Nonlinear Systems And Control Lecture 1 Introduction

For over a quarter of a century, high-gain observers have been used extensively in the design of output feedback control of nonlinear systems. This book presents a clear, unified treatment of the theory of high-gain observers and their use in feedback control. Also provided is a discussion of the separation principle for nonlinear systems; this differs from other separation results in the literature in that recovery of stability as well as performance of state feedback controllers is given. The author provides a detailed discussion of applications of high-gain observers to adaptive control and regulation problems and recent results on the extended high-gain observers. In addition, the author addresses two challenges that face the implementation of high-gain observers: high dimension and measurement noise. Low-power observers are presented for high-dimensional systems. The effect of measurement noise is characterized and techniques to reduce that effect are presented. The book ends with discussion of digital implementation of the observers. Readers will find comprehensive coverage of the main results on high-

gain observers; rigorous, self-contained proofs of all results; and numerous examples that illustrate and provide motivation for the results. The book is intended for engineers and applied mathematicians who design or research feedback control systems. Theincreasingcomplexityofspacevehiclessuchassatellites,andthecostreduction measures that have affected satellite operators are increasingly driving the need for more autonomy in satellite diagnostics and control systems. Current methods for detecting and correcting anomalies onboard the spacecraft as well as on the ground are primarily manual and labor intensive, and therefore, tend to be slow. Operators inspect telemetry data to determine the current satellite health. They use various statisticaltechniques andmodels,buttheanalysisandevaluation ofthelargevolume of data still require extensive human intervention and expertise that is prone to error. Furthermore, for spacecraft and most of these satellites, there can be potentially unduly long delays in round-trip communications between the ground station and the satellite. In this context, it is desirable to have onboard fault-diagnosis system that is capable of detecting, isolating, identifying or classifying faults in the

system withouttheinvolvementandinterventionofoperators.Towardthis end,theprinciple goal here is to improve the ef?ciency, accuracy, and reliability of the trend analysis and diagnostics techniques through utilization of intelligent-based and hybrid-based methodologies.
While conceptually elegant, the generic formulations of nonlinear model predictive control are not ready to use for the stabilization of relatively fast systems. This book presents a successful approach to this problem based on a co-operation between structural considerations and on-line optimization. It also provides research showing how generic predictive control schemes can be extended from slow process-based systems to a variety of fast systems.
This research monograph summarizes solutions to reconfigurable fault-tolerant control problems for nonlinear dynamical systems that are based on the fault-hiding principle. It emphasizes but is not limited to complete actuator and sensor failures. In the first part, the monograph starts with a broad introduction of the control reconfiguration problems and objectives as well as summaries and explanations of solutions for linear dynamical systems. The solution is always a reconfiguration block, which consists of linear virtual

actuators in the case of actuator faults and linear virtual sensors in the case of sensor faults. The main advantage of the fault-hiding concept is the reusability of the nominal controller, which remains in the loop as an active system while the virtual actuator and sensor adapt the control input and the measured output to the fault scenario. The second and third parts extend virtual actuators and virtual sensors towards the classes of Hammerstein-Wiener systems and piecewise affine systems. The main analyses concern stability recovery, setpoint tracking recovery, and performance recovery as reconfiguration objectives. The fourth part concludes the monograph with descriptions of practical implementations and case studies. The book is primarily intended for active researchers and practicing engineers in the field of fault-tolerant control. Due to many running examples it is also suitable for interested graduate students.

A Differential and Algebraic Viewpoint

Mathematical Methods for Robust and Nonlinear Control

Switching in Systems and Control

Noninteracting Control with Stability for Nonlinear Systems

Variable Structure Systems, Sliding Mode and Nonlinear Control

This book acquaints readers with recent developments in dynamical systems theory and its applications, with a strong focus on the control and estimation of nonlinear systems. Several algorithms are proposed and worked out for a set of model systems, in particular so-called input affine or bilinear systems, which can serve to approximate a wide class of nonlinear control systems. These can either take the form of state space models or be represented by an input-output equation. The approach taken here further highlights the role of modern mathematical and conceptual tools, including differential algebraic theory, observer design for nonlinear systems and generalized canonical forms.

Papers in this collection partly represent the set of talks that were presented at Texas Tech University on the occasion of Daya's memorial workshop in the year 2007. Daya had a varied interest in the field of Dynamics and Control Theory and the papers bring out the essence of his involvement in these activities. He also had a large number of collaborators and this collection represent a good fraction of them. The papers included here cover his interest in control theory. Also included are papers from application areas that we believe are of strong interest to him.

