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**Linear Parameter-Varying Control for Engineering Applications**-Andrew P. White
2013-03-30 The subject of this brief is the application of linear parameter-varying (LPV) control to a class of dynamic systems to provide a systematic synthesis of gain-scheduling controllers with guaranteed stability and performance. An important step in LPV control design, which is not well covered in the present
literature, is the selection of weighting functions. The proper selection of weighting functions tunes the controller to obtain the desired closed-loop response. The selection of appropriate weighting functions is difficult and sometimes appears arbitrary. In this brief, gain-scheduling control with engineering applications is covered in detail, including the LPV modeling, the control problem formulation, and the weighting function optimization. In addition, an iterative algorithm for obtaining optimal output weighting functions with respect to the H2 norm bound is presented in this brief. Using this algorithm, the selection of appropriate weighting functions becomes an automatic process. The LPV design and control synthesis procedures in this brief are illustrated using: • air-to-fuel ratio control for port-fuel-injection engines; • variable valve timing control; and • application to a vibration control problem. After reading this brief, the reader will be able to apply its concepts to design gain-scheduling controllers for their own engineering applications. This brief provides detailed step-by-step LPV modeling and control design strategies along with an automatic weight-selection algorithm so that engineers can apply state-of-the-art LPV control synthesis to solve their own engineering problems. In addition, this brief should serve as a bridge between the H-infinity and H2 control theory and the real-world application of gain-scheduling control.

Control of Linear Parameter Varying Systems with Applications-Javad Mohammadpour 2012-03-08 Control of Linear Parameter Varying Systems compiles state-of-the-art contributions on novel analytical and computational methods for addressing system identification, model reduction, performance analysis and feedback control design and addresses address theoretical developments, novel computational approaches and illustrative applications to various fields. Part I discusses modeling and system identification of linear parameter varying systems, Part II covers the importance of analysis and control design when working with linear parameter varying systems.
Finally, Part III presents an applications based approach to linear parameter varying systems, including modeling of a turbocharged diesel engines, Multivariable control of wind turbines, modeling and control of aircraft engines, control of an autonomous underwater vehicles and analysis and synthesis of re-entry vehicles.

**Linear Parameter-Varying and Time-Delay Systems**-Corentin Briat 2014-09-03 This book provides an introduction to the analysis and control of Linear Parameter-Varying Systems and Time-Delay Systems and their interactions. The purpose is to give the readers some fundamental theoretical background on these topics and to give more insights on the possible applications of these theories. This self-contained monograph is written in an accessible way for readers ranging from undergraduate/PhD students to engineers and researchers willing to know more about the fields of time-delay systems, parameter-varying systems, robust analysis, robust control, gain-scheduling techniques in the LPV fashion and LMI based approaches. The only prerequisites are basic knowledge in linear algebra, ordinary differential equations and (linear) dynamical systems. Most of the results are proved unless the proof is too complex or not necessary for a good understanding of the results. In the latter cases, suitable references are systematically provided. The first part pertains on the representation, analysis and control of LPV systems along with a reminder on robust analysis and control techniques. The second part is concerned with the representation and analysis of time-delay systems using various time-domain techniques. The third and last part is devoted to the representation, analysis, observation, filtering and control of LPV time-delay systems. The book also presents many important basic and advanced results on the manipulation of LMIs.

**Modeling and Identification of Linear Parameter-Varying Systems**-Roland Toth 2010-06-13 Through the past 20 years, the
framework of Linear Parameter-Varying (LPV) systems has become a promising system theoretical approach to handle the control of mildly nonlinear and especially position dependent systems which are common in mechatronic applications and in the process industry. The birth of this system class was initiated by the need of engineers to achieve better performance for nonlinear and time-varying dynamics, common in many industrial applications, than what the classical framework of Linear Time-Invariant (LTI) control can provide. However, it was also a primary goal to preserve simplicity and “re-use” the powerful LTI results by extending them to the LPV case. The progress continued according to this philosophy and LPV control has become a well established field with many promising applications. Unfortunately, modeling of LPV systems, especially based on measured data (which is called system identification) has seen a limited development since the birth of the framework. Currently, this bottleneck of the LPV framework is halting the transfer of the LPV theory into industrial use. Without good models that fulfill the expectations of the users and without the understanding how these models correspond to the dynamics of the application, it is difficult to design high performance LPV control solutions. This book aims to bridge the gap between modeling and control by investigating the fundamental questions of LPV modeling and identification. It explores the missing details of the LPV system theory that have hindered the formulation of a well-established identification framework.

