

<<时滞系统的鲁棒控制和稳定性分析>>

图书基本信息

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前言

A system is said to have a delay when the rate of variation in the system state depends on past states. Such a system is called a time-delay system. Delays appear frequently in real-world engineering systems. They are often a source of instability and poor performance, and greatly increase the difficulty of stability analysis and control design. So, many researchers in the field of control theory and engineering study the robust control of time-delay systems. The study of such systems has been very active for the last 20 years; and new developments, such as fixed model transformations based on the Newton-Leibnitz formula and parameterized model transformations, are continually appearing. Although these methods are a great improvement over previous ones, they still have their limitations. We recently devised a method called the free-weighting-matrix (FWM) approach for the stability analysis and control synthesis of various classes of time-delay systems; and we obtained a series of not so conservative delay-dependent stability criteria and controller design methods. This book is based primarily on our recent research. It focuses on the stability analysis and robust control of various time-delay systems, and includes such topics as stability analysis, stabilization, control design, and filtering. The main method employed is the FWM approach. The effectiveness of this method and its advantages over other existing ones are proven theoretically and illustrated by means of various examples. The book will give readers an overview of the latest advances in this active research area and equip them with a state-of-the-art method for studying time-delay systems. This book is a useful reference for control theorists and mathematicians working with time-delay systems, engineering designing controllers for plants or systems with delays, and for graduate students interested in robust control theory and/or its application to time-delay systems.

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内容概要

Stability Analysis and Robust Control of Time-Delay Systems focuses on essential aspects of this field, including the stability analysis, stabilization, control design, and filtering of various time-delay systems: Primarily based on the most recent research, this monograph presents all the above areas using a free-weighting matrix approach first developed by the authors. The effectiveness of this method and its advantages over other existing ones are proven theoretically and illustrated by means of various examples. The book will give readers an overview of the latest advances in this active research area and equip them with a pioneering method for studying time-delay systems. It will be of significant interest to researchers and practitioners engaged in automatic control engineering.

作者简介

Prof. Min Wu, senior member of the IEEE, works at the Central South University, China.

<<时滞系统的鲁棒控制和稳定性分析>>

书籍目录

1.Introduction	1.1 Review of Stability Analysis for Time-Delay Systems	1.2 Introduction to FWMs	1.3 Outline of This Book	References
2.Preliminaries	2.1 Lyapunov Stability and Basic Theorems	2.1.1 Types of Stability	2.1.2 Lyapunov Stability Theorems	2.2 Stability of Time-Delay Systems
	2.2.1 Stability-Related Topics	2.2.2 Lyapunov-Krasovskii Stability Theorem	2.2.3 Razumikhin Stability Theorem	2.3 H_∞ Norm
	2.3.1 Norm	2.3.2 H_∞ Norm	2.4 H_∞ Control	2.5 LMI Method
	2.5.1 Common Specifications of LMIs	2.5.2 Standard LMI Problems	2.6 Lemmas	2.7 Conclusion
References	3.Stability of Systems with Time-Varying Delay	3.1 Problem Formulation	3.2 Stability of Nominal System	3.2.1 Replacing the Term $x(t)$
	3.2.2 Retaining the Term $x(t)$	3.2.3 Equivalence Analysis	3.3 Stability of Systems with Time-Varying Structured Uncertainties	3.3.1 Robust Stability Analysis
	3.3.2 Numerical Example	3.4 Stability of Systems with Polytopic-Type Uncertainties	3.4.1 Robust Stability Analysis	3.4.2 Numerical Example
	3.5 IFWM Approach	3.5.1 Retaining Useful Terms	3.5.2 Further Investigation	3.5.3 Numerical Examples
	3.6 Conclusion	References	4.Stability of Systems with Multiple Delays	4.1 Problem Formulation
	4.2 Two Delays	4.2.1 Nominal Systems	4.2.2 Equivalence Analysis	4.2.3 Systems with Time-Varying Structured Uncertainties
	4.2.4 Numerical Examples	4.3 Multiple Delays	4.4 Conclusion	References
5.Stability of Neutral Systems	5.1 Neutral Systems with Time-Varying Discrete Delay	5.1.1 Problem Formulation	5.1.2 Nominal Systems	5.1.3 Systems with Time-Varying Structured Uncertainties
	5.1.4 Numerical Example	5.2 Neutral Systems with Identical Discrete and Neutral Delays	5.2.1 FWM Approach	5.2.2 FWM Approach in Combination with Parameterized Model Transformation
	5.2.3 FWM Approach in Combination with Augmented Lyapunov-Krasovskii Functional	5.2.4 Numerical Examples	5.3 Neutral Systems with Different Discrete and Neutral Delays	5.3.1 Nominal Systems
	5.3.2 Equivalence Analysis	5.3.3 Systems with Time-Varying Structured Uncertainties	5.3.4 Numerical Example	5.4 Conclusion
References	6.Stabilization of Systems with Time-Varying Delay	6.1 Problem Formulation	6.2 Iterative Nonlinear Minimization Algorithm	6.3 Parameter-Tuning Method
	6.4 Completely LMI-Based Design Method	6.5 Numerical Example	6.6 Conclusion	References
7.Stability and Stabilization of Discrete-Time Systems with Time-Varying Delay	7.1 Problem Formulation	7.2 Stability Analysis	7.3 Controller Design	7.3.1 SOF Controller
	7.3.2 DOF Controller	7.4 Numerical Examples	7.5 Conclusion	References
8. H_∞ Control Design for Systems with Time-Varying Delay	8.1 Problem Formulation	8.2 BRL	8.3 Design of State-Feedback H_∞ Controller	8.4 Numerical Examples
	8.5 Conclusion	References	9. H_∞ Filter Design for Systems with Time-Varying Delay	9.1 H_∞ Filter Design for Continuous-Time Systems
	9.1.1 Problem Formulation	9.1.2 H_∞ Performance Analysis	9.1.3 Design of H_∞ Filter	9.1.4 Numerical Examples
	9.2 H_∞ Filter Design for Discrete-Time Systems	9.2.1 Problem Formulation	9.2.2 H_∞ Performance Analysis	9.2.3 Design of H_∞ Filter
	9.2.4 Numerical Example	9.3 Conclusion	References	10.Stability of Neural Networks with Time-Varying Delay
	10.1 Stability of Neural Networks with Multiple Delays	10.1.1 Problem Formulation	10.1.2 Stability Criteria	10.1.3 Numerical Examples
	10.2 Stability of Neural Networks with Interval Delay	10.2.1 Problem Formulation	10.2.2 Stability Criteria	10.2.3 Numerical Examples
	10.3 Exponential Stability of Continuous-Time Neural Networks	10.3.1 Problem Formulation	10.3.2 Stability Criteria Derived by FWM Approach	10.3.3 Stability Criteria Derived by IFWM Approach
	10.3.4 Numerical Examples	10.4 Exponential Stability of Discrete-Time Recurrent Neural Networks	10.4.1 Problem Formulation	10.4.2 Stability Criterion Derived by IFWM Approach
	10.4.3 Numerical Examples	10.5 Conclusion	References	11.Stability of T-S Fuzzy Systems with Time-Varying Delay
	11.1 Problem Formulation	11.2 Stability Analysis	11.3 Numerical Examples	11.4 Conclusion
References	12.Stability and Stabilization of NCSs	12.1 Modeling of NCSs with Network-Induced Delay	12.2 Stability Analysis	12.3 Controller Design
	12.4 Numerical Examples	12.5 Conclusion	References	13.Stability of Stochastic Systems with Time-Varying Delay
	13.1 Robust Stability of Uncertain Stochastic Systems	13.1.1 Problem Formulation	13.1.2 Robust Stability Analysis	13.1.3 Numerical Example
	13.2 Exponential Stability of Stochastic Markovian Jump Systems with Nonlinearities	13.2.1 Problem Formulation	13.2.2 Exponential-Stability Analysis	13.2.3 Numerical Example
	13.3 Conclusion			