Applied Nonlinear Control

This book, published in honor of Professor Laurent Praly on the occasion of his 65th birthday, explores the responses of some leading international authorities to new challenges in nonlinear and adaptive control. The mitigation of the effects of uncertainty and nonlinearity – ubiquitous features of real-world engineering and natural systems – on closed-loop stability and robustness being of crucial importance, the contributions report the latest research into overcoming these difficulties in: autonomous systems; reset control systems; multiple-input–multiple-output nonlinear systems; input delays; partial differential equations; population games; and data-driven control. Trends in Nonlinear and Adaptive Control presents research inspired by and related to Professor Praly's lifetime of contributions to control theory and is a valuable addition to the literature of advanced control.

EPSRC Summer School

Nonlinear and Adaptive Control

A Tribute to Laurent Praly for his 65th Birthday

A Parametrized Approach for Fast Systems

Nonlinear Control Engineering

Stability and Stabilization of Nonlinear Systems

Over the past few years significant progress has been achieved in the field of nonlinear model predictive control (NMPC), also referred to as receding horizon control or moving horizon control. More than 250 papers have been published in 2006 in ISI Journals. With this book we want to bring together the contributions of a diverse group of internationally well recognized researchers and industrial practitioners, to critically assess the current status of the NMPC field and to discuss future directions and needs. The book consists of selected papers presented at the International Workshop on Assessment an Future Directions of Nonlinear Model Predictive Control that took place from September 5 to 9, 2008, in Pavia, Italy.

This volume deals with controllability and observability properties of nonlinear systems, as well as various ways to obtain input-output representations. The emphasis is on fundamental notions as (controlled) invariant distributions and submanifolds, together with algorithms to compute the required feedbacks.
This treatment of modern topics related to mathematical systems theory forms the proceedings of a workshop, Mathematical Systems Theory: From Behaviors to Nonlinear Control, held at the University of Groningen in July 2015. The workshop celebrated the work of Professors Arjan van der Schaft and Harry Trentelman, honouring their 60th Birthdays. The first volume of this two-volume work covers a variety of topics related to nonlinear and hybrid control systems. After giving a detailed account of the state of the art in the related topic, each chapter presents new results and discusses new directions. As such, this volume provides a broad picture of the theory of nonlinear and hybrid control 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 exciting new approaches to control and system theory and their predictions of future directions for the subject that were discussed at the workshop.
This work presents nonlinear control algorithms for a benchmark mechanical system actuated by different types of electric machinery, emphasizing system stability and robustness - pivotal in the development of optimal position trajectory controllers for common motors.;College or university bookstores may order five or more copies at a special student price, available on request from Marcel Dekker.

Reconfigurable Control of Nonlinear Dynamical Systems
Proceedings of the Joint Workshop on Feedback and Synthesis of Linear and Nonlinear Systems, Bielefeld/Rom
Towards New Challenging Applications
Linear and Nonlinear Control of Small-Scale Unmanned Helicopters
Lecture Notes on Nonlinear Control Systems
An LMI Approach

This book focuses on methods that relate, in one form or another, to the “small-gain theorem”. It is aimed at readers who are interested in learning methods for the design of feedback laws for linear and nonlinear multivariable systems in the presence of model uncertainties. With worked examples throughout, it includes both introductory material and more advanced topics. Divided into two parts, the first covers relevant aspects of linear-systems theory, the second, nonlinear theory. In order to deepen readers’ understanding, simpler single-input–single-output systems generally precede treatment of more complex multi-input–multi-output (MIMO) systems and linear systems precede nonlinear systems. This approach is used throughout, including in the final chapters, which explain the latest advanced ideas governing the stabilization, regulation, and tracking of nonlinear MIMO systems. Two major design problems are considered, both in the presence of model uncertainties: asymptotic stabilization with a “guaranteed region of attraction" of a given equilibrium point and asymptotic rejection of the effect of exogenous (disturbance) inputs on selected regulated outputs. Much of the introductory instructional material in this book has been developed for teaching students, while the final coverage of nonlinear MIMO systems offers readers a first coordinated treatment of completely novel results. The worked examples presented provide the instructor with ready-to-use material to help students to understand the mathematical theory. Readers should be familiar with the fundamentals of linear-systems and control theory. This book is a valuable resource for students following postgraduate programs in systems and control, as well as engineers working on the control of robotic, mechatronic and power systems.

