Reduction of Nonlinear Control Systems

Reduction Of Nonlinear Control Systems A Differential Geometric Approach Mathematics And Its Appli

Francesco Bullo,Andrew D. Lewis

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Tautological Control Systems Andrew D. Lewis,2014-07-22 This brief presents a description of a new modelling framework for nonlinear geometric control theory The framework is intended to be and shown to be feedback invariant As such Tautological Control Systems provides a platform for understanding fundamental structural problems in geometric

control theory Part of the novelty of the text stems from the variety of regularity classes e g Lipschitz finitely differentiable smooth real analytic with which it deals in a comprehensive and unified manner The treatment of the important real analytic class especially reflects recent work on real analytic topologies by the author Applied mathematicians interested in nonlinear and geometric control theory will find this brief of interest as a starting point for work in which feedback invariance is important Graduate students working in control theory may also find Tautological Control Systems to be a stimulating starting point for their research *Geometric Control of Mechanical Systems* Francesco Bullo,Andrew D. Lewis,2019-06-12 The primary emphasis of this book is the modeling analysis and control of mechanical systems The methods and results presented can be applied to a large class of mechanical control systems including applications in robotics autonomous vehicle control and multi body systems The book is unique in that it presents a unified rather than an inclusive treatment of control theory for mechanical systems A distinctive feature of the presentation is its reliance on techniques from differential and Riemannian geometry The book contains extensive examples and exercises and will be suitable for a growing number of courses in this area It begins with the detailed mathematical background proceeding through innovative approaches to physical modeling analysis and design techniques Numerous examples illustrate the proposed methods and results while the many exercises test basic knowledge and introduce topics not covered in the main body of the text The audience of this book consists of two groups The first group is comprised of graduate students in engineering or mathematical sciences who wish to learn the basics of geometric mechanics nonlinear control theory and control theory for mechanical systems Readers will be able to immediately begin exploring the research literature on these subjects The second group consists of researchers in mechanics and control theory Nonlinear control theoreticians will find explicit links between concepts in geometric mechanics and nonlinear control theory Researchers in mechanics will find an overview of topics in control theory that have relevance to mechanics **Optimization and Control of Bilinear Systems** Panos M. Pardalos,Vitaliy A. Yatsenko,2010-03-14 The present book is based on results of scienti c investigations and on the materials of special courses o ered for graduate and undergraduate students The purpose of this book is to acquaint the reader with the developments in bilinear systems theory and its applications Particular attention is paid to control of open physical processes functioning in a nonequilibrium mode The text consists of eight chapters Chapter 1 is concerned with the problems of systems analysis of bilinear processes Chapter 2 solves the problem of optimal control of bilinear systems on the basis of di er tial geometry methods Chapter 3 deals with the progress made in an adaptive estimation technique Chapter 4 is devoted to the application of the Yang Mills elds to investigation of nonlinear control problems Chapter 5 considers intelligent sensors used to examine weak signals This chapter also describes and analyzes bilinear models of intelligent sensing elements Chapter 6 illustrates control problems of a quantum system Chapter 7 discusses the problems of control and identi cation in systems with chaotic dynamics Finally Chapter 8 examines the c trolled processes running in biomolecular systems This book is directed to

students postgraduate students and speci ists engaged in the elds of control of physical processes quantum and molecular computing biophysics and physical information science *Geometrical Methods in Variational Problems* N.A. Bobylov,S.V. Emel'yanov,S. Korovin,2012-12-06 This self contained monograph presents methods for the investigation of nonlinear variational problems These methods are based on geometric and topological ideas such as topological index degree of a mapping Morse Conley index Euler characteristics deformation invariant homotopic invariant and the Lusternik Shnirelman category Attention is also given to applications in optimisation mathematical physics control and numerical methods Audience This volume will be of interest to specialists in functional analysis and its applications and can also be recommended as a text for graduate and postgraduate level courses in these fields Nonlinear Systems Nathan van de Wouw,Erjen Lefeber,Ines Lopez Arteaga,2016-07-07 This treatment of modern topics related to the control of nonlinear systems is a collection of contributions celebrating the work of Professor Henk Nijmeijer and honoring his 60th birthday It addresses several topics that have been the core of Professor Nijmeijer s work namely the control of nonlinear systems geometric control theory synchronization coordinated control convergent systems and the control of underactuated systems The book presents recent advances in these areas contributed by leading international researchers in systems and control In addition to the theoretical questions treated in the text particular attention is paid to a number of applications including mobile robotics marine vehicles neural dynamics and mechanical systems generally This volume provides a broad picture of the analysis and control of nonlinear systems for scientists and engineers with an interest in the interdisciplinary field of systems and control theory The reader will benefit from the expert participants ideas on important open problems with contributions that represent the state of the art in nonlinear control Applied Differential Geometry: A Modern Introduction Vladimir G Ivancevic,Tijana T Ivancevic,2007-05-21 This graduate level monographic textbook treats applied differential geometry from a modern scientific perspective Co authored by the originator of the world s leading human motion simulator Human Biodynamics Engine a complex 264 DOF bio mechanical system modeled by differential geometric tools this is the first book that combines modern differential geometry with a wide spectrum of applications from modern mechanics and physics via nonlinear control to biology and human sciences The book is designed for a two semester course which gives mathematicians a variety of applications for their theory and physicists as well as other scientists and engineers a strong theory underlying their models **Contemporary Trends In Nonlinear Geometric Control Theory And Its Applications** Alfonso Anzaldo-meneses,Bernard Bonnard,Jean Paul Gauthier,Felipe Monroy Perez,2002-01-30 Mathematical control theory has evolved from the study of practical problems in engineering and sciences to the elaboration of deep important concepts in mathematics and applied sciences This volume concerns contemporary trends in nonlinear geometric control theory and its applications It is a fine collection of papers presenting new results relevant open problems and important applications regarding academic and real world problems The book is dedicated to Velimir Jurdjevic whose

scientific activity has been influential in the research of many of the authors It contains a number of articles specially written by colleagues and friends of Vel Jurdjevic all of them leading applied mathematicians and control theorists There is also place for surveys on topics of current research which present the state of the art of modern geometric control theory Finally the volume contains several new mathematical ideas generated by geometric control theory techniques which may initiate new directions of research beyond control theory Algebraic Methods for Nonlinear Control Systems Giuseppe Conte,Claude H. Moog,Anna Maria Perdon,2007-01-19 A self contained introduction to algebraic control for nonlinear systems suitable for researchers and graduate students Algebraic Methods for Nonlinear Control Systems develops a linear algebraic alternative to the usual differential geometric approach to nonlinear control using vector spaces over suitable fields of nonlinear functions It describes a range of results some of which can be derived using differential geometry but many of which cannot They include classical and generalized realization in the nonlinear context accessibility and observability recast for the linear algebraic setting discussion and solution of basic feedback problems results for dynamic and static state and output feedback Dynamic feedback and realization are shown to be dealt with and solved much more easily in the algebraic framework The second edition has been completely revised with new text examples and exercises it is divided into two parts necessary methodology and applications to control problems

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