Robust Control and Linear Parameter Varying Approaches - Olivier Sename
2013-02-01 Vehicles are complex systems (nonlinear, multi-variable) where the abundance of embedded controllers should ensure better security. This book aims at emphasizing the interest and potential of Linear Parameter Varying methods within the framework of vehicle dynamics, e.g. proposed control-oriented model, complex enough to handle some system non
linearities but still simple for control or observer design, take into account the adaptability of the vehicle's response to driving situations, to the driver request and/or to the road solicitations, manage interactions between various actuators to optimize the dynamic behavior of vehicles. This book results from the 32th International Summer School in Automatic that held in Grenoble, France, in September 2011, where recent methods (based on robust control and LPV technics), then applied to the control of vehicle dynamics, have been presented. After some theoretical background and a view on some recent works on LPV approaches (for modelling, analysis, control, observation and diagnosis), the main emphasis is put on road vehicles but some illustrations are concerned with railway, aerospace and underwater vehicles. The main objective of the book is to demonstrate the value of this approach for controlling the dynamic behavior of vehicles. It presents, in a rm way, background and new results on LPV methods and their application to vehicle dynamics.

Linear Parameter-varying System Identification-Paulo Lopes dos Santos 2012 This review volume reports the state-of-the-art in Linear Parameter Varying (LPV) system identification. It focuses on the most recent LPV identification methods for both discrete-time and continuous-time models--

Linear Parameter-Varying Control for Engineering Applications-Andrew P. White 2013-04-02 The subject of this brief is the application of linear parameter-varying (LPV) control to a class of dynamic systems to provide a systematic synthesis of gain-scheduling controllers with guaranteed stability and performance. An important step in LPV control design, which is not well covered in the present literature, is the selection of weighting functions. The proper selection of weighting functions tunes the controller to obtain the desired closed-loop response. The selection of appropriate weighting functions is difficult and sometimes appears
arbitrary. In this brief, gain-scheduling control with engineering applications is covered in detail, including the LPV modeling, the control problem formulation, and the weighting function optimization. In addition, an iterative algorithm for obtaining optimal output weighting functions with respect to the H2 norm bound is presented in this brief. Using this algorithm, the selection of appropriate weighting functions becomes an automatic process. The LPV design and control synthesis procedures in this brief are illustrated using: • air-to-fuel ratio control for port-fuel-injection engines; • variable valve timing control; and • application to a vibration control problem. After reading this brief, the reader will be able to apply its concepts to design gain-scheduling controllers for their own engineering applications. This brief provides detailed step-by-step LPV modeling and control design strategies along with an automatic weight-selection algorithm so that engineers can apply state-of-the-art LPV control synthesis to solve their own engineering problems. In addition, this brief should serve as a bridge between the H-infinity and H2 control theory and the real-world application of gain-scheduling control.

Advanced Linear Parameter Varying Control for Systems with Delays, Saturation and Implementation Constraints - Feng Zhang 2005

Robust Control Design for Active Driver Assistance Systems - Péter Gáspár 2016-11-18
This monograph focuses on control methods that influence vehicle dynamics to assist the driver in enhancing passenger comfort, road holding, efficiency and safety of transport, etc., while maintaining the driver’s ability to override that assistance. On individual-vehicle-component level the control problem is formulated and solved by a unified modelling and design method provided by the linear parameter varying (LPV) framework. The global behaviour desired is achieved by a judicious interplay between the individual components, guaranteed by an integrated control mechanism. The integrated
control problem is also formalized and solved in the LPV framework. Most important among the ideas expounded in the book are: application of the LPV paradigm in the modelling and control design methodology; application of the robust LPV design as a unified framework for setting control tasks related to active driver assistance; formulation and solution proposals for the integrated vehicle control problem; proposal for a reconfigurable and fault-tolerant control architecture; formulation and solution proposals for the plug-and-play concept; detailed case studies. Robust Control Design for Active Vehicle Assistance Systems will be of interest to academic researchers and graduate students interested in automotive control and to control and mechanical engineers working in the automotive industry. Advances in Industrial Control aims to report and encourage the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

**Linear Parameter Varying Control for Complex Engineering Systems**-Mona Meisami-Azad 2011

**Linear Parameter-Varying System Identification**-Paulo Lopes dos Santos 2012 This review volume reports the state-of-the-art in Linear Parameter Varying (LPV) system identification. Written by world renowned researchers, the book contains twelve chapters, focusing on the most recent LPV identification methods for both discrete-time and continuous-time models, using different approaches such as optimization methods for input/output LPV models Identification, set membership methods, optimization methods and subspace methods for state-space LPV models identification and orthonormal basis functions methods. Since there is a strong connection between LPV systems, hybrid switching systems and piecewise
affine models, identification of hybrid switching systems and piecewise affine systems will be considered as well.