The purpose of this book is twofold: To survey control system design methods based on the system inversion technique and to collect into one place the many recent results in the field. It has been known for some time that inverse systems may be used to solve numerous control problems. Despite the importance and conceptual simplicity of this topic there appears to be no monograph written on it. The purpose of this work is therefore to present and apply a systematic design method which bases itself on the fundamental system property of invertibility. Many different theoretical and practical aspects are considered in this volume working from elementary topics in the first section to current research in the second.

This book examines control of nonlinear systems. Coverage ranges from mathematical system theory to practical industrial control applications. The author offers web-based videos illustrating some dynamical aspects and case studies in simulation.

The underlying theory on which much modern robust and nonlinear control is based can be difficult to grasp. This volume is a collection of lecture notes presented by experts in advanced control engineering. The book is designed to provide a better grounding in the theory underlying several important areas of control. It is hoped the book will help the reader to apply otherwise abstruse ideas of nonlinear control in a variety of real systems.

A fault-hiding Approach

Nonlinear and Optimal Control Theory

Lecture Notes from FAP 2005

Inversion Method in the Discrete-time Nonlinear Control Systems Synthesis Problems

Notes on Lie Algebras

A Flatness-based Approach

The noninteracting control problem with stability consists of rendering a nonlinear system noninteractive while achieving internal stability. With the exception of systems with outputs partitioned into given blocks or when the state of the system is not available for feedback, this problem is well understood. However, this book provides a useful supplement to the standard texts on the nonlinear control theory and collects all the existing results on the nonlinear noninteracting control problem into a self-contained and extensive concept.

The lectures gathered in this volume present some of the different aspects of Mathematical Control Theory. Adopting the point of view of Geometric Control Theory and of Nonlinear Control Theory, the lectures focus on some aspects of the Optimization and Control of nonlinear, not necessarily smooth, dynamical systems. Specifically, three of the five lectures discuss respectively: logic-based switching control, sliding mode control and the input to the state stability paradigm for the control and stability of nonlinear systems. The remaining two lectures are devoted to Optimal Control: one investigates the connections between Optimal Control Theory, Dynamical Systems and Differential Geometry, while the

second presents a very general version, in a non-smooth context, of the Pontryagin Maximum Principle. The arguments of the whole volume are self-contained and are directed to everyone working in Control Theory. They offer a sound presentation of the methods employed in the control and optimization of nonlinear dynamical systems.
This book includes selected contributions by lecturers at the third annual Formation d'Automatique de Paris. It provides a well-integrated synthesis of the latest thinking in nonlinear optimal control, observer design, stability analysis and structural properties of linear systems, without the need for an exhaustive literature review. The internationally known contributors to this volume represent many of the most reputable control centers in Europe.
Although the problem of nonlinear controller design is as old as that of linear controller design, the systematic design methods framed in response are more sparse. Given the range and complexity of nonlinear systems, effective new methods of control design are therefore of significant importance. Dynamic Surface Control of Uncertain Nonlinear Systems provides a theoretically rigorous and practical introduction to nonlinear control design. The

convex optimization approach applied to good effect in linear systems is extended to the nonlinear case using the new dynamic surface control (DSC) algorithm developed by the authors. A variety of problems – DSC design, output feedback, input saturation and fault-tolerant control among them – are considered. The inclusion of applications material demonstrates the real significance of the DSC algorithm, which is robust and easy to use, for nonlinear systems with uncertainty in automotive and robotics. Written for the researcher and graduate student of nonlinear control theory, this book will provide the applied mathematician and engineer alike with a set of powerful tools for nonlinear control design. It will also be of interest to practitioners working with a mechatronic systems in aerospace, manufacturing and automotive and robotics, milieux.

Feedback Control of Linear and Nonlinear Systems

Nonlinear Control

Analysis, Stability, and Control

Nonlinear Model Predictive Control

Mathematical Control Theory I

Trends in Nonlinear and Adaptive Control

From the reviews: "The book is an excellent combination of theory and

real-world applications. Each application not only demonstrates the power of the theoretical results but also is important on its own behalf." IEEE Control Systems Magazine

"Neural Network-Based State Estimation of Nonlinear Systems" presents efficient, easy to implement neural network schemes for state estimation, system identification, and fault detection and Isolation with mathematical proof of stability, experimental evaluation, and Robustness against unmolded dynamics, external disturbances, and measurement noises.

