Nonlinear H Infinity Controller For The Quad Rotor

A Practical Design Approach Using Neural Networks
Nonlinear Dynamics and Chaos
Nonlinear H2/H-Infinity Constrained Feedback Control
Kalman, H Infinity, and Nonlinear Approaches
Design of H [infinity] Stabilizing Controller for a Class of Nonlinear Systems Presented by Their Describing Functions
Stochastic H2/H ∞ Control: A Nash Game Approach
Control of Nonlinear Systems Via State Feedback State-dependent Riccati Equation Techniques
Select Proceedings of AEOTIT 2018
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2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT)
Analysis and Synthesis
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Foundations of Adaptive Control
Robust Control Design with MATLAB®
H [infinity] Controller Synthesis for Sampled-data Systems and Nonlinear Systems
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BREWER OCONNOR

A Practical Design Approach Using Neural Networks Springer
This volume discusses advances in applied nonlinear optimal control, comprising both theoretical analysis of the developed control methods and case studies about their use in robotics, mechatronics, electric power generation, power electronics, micro-electronics, biological systems, biomedical systems, financial systems and industrial production processes. The advantages of the nonlinear optimal control approaches which are developed here are that, by applying approximate linearization of the controlled systems' state-space description, one can avoid the elaborated state variables transformations (diffeomorphisms) which are required by global linearization-based control methods. The book also applies the control input directly to the power unit of the controlled systems and not on an equivalent linearized description, thus avoiding the inverse transformations met in global linearization-based control methods and the potential appearance of singularity problems. The method adopted here also retains the known advantages of optimal control, that is, the best trade-off between accurate tracking of reference setpoints and moderate variations of the control inputs. The book's findings on nonlinear optimal control are a substantial contribution to the areas of nonlinear control and complex dynamical systems, and will find use in several research and engineering disciplines and in practical applications.
Nonlinear Dynamics and Chaos Springer Science & Business Media
Presented in a tutorial style, this comprehensive treatment unifies, simplifies, and explains most of the techniques for

designing and analyzing adaptive control systems. Numerous examples clarify procedures and methods. 1995 edition.

Nonlinear H2/H-Infinity Constrained Feedback Control John Wiley & Sons

The purpose of this book is to present a self-contained description of the fun damentals of the theory of nonlinear control systems, with special emphasis on the differential geometric approach. The book is intended as a graduate text as weil as a reference to scientists and engineers involved in the analysis and design of feedback systems. The first version of this book was written in 1983, while I was teach ing at the Department of Systems Science and Mathematics at Washington University in St. Louis. This new edition integrates my subsequent teaching experience gained at the University of Illinois in Urbana-Champaign in 1987, at the Carl-Cranz Gesellschaft in Oberpfaffenhofen in 1987, at the University of California in Berkeley in 1988. In addition to a major rearrangement of the last two Chapters of the first version, this new edition incorporates two additional Chapters at a more elementary level and an exposition of some relevant research findings which have occurred since 1985.

Kalman, H Infinity, and Nonlinear Approaches Cambridge University Press

The 1990 Grainger Lectures delivered at the University of Illinois, Urbana-Champaign, September 28 - October 1, 1990 were devoted to a critical reexamination of the foundations of adaptive control. In this volume the lectures are expanded by most recent developments and solutions for some long-standing open problems. Concepts and approaches presented are both novel and of fundamental importance for adaptive control research in the 1990s. The papers in Part I present unifications, reappraisals and new results on tunability, convergence and robustness of adaptive linear control, whereas the papers in Part II formulate new problems in adaptive control of nonlinear systems and solve them without any linear constraints imposed on the nonlinearities.

Design of H [infinity] Stabilizing Controller for a Class of Nonlinear Systems Presented by Their Describing Functions Springer Science & Business Media

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.

Stochastic H2/H ∞ Control: A Nash Game Approach American Mathematical Soc.