<<时滞系统的鲁棒控制和稳定性分析>>

References
14. Stability of Nonlinear Time-Delay Systems
14.1 Absolute Stability of Nonlinear Systems with Delay and Multiple Nonlinearities
14.1.1 Problem Formulation
14.1.2 Nominal Systems
14.1.3 Systems with Time-Varying Structured Uncertainties
14.1.4 Numerical Examples
14.2 Absolute Stability of Nonlinear Systems with Time-Varying Delay
14.2.1 Problem Formulation
14.2.2 Nominal Systems
14.2.3 Systems with Time-Varying Structured Uncertainties
14.2.4 Numerical Example
14.3 Stability of Systems with Interval Delay and Nonlinear Perturbations
14.3.1 Problem Formulation
14.3.2 Stability Results
14.3.3 Further Results Obtained with Augmented Lyapunov-Krasovskii Functional
14.3.4 Numerical Examples
14.4 Conclusion
References
Index

<<时滞系统的鲁棒控制和稳定性分析>>

章节摘录

In many physical and biological phenomena , the rate of variation in the sys-tem state depends on past states. This characteristic is called a delay or a time delay , and a system with a time delay is called a time-delay system. Time-delay phenomena were first discovered in biological systems and were later found in many engineering systems , such as mechanical transmissions , fluid transmissions , metallurgical processes , and networked control systems. They are often a source of instability and poor control performance. Time delay systems have attracted the attention of many researchers [1-3] because of their importance and widespread occurrence. Basic theories describing such systems were established in the 1950s and 1960s; they covered topics such as the existence and uniqueness of solutions to dynamic equations , stability theory for trivial solutions , etc. That work laid the foundation for the later analysis and design of time-delay systems. The robust control of time-delay systems has been a very active field for the last 20 years and has spawned many branches , for example , stability analysis , stabilization design , H_∞ control , passive and dissipative control , reliable control , guaranteed-cost control , H_2 filtering , Kalman filtering , and stochastic control. Regardless of the branch , stability is the foundation. So , important developments in the field of time-delay systems that explore new directions have generally been launched from a consideration of stability as the starting point. This chapter reviews methods of studying the stability of time-delay systems and points out their limitations , and then goes on to describe a new method called the free-weighting-matrix (FWM) approach.

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