

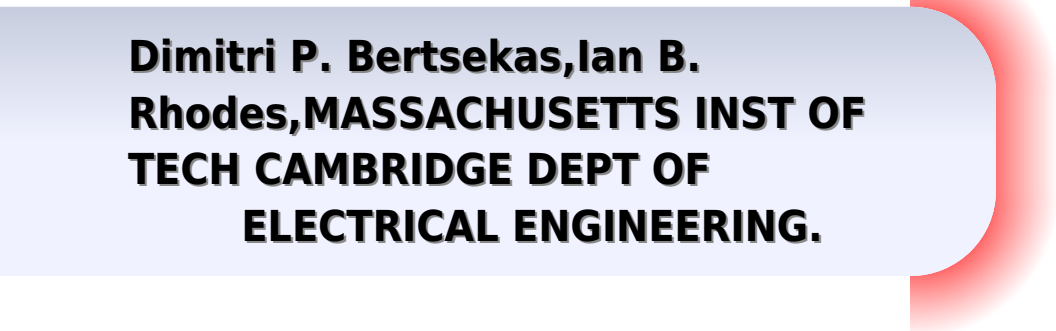
Rama K. Yedavalli

Robust Control of Uncertain Dynamic Systems

A Linear State Space Approach

Control Of Uncertain Dynamic Systems

**Dimitri P. Bertsekas, Ian B.
Rhodes, MASSACHUSETTS INST OF
TECH CAMBRIDGE DEPT OF
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Control Of Uncertain Dynamic Systems:

Robust Control of Uncertain Dynamic Systems Rama K. Yedavalli, 2013-12-05 This textbook aims to provide a clear understanding of the various tools of analysis and design for robust stability and performance of uncertain dynamic systems. In model based control design and analysis mathematical models can never completely represent the real world system that is being modeled and thus it is imperative to incorporate and accommodate a level of uncertainty into the models. This book directly addresses these issues from a deterministic uncertainty viewpoint and focuses on the interval parameter characterization of uncertain systems. Various tools of analysis and design are presented in a consolidated manner. This volume fills a current gap in published works by explicitly addressing the subject of control of dynamic systems from linear state space framework namely using a time domain matrix theory based approach. This book also presents and formulates the robustness problem in a linear state space model framework. Illustrates various systems level methodologies with examples and applications drawn from aerospace electrical and mechanical engineering. Provides connections between Lyapunov based matrix approach and the transfer function based polynomial approaches. **Robust Control of Uncertain Dynamic Systems: A Linear State Space Approach** is an ideal book for first year graduate students taking a course in robust control in aerospace mechanical or electrical engineering.

Control of Uncertain Dynamic Systems Shankar P. Bhattacharyya, Lee H. Keel, 2020-09-23 This book is a collection of 34 papers presented by leading researchers at the International Workshop on Robust Control held in San Antonio Texas in March 1991. The common theme tying these papers together is the analysis, synthesis and design of control systems subject to various uncertainties. The papers describe the latest results in parametric uncertainty, H_∞ control and Quantitative Feedback Theory (QFT). The book is the first to bring together all the diverse points of view addressing the robust control problem and should strongly influence development in the robust control field for years to come. For this reason control theorists, engineers and applied mathematicians should consider it a crucial acquisition for their libraries.

Control of Uncertain Dynamic Systems S. P. Bhattacharyya, L. H. Keel, 1991

Resilient Control of Uncertain Dynamical Systems Magdi S. Mahmoud, 2004-05-18 This monograph provides a complete description of resilient control theory. It unifies the methods for developing resilient controllers and filters for a class of uncertain dynamical systems and reports recent advances in design methodologies. The book presents an introductory and comprehensive treatment of resilient controller design methods, placing great emphasis on the derivation of necessary and sufficient design conditions and on the use of linear matrix inequalities as a convenient computational tool. The book can be used as a graduate level textbook in control engineering or applied mathematics as well as a reference for practicing engineers, researchers and students.

Estimators for Uncertain Dynamic Systems A.I. Matasov, 2012-12-06 When solving the control and design problems in aerospace and naval engineering, energetics, economics, biology etc, we need to know the state of investigated dynamic processes. The presence of inherent uncertainties in the description of these

processes and of noises in measurement devices leads to the necessity to construct the estimators for corresponding dynamic systems. The estimators recover the required information about system state from measurement data. An attempt to solve the estimation problems in an optimal way results in the formulation of different variational problems. The type and complexity of these variational problems depend on the process model, the model of uncertainties and the estimation performance criterion. A solution of variational problem determines an optimal estimator. However, there exist at least two reasons why we use nonoptimal estimators. The first reason is that the numerical algorithms for solving the corresponding variational problems can be very difficult for numerical implementation. For example, the dimension of these algorithms can be very high.