Present state of the art advances, research and development in the area of unmanned aviation Educate faculty, students, scientists, engineers, researchers, practitioners, end users and the public about UAS Advance knowledge frontier in the area of UAS Couple technology advances with public policy, legal and ethical issues and privacy Provide the framework for integration of UAS into the national airspace design and build the next generation of unmanned systems that are safe, reliable and resilient

Control of Nonlinear Systems Via State Feedback State-dependent Riccati Equation Techniques CRC Press

This book is an introduction to optimal stochastic control for continuous time Markov processes and the theory of viscosity solutions. It covers dynamic programming for deterministic optimal control problems, as well as to the corresponding theory of viscosity solutions. New chapters in this second edition introduce the role of stochastic optimal control in portfolio optimization and in pricing derivatives in incomplete markets and two-controller, zero-sum differential games.

Select Proceedings of AEOTIT 2018 Springer Science & Business Media

Robust Control of Robots bridges the gap between robust control theory and applications, with a special focus on robotic manipulators. It is divided into three parts: robust control of regular, fully-actuated robotic manipulators; robust post-failure control of robotic manipulators; and robust control of cooperative robotic manipulators. In each chapter the mathematical concepts are illustrated with experimental results obtained with a two-manipulator system. They are presented in enough detail to allow readers to implement the concepts in their own systems, or in Control Environment for Robots, a MATLAB®-based simulation program freely available from the authors. The target audience for Robust Control of Robots includes researchers, practicing engineers, and graduate students interested in implementing robust and fault tolerant control methodologies to robotic manipulators.

With Aerospace Applications CRC Press

The authors have developed a methodology for control of nonlinear systems in the presence of long delays, with large and rapid variation in the actuation or sensing path, or in the presence of long delays affecting the internal state of a system. In addition to control synthesis, they introduce tools to quantify the performance and the robustness properties of the designs provided in the book. The book is based on the concept of predictor feedback and infinite-dimensional backstepping transformation for linear systems and the authors guide the reader from the basic ideas of the concept?with constant delays only on the input?all the way through to nonlinear systems with state-dependent delays on the input as well as on system states. Readers will find the book useful because the authors provide elegant and systematic treatments of long-standing problems in delay systems, such as systems with state-dependent delays that arise in many applications. In addition, the authors give all control designs by explicit formulae, making the book especially useful for engineers who have faced delay-related challenges and are concerned with actual implementations and they accompany all control designs with Lyapunov-based analysis for establishing stability and performance guarantees.

Linear Controller Design Springer Science & Business Media

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.

2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT) Springer

A comprehensive overview of nonlinear H∞ control theory for both continuous-time and discrete-time systems, Nonlinear H∞-Control, Hamiltonian Systems and Hamilton-Jacobi Equations covers topics as diverse as singular nonlinear H∞-control, nonlinear H∞ -filtering, mixed H2/ H∞-nonlinear control and filtering, nonlinear H∞-almost-disturbance-decoupling, and algorithms for solving the ubiquitous Hamilton-Jacobi-Isaacs equations. The link between the subject and analytical mechanics as well as the theory of partial differential equations is also elegantly summarized in a single chapter. Recent progress in developing computational schemes for solving the Hamilton-Jacobi equation (HJE) has facilitated the application of Hamilton-Jacobi theory in both mechanics and control. As there is currently no efficient systematic analytical or numerical approach for solving them, the biggest bottle-neck to the practical application of the nonlinear equivalent of the H∞-control theory has been the difficulty in solving the Hamilton-Jacobi-Isaacs partial differential-equations (or inequalities). In light of this challenge, the author hopes to inspire continuing research and discussion on this topic via examples and simulations, as well as helpful notes and a rich bibliography. Nonlinear H∞-Control, Hamiltonian Systems and Hamilton-Jacobi Equations was written for practicing professionals, educators, researchers and graduate students in electrical, computer, mechanical, aeronautical, chemical, instrumentation, industrial and systems engineering, as well as applied mathematics, economics and management.

