《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

《时滞系统的鲁棒控制和稳定性分析(英文版)》内容简介：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.

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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∞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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