monograph devoted to the theory of discontinuous dynamic systems no background in discontinuous systems is required such systems are introduced in the book at the appropriate conceptual level Being developed for discontinuous systems the theory is successfully applied to their subclasses variable structure and impulsive systems as well as to finite and infinite dimensional systems such as distributed parameter and time delay systems The presentation concentrates on algorithms rather than on technical implementation although theoretical results are illustrated by electromechanical applications These specific applications complete the book and together with the introductory theoretical constituents bring some elements of the tutorial to the text Road Map for Sliding Mode Control Design Vadim Utkin, Alex Poznyak, Yury V. Orlov, Andrey Polyakov, 2020-04-13 This book is devoted to control of finite and infinite dimensional processes with continuous time and discrete time control focusing on suppression problems and new methods of adaptation applicable for systems with sliding motions only Special mathematical methods are needed for all the listed control tasks These methods are addressed in the initial chapters with coverage of the definition of the multidimensional sliding modes the derivation of the differential equations of those motions and the existence conditions Subsequent chapters discuss various areas of further research The book reflects the consensus view of the authors regarding the current status of SMC theory It is addressed to a broad spectrum of engineers and theoreticians working in diverse areas of control theory and applications It is well suited for use in graduate and postgraduate courses in such university programs as Electrical Engineering Control of Nonlinear Systems and Mechanical Engineering *Dissipative Systems Analysis and Control* Bernard Brogliato, Rogelio Lozano, Bernhard Maschke, Olav Egeland, 2019-07-03 The third edition of the now standard *Dissipative Systems Analysis and Control* presents a revised and expanded treatment of dissipative systems theory constituting a self contained advanced introduction for graduate students researchers and practising engineers It examines linear nonlinear and nonsmooth systems with many examples in each chapter occasional infinite dimensional examples are also included Throughout emphasis is placed on the use of the dissipative properties of a system for the design of stable and robust feedback control laws or state observers The theory is substantiated by experimental results and by reference to its application in illustrative physical cases Lagrangian systems passivity based and adaptive controllers are covered thoroughly The third edition is substantially updated to accommodate new material within the existing chapter structure The additions include the introduction of negative imaginary transfer functions the design of stable state observers that use passivity as a tool for their stability

analysis a new section on robust set valued control of uncertain Lagrangian systems extended section on discrete time systems especially the preservation of dissipativity after discretization a thorough treatment of nonsmooth set valued Lur e systems well posedness and stability an extended chapter on the Kalman Yakubovich Popov Lemma and over 1000 references

Design of Nonlinear Control Systems with the Highest Derivative in Feedback Valery D. Yurkevich, 2004 This unique book presents an analytical uniform design methodology of continuous time or discrete time nonlinear control system design which guarantees desired transient performances in the presence of plant parameter variations and unknown external disturbances All results are illustrated with numerical simulations their practical importance is highlighted and they may be used for real time control system design in robotics mechatronics chemical reactors electrical and electro mechanical systems as well as aircraft control systems The book is easy reading and is suitable for teaching

Generalized Homogeneity in Systems and Control Volume I Andrey Polyakov, 2025-08-05 This book is an introduction to the theory of homogeneous systems useful for the simplification of many types of nonlinear control problems It propounds methods that can be employed when linearization proves unsuitable and provides a unified approach to stability and robustness analysis control and observer design and system discretization The second edition splits the coverage of homogeneity allowing expanded coverage of finite dimensional systems in this book and infinite dimensional systems in Volume II The results are better systematized and easier for readers to study and assimilate The first volume details the concepts of finite time and fixed time stability Key features of the book include mathematical models of dynamical systems in finite dimensional spaces the theory of linear dilations in Euclidean spaces homogeneous control and estimation extensively expanded and original chapters with entirely new treatments of digitization safety critical systems neural networks and multiagent control simple methods for an upgrade of existing linear control laws numerical schemes for a consistent digital implementation of homogeneous algorithms and experimental results that confirm an improvement of PID controllers Illustrative examples numerical results computer simulations and real experiments support all the theoretical material The coverage of finite dimensional systems presented in this book is of interest to graduate students of control theory from engineering and applied mathematical backgrounds and to practising control engineers