Analysis and Synthesis Springer Science & Business Media

A comprehensive overview of nonlinear H� control theory for both continuous-time and discrete-time systems, Nonlinear H�-Control, Hamiltonian Systems and Hamilton-Jacobi Equations covers topics as diverse as singular nonlinear H�-control, nonlinear H � -filtering, mixed H2/ H�-nonlinear control and filtering, nonlinear H�-almost-disturbance-decoupling, and algorithms for solving the ubiquitous Hamilton-Jacobi-Isaacs equations. The link between the subject and analytical mechanics as well as the theory of partial differential equations is also elegantly summarized in a single chapter. Recent progress in developing computational schemes for solving the Hamilton-Jacobi equation (HJE) has facilitated the application of Hamilton-Jacobi theory in both mechanics and control. As there is currently no efficient systematic analytical or numerical approach for solving them, the biggest bottle-neck to the practical application of the nonlinear equivalent of the H�-control theory has been the difficulty in solving the Hamilton-Jacobi-Isaacs partial differential-equations (or inequalities). In light of this challenge, the author hopes to inspire continuing research and discussion on this topic via examples and simulations, as well as helpful notes and a rich bibliography. Nonlinear H�-Control, Hamiltonian Systems and Hamilton-Jacobi Equations was written for practicing professionals, educators, researchers and graduate students in electrical, computer, mechanical, aeronautical, chemical, instrumentation, industrial and systems engineering, as well as applied mathematics, economics and management.

Robust Control of Robots Springer Science & Business Media
This book presents methods to study the controllability and the stabilization of nonlinear control systems in finite and infinite dimensions. The emphasis is put on specific phenomena due to nonlinearities. In particular, many examples are given where nonlinearities turn out to be essential to get controllability or stabilization. Various methods are presented to study the controllability or to construct stabilizing feedback laws. The power of these methods is illustrated by numerous examples coming from such areas as celestial mechanics, fluid mechanics, and quantum mechanics. The book is addressed to graduate students in mathematics or control theory, and to mathematicians or engineers with an interest in nonlinear control systems governed by ordinary or partial differential equations.

Applied Nonlinear Control Courier Corporation
Nonlinear regulation and nonlinear H-infinity control via state-dependent Riccati equation (SDRE) techniques are considered. Relationships between SDREs and Hamilton-Jacobi/Bellman inequalities/equations are examined, and a necessary condition for existence of solutions involving nonlinear stabilizability is derived. A single additional necessary criterion is given for the SDRE methods to yield the optimal control or guaranteed induced L2 gain properties. Pointwise stabilizability and detectability of factorizations prove necessary and sufficient, respectively, for well-posedness of standard numerical implementations of suboptimal SDRE regulators, but neither proves necessary if analytical solutions are allowed. For scalar analytic systems or those with full rank constant control input matrices, stabilizability and nonsingularity of the state weighting matrix function result in local and global asymptotic stability, respectively, due to equivalence between nonlinear and factored controllability in these cases. A proof of asymptotic stability for sampled data analytic SDRE controllers is also given, but restrictive assumptions make the main utility of these results guidance in choosing appropriate system factorizations. Conditions for exponential stability are also derived. All results are extendable to SDRE nonlinear H-infinity control with additional assumptions. The SDRE theory is illustrated by application to momentum

control of a dual-spin satellite and comparison with other current methods.

Springer Science & Business Media

Robust and Adaptive Control shows the reader how to produce consistent and accurate controllers that operate in the presence of uncertainties and unforeseen events. Driven by aerospace applications the focus of the book is primarily on continuous-dynamical systems. The text is a three-part treatment, beginning with robust and optimal linear control methods and moving on to a self-contained presentation of the design and analysis of model reference adaptive control (MRAC) for nonlinear uncertain dynamical systems. Recent extensions and modifications to MRAC design are included, as are guidelines for combining robust optimal and MRAC controllers. Features of the text include: · case studies that demonstrate the benefits of robust and adaptive control for piloted, autonomous and experimental aerial platforms; · detailed background material for each chapter to motivate theoretical developments; · realistic examples and simulation data illustrating key features of the methods described; and · problem solutions for instructors and MATLAB® code provided electronically. The theoretical content and practical applications reported address real-life aerospace problems, being based on numerous transitions of control-theoretic results into operational systems and airborne vehicles that are drawn from the authors' extensive professional experience with The Boeing Company. The systems covered are challenging, often open-loop unstable, with uncertainties in their dynamics, and thus requiring both persistently reliable control and the ability to track commands either from a pilot or a guidance computer. Readers are assumed to have a basic understanding of root locus, Bode diagrams, and Nyquist plots, as well as linear algebra, ordinary differential equations, and the use of state-space methods in analysis and modeling of dynamical systems. Robust and Adaptive Control is intended to methodically teach senior undergraduate and graduate students how to construct stable and predictable control algorithms for realistic industrial applications. Practicing engineers and academic researchers will also find the book of great instructional value.