This volume is based on the course notes of the 2nd NCN Pedagogical School, the second in the series of Pedagogical Schools in the frame work of the European TMR project, "Breakthrough in the control of nonlinear systems (Nonlinear Control Network)". The school consists of four courses that have been chosen to give a broad range of techniques for the analysis and synthesis of nonlinear control systems, and have been developed by leading experts in the field. The topics covered are: Differential Algebraic Methods in Nonlinear Systems; Nonlinear QFT; Hybrid Systems; Physics in Control. The book has a pedagogical character, and is specially directed to postgraduates in *most areas of engineering and applied sciences like mathematics and physics. It will also be of interest to researchers and practitioners needing a solid introduction to the above topics.*

The theory of switched systems is related to the study of hybrid systems, which has gained attention from control theorists, computer scientists, and practicing engineers. This book examines switched systems from a control-theoretic perspective, focusing on stability analysis and control synthesis of systems that combine continuous dynamics with switching events. It includes a vast bibliography and a section of technical and historical notes.

Concepts, Methodologies, and Applications

Nonlinear and Hybrid Control Systems

Lectures in Feedback Design for Multivariable Systems

Algorithms of Estimation for Nonlinear Systems

Explicit Nonlinear Model Predictive Control

Nonlinear Dynamical Control Systems

The authors present a study of the H-infinity control problem and related topics for descriptor systems, described by a set of nonlinear differential-algebraic equations. They derive necessary and sufficient conditions for

the existence of a controller solving the standard nonlinear H-infinity control problem considering both state and output feedback. One such condition for the output feedback control problem to be solvable is obtained in terms of Hamilton–Jacobi inequalities and a weak coupling condition; a parameterization of output feedback controllers solving the problem is also provided. All of these results are then specialized to the linear case. The derivation of state-space formulae for all controllers solving the standard H-infinity control problem for descriptor systems is proposed. Among other important topics covered are balanced realization, reduced-order controller design and mixed H2/H-infinity control. "H-infinity Control for Nonlinear Descriptor Systems" provides a comprehensive introduction and easy access to advanced topics.

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.

There has been significant interest for designing flight controllers for small-scale unmanned helicopters. Such helicopters preserve all the physical attributes of their full-scale counterparts, being at the same time more agile and dexterous. This book presents a comprehensive and well justified analysis for designing flight controllers for small-scale unmanned helicopters guarantying flight stability and tracking accuracy. The design of the flight controller is a critical and integral part for developing an autonomous helicopter platform. Helicopters are underactuated, highly nonlinear systems with significant dynamic coupling that needs to be considered and accounted for during controller design and

implementation. Most reliable mathematical tools for analysis of control systems relate to modern control theory. Modern control techniques are model-based since the controller architecture depends on the dynamic representation of the system to be controlled. Therefore, the flight controller design problem is tightly connected with the helicopter modeling. This book provides a step-by-step methodology for designing, evaluating and implementing efficient flight controllers for small-scale helicopters. Design issues that are analytically covered include: • An illustrative presentation of both linear and nonlinear models of ordinary differential equations representing the helicopter dynamics. A detailed presentation of the helicopter equations of motion is given for the derivation of both model types. In addition, an insightful presentation of the main rotor's mechanism, aerodynamics and dynamics is also provided. Both model types are of low complexity, physically meaningful and capable of encapsulating the dynamic behavior of a large class of small-scale helicopters. • An illustrative and rigorous derivation of mathematical control algorithms based on both the linear and nonlinear representation of the helicopter dynamics. Flight controller designs guarantee that the tracking objectives of the helicopter's inertial position (or velocity) and

heading are achieved. Each controller is carefully constructed by considering the small-scale helicopter's physical flight capabilities. Concepts of advanced stability analysis are used to improve the efficiency and reduce the complexity of the flight control system. Controller designs are derived in both continuous time and discrete time covering discretization issues, which emerge from the implementation of the control algorithm using microprocessors. • Presentation of the most powerful, practical and efficient methods for extracting the helicopter model parameters based on input/output responses, collected by the measurement instruments. This topic is of particular importance for real-life implementation of the control algorithms. This book is suitable for students and researches interested in the development and the mathematical derivation of flight controllers for small-scale helicopters. Background knowledge in modern control is required.