Generalized Homogeneity in Systems and Control Andrey Polyakov, 2020-02-05 This monograph introduces the theory of generalized homogeneous systems governed by differential equations in both Euclidean finite dimensional and Banach Hilbert infinite dimensional spaces It develops methods of stability and robustness analysis control design state estimation and discretization of homogeneous control systems Generalized Homogeneity in Systems and Control is structured in two parts Part I discusses various models of control systems and related tools for their analysis including Lyapunov functions Part II deals with the analysis and design of homogeneous control systems Some of the key features of the text include mathematical models of dynamical systems in finite dimensional and infinite dimensional spaces the theory of linear dilations in Banach spaces homogeneous control and estimation simple methods for an upgrade of

existing linear control laws numerical schemes for a consistent digital implementation of homogeneous algorithms and experiments confirming an improvement of PID controllers The advanced mathematical material will be of interest to researchers mathematicians working in control theory and mathematically oriented control engineers Dynamics and Control of Advanced Structures and Machines Valerii P. Matveenko, Michael Krommer, Alexander K. Belyaev, Hans Irschik, 2019-03-08 The volume includes 30 contributions from the 3rd International Workshop on Advanced Dynamics and Model Based Control of Structures and Machines representing the frontiers in the mechanics of controlled machines and structures The Workshop held in Perm Russia in September 2017 continued a series of international workshops starting in with the Japan Austria Joint Workshop on Mechanics and Model Based Control of Smart Materials and Structures the Russia Austria Joint Workshop on Advanced Dynamics and Model Based Control of Structures and Machines and the first two editions of the International Workshop on Advanced Dynamics and Model Based Control of Structures and Machines The previous workshops took place in Linz Austria in September 2008 and April 2010 in St Petersburg Russia in July 2012 and in Vienna Austria in September 2015 The up to date contributions are authored by internationally re known leading experts in dynamics and control representing a broad spectrum of topics in the field of Advanced Structures and Machines both with respect to theoretical aspects as well as applications to contemporary engineering problems *Nonlinear Control of Dynamic Networks* Tengfei Liu, Zhong-Ping Jiang, David J. Hill, 2018-09-03 Significant progress has been made on nonlinear control systems in the past two decades However many of the existing nonlinear control methods cannot be readily used to cope with communication and networking issues without nontrivial modifications For example small quantization errors may cause the performance of a well designed nonlinear control system to deteriorate Motivated by the need for new tools to solve complex problems resulting from smart power grids biological processes distributed computing networks transportation networks robotic systems and other cutting edge control applications Nonlinear Control of Dynamic Networks tackles newly arising theoretical and real world challenges for stability analysis and control design including nonlinearity dimensionality uncertainty and information constraints as well as behaviors stemming from quantization data sampling and impulses Delivering a systematic review of the nonlinear small gain theorems the text Supplies novel cyclic small gain theorems for large scale nonlinear dynamic networks Offers a cyclic small gain framework for nonlinear control with static or dynamic quantization Contains a combination of cyclic small gain and set valued map designs for robust control of nonlinear uncertain systems subject to sensor noise Presents a cyclic small gain result in directed graphs and distributed control of nonlinear multi agent systems with fixed or dynamically changing topology Based on the authors recent research Nonlinear Control of Dynamic Networks provides a unified framework for robust quantized and distributed control under information constraints Suggesting avenues for further exploration the book encourages readers to take into consideration more communication and networking issues in control designs to better handle the arising challenges **Nonlinear and**

Adaptive Control Alessandro Astolfi, 2006 This book summarizes the main results achieved in a four year European Project on nonlinear and adaptive control The project involves leading researchers from top notch institutions Imperial College London Prof A Astolfi Lund University Prof A Rantzer Supélec Paris Prof R Ortega University of Technology of Compiègne Prof R Lozano Grenoble Polytechnic Prof C Canudas de Wit University of Twente Prof A van der Schaft Politecnico di Milano Prof S Bittanti and Polytechnic University of Valencia Prof P Albertos The book also provides an introduction to theoretical advances in nonlinear and adaptive control and an overview of novel applications of advanced control theory particularly topics on the control of partially known systems under actuated systems and bioreactors *Discontinuity and Complexity in Nonlinear Physical Systems* J. A. Tenreiro Machado, Dumitru Baleanu, Albert C J Luo, 2013-12-04 Discontinuity in Nonlinear Physical Systems explores recent developments in experimental research in this broad field organized in four distinct sections Part I introduces the reader to the fractional dynamics and Lie group analysis for nonlinear partial differential equations Part II covers chaos and complexity in nonlinear Hamiltonian systems important to understand the resonance interactions in nonlinear dynamical systems such as Tsunami waves and wildfire propagations as well as Lev flights in chaotic trajectories dynamical system synchronization and DNA information complexity analysis Part III examines chaos and periodic motions in discontinuous dynamical systems extensively present in a range of systems including piecewise linear systems vibro impact systems and drilling systems in engineering And in Part IV engineering and financial nonlinearity are discussed The mechanism of shock wave with saddle node bifurcation and rotating disk stability will be presented and the financial nonlinear models will be discussed *Hidden Dynamics* Mike R. Jeffrey, 2018-12-11 The dream of mathematical modeling is of systems evolving in a continuous deterministic predictable way Unfortunately continuity is lost whenever the rules of the game change whether a change of behavioural regime or a change of physical properties From biological mitosis to seizures From rattling machine parts to earthquakes From individual decisions to economic crashes Where discontinuities occur determinacy is inevitably lost Typically the physical laws of such change are poorly understood and too ill defined for standard mathematics Discontinuities offer a way to make the bounds of scientific knowledge a part of the model to analyse a system with detail and rigour yet still leave room for uncertainty This is done without recourse to stochastic modeling instead retaining determinacy as far as possible and focussing on the geometry of the many outcomes that become possible when it breaks down In this book the foundations of piecewise smooth dynamics theory are rejuvenated given new life through the lens of modern nonlinear dynamics and asymptotics Numerous examples and exercises lead the reader through from basic to advanced analytical methods particularly new tools for studying stability and bifurcations The book is aimed at scientists and engineers from any background with a basic grounding in calculus and linear algebra It seeks to provide an invaluable resource for modeling discontinuous systems but also to empower the reader to develop their own novel models and discover as yet unknown phenomena **Complexity And Control: Towards A Rigorous Behavioral Theory Of Complex**