Adaptive Control of Dynamic Systems with Uncertainty and Quantization Jing Zhou, Lantao Xing, Changyun Wen, 2021-12-14. This book presents a series of innovative technologies and research results on adaptive control of dynamic systems with quantization uncertainty and nonlinearity, including the theoretical success and practical development such as the approaches for stability analysis, the compensation of quantization, the treatment of subsystem interactions and the improvement of system tracking and transient performance. Novel solutions by adopting backstepping design tools to a number of hotspots and challenging problems in the area of adaptive control are provided. In the first three chapters, the general design procedures and stability analysis of backstepping controllers and the basic descriptions and properties of quantizers are introduced as preliminary knowledge for this book. In the remainder of this book, adaptive control schemes are introduced to compensate for the effects of input quantization, state quantization, both input and state output quantization for uncertain nonlinear systems and are applied to helicopter systems and DC Microgrid. Discussion remarks are provided in each chapter, highlighting new approaches and contributions to emphasize the novelty of the presented design and analysis methods. Simulation results are also given in each chapter to show the effectiveness of these methods. This book is helpful to learn and understand the fundamental backstepping schemes for state feedback control and output feedback control. It can be used as a reference book or a textbook on adaptive quantized control for students with some background in feedback control systems. Researchers, graduate students and engineers in the fields of control, information and communication, electrical engineering, mechanical engineering, computer science and others will benefit from this book.

Robust Control Design for Uncertain Dynamic Systems Ye-Hwa Chen, Georgia Institute of Technology. Mechanical Engineering. Project E-25-678, 1990.

Control and Dynamic Systems V50: Robust Control System Techniques and Applications C.T. Leonides, 2012-12-02. Control and Dynamic Systems Advances in Theory and Applications Volume 50. Robust Control System Techniques and Applications Part 1 of 2 is a two-volume sequence devoted to the issues and application of robust control systems techniques. This volume is composed of 10 chapters and begins with a presentation of the important techniques for dealing with conflicting design objectives in control systems. The subsequent chapters describe the robustness techniques of systems using differential difference equations, the design of a wide class of robust nonlinear systems, the techniques for

dealing with the problems resulting from the use of observers in robust systems design and the effective techniques for the robust control on non linear time varying of tracking control systems with uncertainties These topics are followed by discussions of the effective techniques for the robust control on non linear time varying of tracking control systems with uncertainties and for incorporating adaptive control techniques into a non adaptive robust control design Other chapters present techniques for achieving exponential and robust stability for a rather general class of nonlinear systems techniques in modeling uncertain dynamics for robust control systems design and techniques for the optimal synthesis of these systems The last chapters provide a generalized eigenproblem solution for both singular and nonsingular system cases These chapters also look into the stability robustness design for discrete time systems This book will be of value to process and systems engineers designers and researchers

Structural Dynamic Systems Computational Techniques and Optimization
Cornelius T. Leondes, 1999 Conventional seismic design has been based on structural strength in the initial design of structures resulting in lateral force resisting systems with sufficient strength to be able to absorb and dissipate the seismic For important structures such as urban high speed road systems high rise buildings hospitals airports and other essential structures which must be quite functional after an earthquake modern seismic structural design techniques have been developed with a view toward eliminating or significantly reducing seismic damage to such structures This volume is a comprehensive treatment of the issues involved in modern seismic design techniques for structure with a view to significantly enhancing their capability of surviving earthquakes to an adequate degree i e enhancing the ability of structural systems to withstand high level earthquakes

Robust Control Design for Uncertain Nonlinear Dynamic Systems
Myung-Chul Han, 1992 **Performance-Driven Robust Identification and Control of Uncertain Dynamical Systems**, 2001 The grant DEFG02 97ER13939 from the Department of Energy has supported our research program on robust identification and control of uncertain dynamical systems initially for the three year period June 15 1997 June 14 2000 which was then extended on a no cost basis for another year until June 14 2001 This final report provides an overview of our research conducted during this period along with a complete list of publications supported by the Grant Within the scope of this project we have studied fundamental issues that arise in modeling identification filtering control stabilization control based model reduction decomposition and aggregation and optimization of uncertain systems The mathematical framework we have worked in has allowed the system dynamics to be only partially known with the uncertainties being of both parametric or structural nature and further the dynamics to be perturbed by unknown dynamic disturbances Our research over these four years has generated a substantial body of new knowledge and has led to new major developments in theory applications and computational algorithms These have all been documented in various journal articles and book chapters and have been presented at leading conferences as to be described A brief description of the results we have obtained within the scope of this project can be found in Section 3 To set the stage for the material of that section we first provide in the next

section Section 2 a brief description of the issues that arise in the control of uncertain systems and introduce several criteria under which optimality will lead to robustness and stability Section 4 contains a list of references cited in these two sections A list of our publications supported by the DOE Grant covering the period June 15 1997 June 14 2001 comprises Section 5 of the report