**Linear Parameter Varying Control for Actuator Failure**: Jong-Yeob Shin 2002 A robust linear parameter varying (LPV) control synthesis is carried out for an HiMAT vehicle subject to loss of control effectiveness. The scheduling parameter is selected to be a function of the estimates of the control effectiveness factors. The estimates are provided on-line by a two-stage Kalman estimator. The inherent conservatism of the LPV design is reducing through the use of a scaling factor on the uncertainty block that represents the estimation errors of the effectiveness factors. Simulations of the controlled system with the on-line estimator show that a superior fault-tolerance can be achieved.

**Actuator Failure**: National Aeronautics and Space Administration (NASA) 2018-06-19 A robust linear parameter varying (LPV) control synthesis is carried out for an HiMAT vehicle subject to loss of control effectiveness. The scheduling parameter is selected to be a function of the estimates of the control effectiveness factors. The estimates are provided on-line by a two-stage Kalman estimator. The inherent conservatism of the LPV design is reducing through the use of a scaling factor on the uncertainty block that represents the estimation errors of the effectiveness factors. Simulations of the controlled system with the on-line estimator show that a superior fault-tolerance can be achieved. Shin, Jong-Yeob and Wu, N. Eva and Belcastro, Christine and Bushnell, Dennis M. (Technical Monitor) Langley Research Center NASA/CR-2002-211924, NAS 1.26:211924, ICASE-2002-34

**Application of Linear Parameter Varying Control Synthesis in Power Systems**
In this dissertation, the application of linear parameter varying synthesis to power system controller design is investigated. The study is motivated by the inevitable limitation of an LTI controller on the nonlinear power systems in a large operating range and successful implementation of this approach in safety critical systems like aircrafts and process control. The main goal is to apply the LPV techniques to the Power System Stabilizer synthesis. The LPV model for power systems is developed. A systematic procedure to design PSS using LPV synthesis is presented. The feedback setup is constructed and a general guideline for proper weighting function selection is provided. Both Single Quadratic Lyapunov Function based LPV synthesis and Parameter Dependent Lyapunov Function based LPV synthesis are studied. Comparisons are made with the conventionally designed PSS and the H infinity optimal PSS. The LPV PSS is found to be more effective. Inspired by the characteristic of a LPV controller, that it guarantees system stability and performance for arbitrarily fast-changing scheduling parameters on a predefined range, further work is done on the application of LPV methods to decentralized PSS design. The design framework and procedure are given. By taking generator real and reactive power as scheduling variables, the generator is decoupled from the rest of the system. The design for a given PSS is independent of the design of the others and all the PSSs cooperate with each other automatically. The decoupling also leads to a relatively low order PSS design. The numerical examples further illustrate that LPV approach is useful for designing decentralized controllers in power systems. The nonlinear simulations show that these independently designed decentralized PSSs cooperate well in a wide operating range and have better damping characteristics than conventionally designed PSSs. The disturbances tested have been selected to be different in nature and are at different locations. The performance of the LPV PSSs is superior to the conventionally designed PSSs. A theoretical proof for stability is given for the decentralized controller design. The primary results from this
research clearly demonstrate the great potential of LPV synthesis application in power systems.

**Linear Parameter-Varying and Time-Delay Systems**-Corentin Briat 2014-09-30

**Linear Parameter Varying Control and LMI Optimization of Nonlinear Systems**-Farzad A. Shirazi 2011

**Advances in Linear Matrix Inequality Methods in Control**-Laurent El Ghaoui 2000

Linear matrix inequalities (LMIs) have recently emerged as useful tools for solving a number of control problems. This book provides an up-to-date account of the LMI method and covers topics such as recent LMI algorithms, analysis and synthesis issues, nonconvex problems, and applications. It also emphasizes applications of the method to areas other than control.

