

Preface

Markovian jump systems typically consist of a finite number of subsystems and a jumping law governing the active/deactivate mode switches among these subsystems. The subsystems are usually modeled as differential/difference equations, and the jumping law is a continuous-time/discrete-time Markov chain. Markovian jump systems are a powerful modeling tool in many engineering areas. For instance, abrupt changes are often seen in practical systems, due to the abrupt environmental disturbances, the component and interconnection failures, the abrupt changes of the operation point for the nonlinear plant, etc. The system can be modeled as having different dynamics before and after the abrupt changes, and the changes are usually memoryless and thus Markovian, hence resulting in a Markovian jump system. Indeed, Markovian jump systems can often be seen in the study of networked control systems, circuit and power systems, flight control systems, robotic systems, and so on, where the stability analysis, tracking, fault-tolerant control, etc., have been extensively discussed. However, the theoretical development of Markovian jump systems has its own challenges, mainly due to the exclusive Markovian jumping law. It is well-known that the whole system can still be unstable even if all the subsystems are stable, while the whole system can be stable even if all the subsystems are unstable. Furthermore, the existence of random noises, delays, nonlinearity, modeling error and disturbance, robust stability, H_∞ control and filtering, adaptive control, practical stability and optimal control, etc. are also important topics in Markovian jump systems.

This book discusses the stability analysis of different Markovian jump systems as well as some applications. With multiple stability definitions, we analyze and design Markovian jump systems in a systematic manner. This book is written primarily for postgraduate students in control theory and applications, and can also be useful for the researchers and engineers in this area. In order to use this book, the reader should have the basic knowledge on linear control theory, matrix analysis, optimization techniques, probability and stochastic processes.

This book contains seven chapters. A brief description of each chapter goes as follows. Chapter 1 introduces the related history and background of Markovian jump systems as well as the necessary definitions and notations. Chapter 2 deals

with the robust stability and H_∞ control issues for a class of uncertain Markovian jump systems with delays. Chapter 3 investigates various stochastic stability criteria for nonlinear Markovian jump systems with asynchronous switching and extended asynchronous switching. Chapter 4 discusses a robust adaptive control scheme for a class of nonlinear uncertain Markovian jump systems with nonlinear state-dependent uncertainty. Chapter 5 studies the practical stability in probability, practical stability in the p th mean, and the practical controllability for stochastic nonlinear Markovian jump systems. Chapter 6 considers the Markovian jump system model for networked control systems. Chapter 7 discusses two applications based on the Markov jump theory, i.e., the fault-tolerant control for wheeled mobile manipulators and the jump linear quadratic regulator problem.

We hope the reader will find this book useful.

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