The Singular Case Birkhauser

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.

Robust Adaptive Control Springer Science & Business Media

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.

Advanced H∞ Control SIAM

This book provides techniques to produce robust, stable and useable solutions to problems of H-infinity and H2 control in high-performance, non-linear systems for the first time. The book is of importance to control designers working in a variety of industrial systems. Case studies are given and the design of nonlinear control systems of the same caliber as those obtained in recent years using linear optimal and bounded-norm designs is explained.

Extending H-infinity Control to Nonlinear Systems CRC Press

A comprehensive overview of nonlinear H∞ control theory for both continuous-time and discrete-time systems, Nonlinear H∞-Control, Hamiltonian Systems and Hamilton-Jacobi Equations covers topics as diverse as singular nonlinear H∞-control, nonlinear H∞ -filtering, mixed H2/ H∞-nonlinear control and filtering, nonlinear H∞-almost-disturbance-decoupling, and algorithms for solving the ubiquitous Hamilton-Jacobi-Isaacs equations. The link between the subject and analytical mechanics as well as the theory of partial differential equations is also elegantly summarized in a single chapter. Recent progress in developing computational schemes for solving the Hamilton-Jacobi equation (HJE) has facilitated the application of Hamilton-Jacobi theory in both mechanics and control. As there is currently no efficient systematic analytical or numerical approach for solving them, the biggest bottle-neck to the practical application of the nonlinear equivalent of the H∞-control theory has been the difficulty in solving the Hamilton-Jacobi-Isaacs partial differential-equations (or inequalities). In light of this challenge, the author hopes to inspire continuing research and discussion on this topic via examples and simulations, as well as helpful notes and a rich bibliography. Nonlinear H∞-Control, Hamiltonian Systems and Hamilton-Jacobi Equations was written for practicing professionals, educators, researchers and graduate students in electrical, computer, mechanical, aeronautical, chemical, instrumentation, industrial and systems engineering, as well as applied mathematics, economics and management.

High-Gain Observers in Nonlinear Feedback Control

Springer Science & Business Media

A bottom-up approach that enables readers to master and apply the latest techniques in state estimation This book offers the best mathematical approaches to estimating the state of a general system. The author presents state estimation theory clearly and rigorously, providing the right amount of advanced material, recent research results, and references to enable the reader to apply state estimation techniques confidently across a variety of fields in science and engineering. While there are other textbooks that treat state estimation, this one offers special features and a unique perspective and pedagogical approach that speed learning: * Straightforward, bottom-up approach begins with basic concepts and then builds step by step to more advanced topics for a clear understanding of state estimation * Simple examples and problems that require only paper and pen to solve lead to an intuitive understanding of how theory works in practice * MATLAB(r)-based source code that corresponds to examples in the book, available on the author's Web site, enables readers to recreate results and experiment with other simulation setups and parameters Armed with a solid foundation in the basics, readers are presented with a careful treatment of advanced topics, including unscented filtering, high order nonlinear filtering, particle filtering, constrained state estimation, reduced order filtering, robust Kalman filtering, and mixed Kalman/H? filtering. Problems at the end of each chapter include both written exercises and computer exercises. Written exercises focus on improving the reader's understanding of theory and key concepts, whereas computer exercises help readers apply theory to problems similar to ones they are likely to encounter in industry. With its expert blend of theory and practice, coupled with its presentation of recent research results, Optimal State Estimation is strongly recommended for undergraduate and graduate-level courses in optimal control and state estimation theory. It also serves as a reference for engineers and science professionals across a wide array of industries.