**Torque Vectoring - Linear Parameter-Varying Control for an Electric Vehicle**-Gerd Kaiser 2014

**Linear Parameter-Varying Control of Systems of High Complexity**-Christian Hoffmann 2016

**Linear Parameter-varying Control for an Active Microgravity Vibration Isolation System**-Aider Matarrita 2003

**Advanced Design Techniques in Linear Parameter Varying Control**- 2004 To improve the analysis and control synthesis approach of linear fractional transformation (LFT) parameter-dependent systems, two types of non-quadratic Lyapunov function and switching control scheme are introduced and studied in this thesis. A gain-scheduled controller with parameter variation
rate, a nonlinear gain-scheduled controller and an online switching linear parameter varying (LPV) controller are derived, and the advantages of proposed LPV control techniques are demonstrated through numerical and physical examples. In the first part of this thesis, we introduce a quadratic LFT parameter-dependent Lyapunov function, which includes affine parameter-dependent functions as special cases. Using full-block S-procedure, new LPV synthesis conditions have been derived in terms of finite number of linear matrix inequalities (LMIs). The constructed controller depends on parameters and their variation rate in general form compared with traditional LFT form. It is shown that the proposed approach can achieve better performance in a ship steering example by exploiting parameter variation rates. In the same spirit of exploiting more general type of Lyapunov function to achieve better controller, an analysis and synthesis algorithm for LPV systems using convex hull Lyapunov function (CHLF) and maximum Lyapunov function is presented. Using duality of LPV systems and conjugate properties of CHLF, sufficient LPV analysis and synthesis conditions have been derived in terms of LMIs with linear search over scalar variables. Because of the special structure of CHLF and maximum Lyapunov function, the output feedback controller turns out to be a nonlinear gain-scheduled controller. A second-order plant is used to demonstrate advantages and benefits of the new approach. The other main contribution in this thesis is the application of switching control to LPV systems with online optimization method. Arbitrary switching among subsystems is achieved, as well as performance improvement.

Petition to the Members of the Congress of the United States—George Washington Armstrong 1947

Advances in Gain-Scheduling and Fault Tolerant Control Techniques—Damiano Rotondo 2017-10-14 This thesis reports on novel
methods for gain-scheduling and fault tolerant control (FTC). It begins by analyzing the connection between the linear parameter varying (LPV) and Takagi-Sugeno (TS) paradigms. This is then followed by a detailed description of the design of robust and shifting state-feedback controllers for these systems. Furthermore, it presents two approaches to fault-tolerant control: the first is based on a robust polytopic controller design, while the second involves a reconfiguration of the reference model and the addition of virtual actuators into the loop. In addition, the thesis offers a thorough review of the state-of-the-art in gain scheduling and fault-tolerant control, with a special emphasis on LPV and TS systems.

**Control of Linear Parameter Varying Systems** - Fen Wu 1995

**Applications of Linear Parameter-varying Control Theory** - Weehong Tan 1997

**Linear Parameter-Varying Control of an F-16 Aircraft at High Angle of Attack** - 2002 To improve the aircraft capability at high angle of attack and expand the flight envelope, advanced linear parameter-varying (LPV) control methodologies are studied in this thesis with particular applications of actuator saturation control and switching control. A standard two-step LPV antiwindup control scheme and a systematic switching LPV control approach are derived, and the advantages of LPV control techniques are demonstrated through nonlinear simulations of an F-16 longitudinal autopilot control system. The aerodynamic surface saturation is one of the major issues of flight control in the high angle of attack region. The incorporated unconventional actuators such as thrust vectoring can provide additional control power, but may have a potentially significant pay-off. The proposed LPV antiwindup control scheme is advantageous from the implementation standpoint because it can be thought of as an
augmented control algorithm to the existing control system. Moreover, the synthesis condition for an antiwindup compensator is formulated as a linear matrix inequality (LMI) optimization problem and can be solved efficiently. By treating the input saturation as a sector bounded nonlinearity with a tight sector bound, the synthesized antiwindup compensator can stabilize the open-loop exponentially unstable systems. The LPV antiwindup control scheme is applied to the nonlinear F-16 longitudinal model, and compared with the thrust vectoring control approach. The simulation results show that the LPV antiwindup compensator improves the flight quality, and offers advantages over thrust vectoring in a high angle of attack region. For a thrust vectoring augmented aircraft, the actuator sets may be different at low and high angles of attack. Also due to different control objectives, a single controller may not exist over a wide angle of attack region. The proposed switching LPV control approach based on multiple parameter-dependent Lyapunov functions provides a flexible design m.