This book provides a broad overview of state-of-the-art research at the intersection of the Koopman operator theory and control theory. It also reviews novel theoretical results obtained and efficient numerical methods developed within the framework of Koopman operator theory. The contributions discuss the latest findings and techniques in several areas of

control theory, including model predictive control, optimal control, observer design, systems identification and structural analysis of controlled systems, addressing both theoretical and numerical aspects and presenting open research directions, as well as detailed numerical schemes and data-driven methods. Each contribution addresses a specific problem. After a brief introduction of the Koopman operator framework, including basic notions and definitions, the book explores numerical methods, such as the dynamic mode decomposition (DMD) algorithm and Arnoldi-based methods, which are used to represent the operator in a finite-dimensional basis and to compute its spectral properties from data. The main body of the book is divided into three parts: theoretical results and numerical techniques for observer design, synthesis analysis, stability analysis, parameter estimation, and identification; data-driven techniques based on DMD, which extract the spectral properties of the Koopman operator from data for the structural analysis of controlled systems; and Koopman operator techniques with specific applications in systems and control, which range from heat transfer analysis to robot control. A useful reference resource on the Koopman operator theory for control theorists and practitioners, the book is also of interest to graduate students,

researchers, and engineers looking for an introduction to a novel and comprehensive approach to systems and control, from pure theory to data-driven methods.

NCN4 2001

Application to Fault Detection and Isolation

Lectures given at the C.I.M.E. Summer School held in Cetraro, Italy, June 19-29, 2004

Techniques for Dynamical Analysis and Control

Nonlinear Systems

Neural Network-Based State Estimation of Nonlinear Systems

(Cartan sub Lie algebra, roots, Weyl group, Dynkin diagram, . . .) and the classification, as found by Killing and Cartan (the list of all semisimple Lie algebras consists of (1) the special- linear ones, i. e. all matrices (of any fixed dimension) with trace 0, (2) the orthogonal ones, i. e. all skewsymmetric ma trices (of any fixed dimension), (3) the symplectic ones, i. e. all matrices M (of any fixed even dimension) that satisfy M J = - J MT with a certain non-degenerate skewsymmetric matrix J, and (4) five special Lie

algebras G2, F , E , E , E , of dimensions 14,52,78,133,248, the "exceptional Lie 4 6 7 s algebras" , that just somehow appear in the process). There is also a discus sion of the compact form and other real forms of a (complex) semisimple Lie algebra, and a section on automorphisms. The third chapter brings the theory of the finite dimensional representations of a semisimple Lie alge bra, with the highest or extreme weight as central notion. The proof for the existence of representations is an ad hoc version of the present standard proof, but avoids explicit use of the Poincare-Birkhoff-Witt theorem. Complete reducibility is proved, as usual, with J. H. C. Whitehead's proof (the first proof, by H. Weyl, was analytical-topological and used the exis tence of a compact form of the group in question). Then come H.

These papers were presented at the first EC-TMR Nonlinear Control Network Workshop, on Stability and Stabilization of Nonlinear Systems, that took place in March 1999, Ghent, Belgium. The TMR programme offers a unique opportunity for *the academic community to expand their knowledge, share their experience and identify and discuss strategic issues in aspects of nonlinear control engineering. The aim is to create a resource centre of available expertise and research interests. This outstanding reference volume presents current and emerging research directions, including: Stability analysis of nonlinear dynamical systems and converse Lyapunov theorems; Stabilization and regulation of nonlinear dynamical control systems; Control of physical systems using physics-based Lyapunov functions and passivity, as well as bifurcation analysis and optimal control. This collection of peer-reviewed papers provides a comprehensive overview of this field of research for graduate students and researchers in engineering and applied mathematics.*

There has been much excitement over the emergence of new mathematical techniques for the analysis and control of nonlinear systems. In addition, great technological advances have bolstered the impact of analytic advances and produced *many new problems and applications which are nonlinear in an essential way. This book lays out in a concise mathematical framework the tools and methods of analysis which underlie this diversity of applications.*

This book provides a unique and alternative approach to the study of nonlinear control systems, with applications. The approach presented is based on the use of algebraic methods which are intrinsically linear, rather than differential geometric methods, which are more commonly found in other reference works on the subject. This allows the exposition to remain simple from a mathematical point of view, and accessible for everyone who has a good understanding of linear control theory. The book is divided into the following three parts: Part 1 is devoted to mathematical preliminaries and to the development of tools and methods for system analysis. Part 2 is concerned with solving specific control problems, including disturbance decoupling, non-interactive control, model matching and feedback linearization problems. Part 3 introduces differential *algebraic notions and discusses their applications to nonlinear control and system theory. With numerous examples used to illustrate theoretical results, this self-contained and comprehensive volume will be of interest to all those who have a good basic knowledge of standard linear control systems.*

