Preface

Switched systems are hybrid systems with both continuous dynamics and discrete events. During the past decades, considerable attention has been devoted to the investigation of such systems due to the fact that switched systems provide a unified framework for mathematical modeling of many practical systems such as networked control systems, near space vehicle control systems and circuit and power systems. As the most important issues in the study of switched linear or nonlinear systems, stability analysis and control synthesis are discussed extensively by many researchers.

Switched linear systems have been investigated for a long time, and many excellent results have been obtained for the systems under arbitrary switching or constraint switching. As far as the stability with arbitrary switching is concerned, it is necessary to require that all the subsystems be asymptotically stable. However, even when all the subsystems of a switched linear system are exponentially stable, such a system may fail to preserve stability under arbitrary switching, but may be stable under constraint switching signals. The constraint switching may result from the physical constraints of the system or the designers' intervention that is actually related to the switching stabilization problem. As an important class of controlled switching signals, time-constraint switching has been widely used for switching stabilization, and a number of effective concepts and powerful tools have been developed. Despite of the rapid progress, some fundamental problems are still either unsolved or less well understood. In particular, the existing time-constraint switching signals are somewhat too strict to be applied in some circumstances, and the switching stabilization among unstable linear subsystems has not been successfully solved. These issues are considered in the current monograph.

On the other hand, the switched systems considered in the literature mostly consist of linear subsystems or first-order nonlinear subsystems, and various types of complicated dynamics such as stochastic noises, unknown uncertainties and actuator dead-zone are not taken into account. However, many industrial systems or physical systems cannot be described by simple switched system models, and thus those traditional control synthesis methods are not applicable for such systems. Considering these, we will focus on the problem of control synthesis for more

general switched nonlinear systems containing complicated dynamics, and some intelligent control design methods are also proposed for our considered systems by introducing novel design approaches.

This monograph addresses theoretical explorations on stabilization and intelligent control for both switched linear systems and switched nonlinear systems. A systematic design method of control synthesis is given by establishing new concepts and state-of-the-art results. The book can be used for researchers to carry out studies on switched systems, and is suitable for graduate students of control theory and engineering. It may also be a valuable reference for control design of switched systems by engineers.

The contents of the book are divided into six chapters which contain several independent yet related topics, and they are organized as follows. Chapter 1 introduces some basic background knowledge on switched systems, and also describes the main work of the book. Chapter 2 considers the problem of stabilization of switched linear systems. Chapter 3 addresses the problem of switching stabilization for switched systems composed of unstable subsystems in both linear and nonlinear cases. Chapters 4 and 5 give theoretical developments in detail for adaptive intelligent control for some classes of switched nonlinear systems with uncertainties. Some control problems for constrained switched nonlinear systems are discussed in Chap. 6. Finally, Chap. 7 concludes the book and highlights some future study directions relating to the contents of the book.

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