**Analysis and Control of Linear Parameter-varying Systems**-Sungyung Lim 1999

**Linear, Time-varying Approximations to Nonlinear Dynamical Systems**-Maria Tomas-Rodriguez 2010-02-04 Linear, Time-varying Approximations to Nonlinear Dynamical Systems introduces a new technique for analysing and controlling nonlinear systems. This method is general and requires only very mild conditions on the system nonlinearities, setting it apart from other techniques such as those - well-known - based on differential geometry. The authors cover many aspects of nonlinear systems including stability theory, control design and extensions to distributed parameter systems. Many of the classical and modern control design methods which can be applied to linear, time-varying systems can be extended to nonlinear systems by this technique. The implementation of
the control is therefore simple and can be done with well-established classical methods. Many aspects of nonlinear systems, such as spectral theory which is important for the generalisation of frequency domain methods, can be approached by this method.

Linear Parameter Varying Control of Magneto-rheological Dampers-Eyyup Celik 2008

Blending Methodology of Linear Parameter Varying Control Synthesis of F-16 Aircraft System-Jong-Yeob Shin 2001 This paper presents the design of a linear parameter varying (LPV) controller for the F-16 longitudinal axes over the entire flight envelope using a blending methodology which lets an LPV controller preserve performance level over each parameter subspace and reduces computational costs for synthesizing an LPV controller. Three blending LPV controller synthesis methodologies are applied to control F-16 longitudinal axes. Using a function substitution method, a quasi-LPV model of the F-16 longitudinal axes is constructed from the nonlinear equations of motion over the entire flight envelope, including non-trim regions, to facilitate synthesis of LPV controllers for the F-16 aircraft. The nonlinear simulations of the blending LPV controller show that the desired performance and robustness objectives are achieved across all altitude variations.

Tensor Product Model Transformation in Polytopic Model-Based Control-Péter Baranyi 2018-09-03 Tensor Product Model Transformation in Polytopic Model-Based Control offers a new perspective of control system design. Instead of relying solely on the formulation of more effective LMIs, which is the widely adopted approach in existing LMI-related studies, this cutting-edge book calls for a systematic modification and reshaping of the polytopic convex hull to achieve enhanced performance. Varying the convexity of the
resulting TP canonical form is a key new feature of the approach. The book concentrates on reducing analytical derivations in the design process, echoing the recent paradigm shift on the acceptance of numerical solution as a valid form of output to control system problems. The salient features of the book include: Presents a new HOSVD-based canonical representation for (qLPV) models that enables trade-offs between approximation accuracy and computation complexity Supports a conceptually new control design methodology by proposing TP model transformation that offers a straightforward way of manipulating different types of convexity to appear in polytopic representation Introduces a numerical transformation that has the advantage of readily accommodating models described by non-conventional modeling and identification approaches, such as neural networks and fuzzy rules Presents a number of practical examples to demonstrate the application of the approach to generate control system design for complex (qLPV) systems and multiple control objectives. The authors’ approach is based on an extended version of singular value decomposition applicable to hyperdimensional tensors. Under the approach, trade-offs between approximation accuracy and computation complexity can be performed through the singular values to be retained in the process. The use of LMIs enables the incorporation of multiple performance objectives into the control design problem and assurance of a solution via convex optimization if feasible. Tensor Product Model Transformation in Polytopic Model-Based Control includes examples and incorporates MATLAB® Toolbox TPtool. It provides a reference guide for graduate students, researchers, engineers, and practitioners who are dealing with nonlinear systems control applications.

**Advanced Design Techniques in Linear Parameter Varying Control** - Ke Dong 2006

Keywords: linear matrix inequality, Lyapunov function, bumpless transfer compensation, linear fractional transformation, switching control, linear parameter varying control.
Linear Parameter-varying Control of an F-16 Aircraft at High Angle of Attack - Bei Lu 2004

Keywords: Linear parameter-varying control, Actuator saturation, Switching control, Thrust Vectoring, Linear matrix inequality, Flight Control, Antiwindup compensation.