An Algebraic Setting

The Koopman Operator in Systems and Control

Emergent Problems in Nonlinear Systems and Control

Dynamic Surface Control of Uncertain Nonlinear Systems

Advanced Topics in Control Systems Theory

Analysis and Control of Nonlinear Systems

This book comprises a selection of papers that were first presented at VSS98 (5th International Workshop on Variable Structure Systems) held in Sarasota, Florida. This workshop was the fifth in a series of VSS international workshops, and the first to be held in the United States. Work presented herein on theoretical developments and applications on VSS and Sliding Mode, reflects how trends have advanced beyond the original ideas that are now well documented in a number of books and research monographs. In particular, the concepts of Sliding Sector and Second Order Sliding Mode introduced in this volume, will stimulate discussions and invite further extensions. Also, the focus on Sampled Data systems represents a positive trend towards practical industrial implementations of sliding mode controllers.

For a first course on nonlinear control that can be taught in one semester This book emerges from the award-winning book, Nonlinear Systems, but has a distinctly different mission and organization. While Nonlinear Systems was intended as a reference and a text on nonlinear system analysis and its application to control, this streamlined book is intended as a text for a first course on nonlinear control. In Nonlinear Control, author Hassan K. Khalil employs a writing style that is intended to make the book accessible to a wider audience without compromising the rigor of the presentation. Teaching and Learning Experience This program will provide a better teaching and learning experience-for you and your students. It will help: *Provide an Accessible Approach to Nonlinear Control: This streamlined book is intended as a text for a first course on nonlinear control that can be taught in one semester. *Support Learning: Over 250 end-of-chapter exercises give students plenty of opportunities to put theory into action.

Nonlinear Model Predictive Control (NMPC) has become the accepted methodology to solve complex control problems related to process industries. The main motivation behind explicit NMPC is that an explicit state feedback law avoids the need for executing a numerical optimization algorithm in real time. The benefits of an explicit solution, in addition to the efficient on-line computations, include also verifiability of the implementation and the possibility to design embedded control systems with low software and hardware complexity. This book considers the multi-parametric Nonlinear Programming (mp-NLP) approaches to explicit approximate NMPC of constrained nonlinear systems, developed by the authors, as well as their applications to various NMPC problem formulations and several case studies. The following types of nonlinear systems are considered, resulting in different NMPC problem formulations: Nonlinear systems described by first-principles models and nonlinear systems described by black-box models; - Nonlinear systems with continuous control inputs and nonlinear systems with quantized control inputs; - Nonlinear systems without uncertainty and nonlinear systems with uncertainties (polyhedral description of uncertainty and stochastic description of uncertainty); - Nonlinear systems, consisting of interconnected nonlinear sub-systems. The proposed mp-NLP approaches are illustrated with applications to several case studies, which are taken from diverse areas such as automotive mechatronics, compressor control, combustion plant control, reactor control, pH maintaining system control, cart and spring system control, and diving computers.

The objective of the EU Nonlinear Control Network Workshop was to bring together scientists who are already active in nonlinear control and young researchers working in this field. This book presents selectively invited contributions from the workshop, some describing state-of-the-art subjects that already have a status of maturity while others propose promising future directions in nonlinear control. Amongst others, following topics of nonlinear and adaptive control are included: adaptive and robust control, applications in physical systems, distributed parameter systems, disturbance attenuation, dynamic feedback, optimal control, sliding mode control, and tracking and motion planning.

Applied Nonlinear Control

Robust Autonomous Guidance

Stabilization of Nonlinear Systems Using Receding-horizon Control Schemes

Nonlinear Control of Electric Machinery

Fault Diagnosis of Nonlinear Systems Using a Hybrid Approach

An Internal Model Approach

In this work, the authors present a global perspective on the methods available for analysis and design of non-linear control systems and detail specific applications. They provide a tutorial exposition of the major non-linear systems analysis techniques followed by a discussion of available non-linear design methods.

Nonlinear Control Systems

Advances in the Control of Nonlinear Systems

Theory and Applications

H-infinity Control for Nonlinear Descriptor Systems

High-Gain Observers in Nonlinear Feedback Control