Dynamical Systems Vladimir G Ivancevic, Darryn J Reid, 2014-11-07 The book *Complexity and Control Towards a Rigorous Behavioral Theory of Complex Dynamical Systems* is a graduate level monographic textbook intended to be a novel and rigorous contribution to modern Complexity Theory This book contains 11 chapters and is designed as a one semester course for engineers applied and pure mathematicians theoretical and experimental physicists computer and economic scientists theoretical chemists and biologists as well as all mathematically educated scientists and students both in industry and academia interested in predicting and controlling complex dynamical systems of arbitrary nature *New Trends in Control Theory* Vladimir G. Ivancevic, Tijana T. Ivancevic, 2013 *New Trends in Control Theory* is a graduate level monographic textbook It is a contemporary overview of modern trends in control theory The introductory chapter gives the geometrical and quantum background which is a necessary minimum for comprehensive reading of the book The second chapter gives the basics of classical control theory both linear and nonlinear The third chapter shows the key role that Euclidean group of rigid motions plays in modern robotics and biomechanics The fourth chapter gives an overview of modern quantum control from both theoretical and measurement perspectives The fifth chapter presents modern control and synchronization methods in complex systems and human crowds The appendix provides the rest of the background material complementary to the introductory chapter The book is designed as a one semester course for engineers applied mathematicians computer scientists and physicists both in industry and academia It includes a most relevant bibliography on the subject and detailed index Estimation and Control over Communication Networks Alexey S. Matveev, Andrey V. Savkin, 2009-04-05 This book presents a systematic theory of estimation and control over communication networks It develops a theory that utilizes communications control information and dynamical systems theory motivated and applied to advanced networking scenarios The book establishes theoretically rich and practically important connections among modern control theory Shannon information theory and entropy theory of dynamical systems originated in the work of Kolmogorov This self contained monograph covers the latest achievements in the area It contains many real world applications and the presentation is accessible **The Quantum World of Nuclear Physics** Yuri A. Berezhtnoy, 2005 This book presents a comprehensive explanation of the main ideas and principles of atomic and nuclear physics and quantum mechanics The author invites readers to plunge into the physics of micro objects and to take a fascinating tour of the world of atoms and nuclei The main questions under consideration are the structure of atoms atomic nuclei the substance and systematics of elementary particles the processes of the creation of atomic nuclei and the evolution of stars as well as different applied aspects of the physics of micro objects Recent Progress In Controlling Chaos Miguel A F Sanjuan, Celso Grebogi, 2010-01-13 This review volume consists an indispensable collection of research papers chronicling the recent progress in controlling chaos Here new theoretical ideas as experimental implementations of controlling chaos are included while the applications contained in this volume can be referred to as turbulent magnetized plasmas chaotic neural networks modeling city traffic and models of

interest in celestial mechanics Recent Progress in Controlling Chaos provides an excellent broad overview of the subject matter and will be especially useful for graduate students researchers and scientists working in the areas of nonlinear dynamics chaos and complex systems The authors world renowned scientists and prominent experts in the field of controlling chaos will offer readers through their research works a fascinating insight into the state of the art technology used in the progress in key techniques and concepts in the field of control

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