Worst-case Analysis and Linear Parameter-varying Gain-scheduled Control of Aerospace Systems - Jong-Yeob Shin 2000

Linear Parameter Varying Control of Time-delayed Systems and an Application to Air-fuel Ratio Control - Serdar Coskun 2014

In this thesis one of the recently developed gain scheduling control methods, the linear parameter varying (LPV) technique is demonstrated. Starting from the basic definitions of an LMI, important derivations of time delayed control design conditions are derived. In subsequent steps, a motivating example is shown such that the stability and performance of the system is guaranteed in the full operating envelope. The thesis consists of methods and derivations to address time-delayed LPV plants. The synthesis conditions show that the proposed controllers are not only capable of compensating the delay bound but also its rate variation bound. A main benefit of the obtained controllers is that the scheduling of the parameters lead to a robust behavior even for large delay variation and rate. Numerical examples are used to compare the past methods and the current results on the analysis and control design of the same system. Finally the internal combustion engine air-fuel ratio problem is investigated with the help of the derived output-feedback controller design results. The same problem is addressed with a Smith Predictor based Internal Model Control.
Linear Parameter-varying Gain-scheduled Control of Aerospace Systems - Jeffrey Michael Barker 1999

Development of a Nonlinear Wind Turbine Simulator for Linear Parameter-varying Control Design - Xiangming Xue 2015 Abstract: This paper presents a systematic switching control method for a variable-speed variable-pitch wind turbine over a wide wind speed region. The whole framework is based on the linear parameter-varying (LPV) control theory, which is an extension of robust control for linear systems to nonlinear ones. Two LPV controllers are designed, each suitable in a different wind speed region. A hysteresis switching logic is applied to guarantee the stability when the switching event occurs between the two controllers. Nonlinear simulations are conducted to demonstrate the proposed control scheme.

Switching Linear Parameter-varying Control of a Variable-speed Wind Turbine - Yiming Bu 2015 Abstract: For variable-speed wind energy conversion systems, control objectives may be different in partial and full load regions (or in low and high wind speed regions). Typical control objectives are to maximize the energy capture in low wind speeds, and to maintain the generated power and the rotational turbine speed within safety limits during high wind speeds. In such a case, it is difficult to design a single robust controller covering both partial load and full load conditions. This paper presents a systematic switching control method for a variable-speed variable-pitch wind turbine over a wide wind speed region. The whole framework is based on the linear parameter-varying (LPV) control theory, which is an extension of robust control for linear systems to nonlinear ones. Two LPV controllers are designed, each suitable in a different wind speed region. A hysteresis switching logic is applied to guarantee the stability when the switching event occurs between the two controllers. Nonlinear simulations are conducted to demonstrate the proposed control scheme.

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Linear Parameter-varying Gain-scheduled Control of Aerospace Systems - Jeffrey Michael Barker 1999

Development of a Nonlinear Wind Turbine Simulator for Linear Parameter-varying Control Design - Xiangming Xue 2015 Abstract:
It is challenging to design a controller for a wind turbine system because of its nonlinear time-varying dynamics. To resolve this issue, linear parameter-varying (LPV) control theory has been applied in the past 10 years to deal with nonlinear and wind-speed-dependent dynamics. Before applying the LPV control method, it is required to transform the nonlinear model of the system to an LPV model. The main objectives of this research are to model a 5-megawatt (MW) Reference Wind Turbine for Offshore System as an LPV system, develop a nonlinear wind turbine simulator using MATLAB/Simulink to validate the LPV model, and conduct a preliminary study on LPV control design to test the simulator, which will be used in the future research for applying different LPV control techniques, such as switching LPV control, LPV anti-windup control, and others.

Robust Control of Linear Systems Subject to Uncertain Time-Varying Parameters
Francesco Amato 2006-02-21 The last thirty years have witnessed an enormous effort in the field of robust control of dynamical systems. The main objective of this book is that of presenting, in a unified framework, the main results appeared in the literature on this topic, with particular reference to the robust stability problem for linear systems subject to time-varying uncertainties. The book mainly focuses on those problems for which a definitive solution has been found; indeed most of the results we shall present are given in the form of necessary and sufficient conditions involving the feasibility of Linear Matrix Inequalities based problems. For self-containedness purposes, most of the results provided in the book are proven. We have tried to maintain the development of the proofs as simple as possible, without sacrificing the mathematical rigor. Some parts of the book (especially those contained in Chaps. 2, 3 and 5) can be taught in advanced control courses; however this work is mainly devoted to both researchers in the field of systems and control theory and engineers working in industries which want to apply the methodologies presented in the book to practical
control problems. To this regard, as the various results are derived, they are immediately reinforced with real world examples.