Robust Control of Nonlinear Uncertain Systems Zhihua Qu, 1998-04-29 This timely work presents the definitive treatment of stability analysis and robust control design for nonlinear uncertain systems While other books on the subject deal with robust control in linear systems this is the first book to tackle robust control design for such nonlinear entities as power systems robotics and more It combines examples proofs and applications clearly showing how to build high performance and better control into systems that are too complex to be modeled accurately A unique feature of this book is its Lyapunov based approach to control design which is the only universal approach for nonlinear systems The Lyapunov direct method is used here to develop all design procedures to correlate leading techniques in the field to the structural properties of uncertain systems and to compare robust and nonrobust types of controls such as adaptive control learning control and optimal control The subject is introduced with a self contained treatment of the nonlinear stability theory originally proposed by Lyapunov and LaSalle Emphasizing the basics the introductory chapters incorporate three types of solutions stability concepts and various theorems The main body of the text offers a comprehensive treatment for current design methods including state space robust control designs properties of various robust controllers input output control and discrete robust control designs In *Robust Control of Nonlinear Uncertain Systems* author Zhihua Qu presents the complete set of control design procedures for nonlinear uncertain systems including backward recursive design forward recursive design recursive interlacing design feedback linearization nonlinear optimal control and sub optimal control Also featured here is the breakthrough recursive interlacing design that facilitates robust control for uncertain systems with all cascaded feedback and feedforward dynamics Throughout Professor Qu presents the pros and cons of specific methods rationales for choosing particular design parameters and tips on questions of stability performance and systems structure For engineers and graduate students in mechanical electrical and aerospace engineering *Robust Control of Nonlinear Uncertain Systems* imparts the technical know how for effective design explores key theoretical issues in control and provides insight into future trends in the field

Journal of Dynamic Systems, Measurement, and Control, 2001 Publishes theoretical and applied original papers in dynamic systems Theoretical papers present new theoretical developments and knowledge for controls of dynamical systems together with clear engineering motivation for the new theory Applied papers include modeling simulation and corroboration of theory with emphasis on demonstrated practicality

The Design of Control Laws for Uncertain Dynamic Systems Using Stochastic Robustness Metrics Christopher Ian Marrison, 1995

Uncertain Dynamical Systems A.A. Martynyuk, Yu. A. Martynyuk-Chernienko, 2011-11-28 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 above mentioned type of equations along with some applications Without assuming specific knowledge of uncertain dynamical systems the book includes many fundamental facts about dynamical behaviour of its solutions Giving a concise review of current research developments Uncertain Dynamical Systems Stability and Motion Control Details all proofs of stability conditions for five classes of uncertain systems Clearly defines all used notions of stability and control theory Contains an extensive bibliography facilitating quick access to specific subject areas in each chapter Requiring only a fundamental knowledge of general theory of differential equations and calculus this book serves as an excellent text for pure and applied mathematicians applied physicists industrial engineers operations researchers and upper level undergraduate and graduate students studying ordinary differential equations impulse equations dynamic equations on time scales and set differential equations

Robust Control of Uncertain Nonlinear Dynamical Systems Ahmad Abdalla,1994 **Robust control synthesis for uncertain dynamical systems** Kuk Whan Byun,1990

Variable-Structure Approaches Andreas Rauh,Luise Senkel,2016-05-17 This edited book aims at presenting current research activities in the field of robust variable structure systems The scope equally comprises highlighting novel methodological aspects as well as presenting the use of variable structure techniques in industrial applications including their efficient implementation on hardware for real time control The target audience primarily comprises research experts in the field of control theory and nonlinear dynamics but the book may also be beneficial for graduate students

On the Minimax Feedback Control of Uncertain Dynamic Systems Dimitri P. Bertsekas,Ian B. Rhodes,MASSACHUSETTS INST OF TECH CAMBRIDGE DEPT OF ELECTRICAL ENGINEERING.,1972 In the paper the problem of optimal feedback control of uncertain discrete time dynamic systems is considered where the uncertain quantities do not have a stochastic description but instead are known to belong to given sets The problem is concerted to a sequential minimax problem and dynamic programming is suggested as a general method for its solution The notion of a sufficiently informative function which parallels the notion of a sufficient statistic of stochastic optimal control is introduced and conditions under which the optimal controller decomposes into an estimator and an actuator are identified Author **Control and Estimation of Uncertain Dynamic Systems Described by Difference Inclusions** Spyros Savva Andreou,1995

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