Chapter 1 : Robust Finite-Time Control for Impulsive Switched Nonlinear Systems with State Delay

Switched and Impulsive Systems can be used as a reference or a text for a course at graduate level. Keywords Internet Quality of Service Quality of Service (QoS) Scalable Video Coding Secure Communication Switched and Inpulsive Systems Synchronization chaos communication communication system complex system complex systems control online stability.

 Abstract This paper investigates robust finite-time control for a class of impulsive switched nonlinear systems with time-delay. Firstly, using piecewise Lyapunov function, sufficient conditions ensuring finite-time boundedness of the impulsive switched system are derived. Then, finite-time performance analysis for impulsive switched systems is developed, and a robust finite-time state feedback controller is proposed to guarantee that the resulting closed-loop system is finite-time bounded with disturbance attenuation. All the results are given in terms of linear matrix inequalities LMIs. Finally, two numerical examples are provided to show the effectiveness of the proposed method. Introduction A switched system is a hybrid dynamical system consisting of a family of continuous-time or discrete-time subsystems and a switching law that orchestrates the switching between them [1]. In the last decades, in the stability analysis and stabilization for switched systems, lots of valuable results are established see [2 â€” 5]. Most recently, on the basis of Lyapunov functions and other analysis tools, the stability problem of linear and nonlinear switched systems with time-delay has been further investigated see [6 â€” 15] , and lots of valuable results are established for control problems see [16 â€” 22]. It is well known that impulsive dynamical behaviors inevitably exist in some practical systems like physical, biological, engineering, and information science systems due to abrupt changes at certain instants during the dynamical process. Although hybrid system and switched system are important models for dealing with complex real systems, there is little work concerned with the above impulsive phenomena. Such a phenomenon can be modeled as an impulsive switched system, it is characteristic that their states change during the switching because of the occurrence of impulses [23]. In recent years, the impulsive switched systems have drawn more and more attention and many useful conclusions have been obtained. Multiple Krasovskii-Lyapunov function approach is employed to study the problem of ISS stability of a class of impulsive switched systems with time-delay in [24]. By the Lyapunov-Razumikhin technique, a delay-independent criterion of the exponential stability is established on the minimum dwell time in [25]. The problem of robust stabilization of nonlinear impulsive switched system with time-delays is studied in [23]. Usually, the stability of a system is defined over an infinite-time interval. But in many practical systems, we focus on the dynamical behavior of a system over a fixed finite-time interval. Based on this, finite-time stability is first proposed by Dorato in [26]. Compared with the classical Lyapunov stability, finite-time stability is proposed for the study of the transient performance of the system, which is a totally different concept. The so-called finite-time stability means the boundedness of the state of a system over a fixed finite-time interval. Finite-time stability problems can be found in [27 â€” 32]. The finite-time stability of linear impulsive systems is analyzed in [33], the finite-time stability and stabilization of impulsive dynamic systems are carried out in [34 â€” 36]. The finite-time stability and stabilization of switched systems are investigated in [37]. Recently, robust finite-time control of switched systems is studied in [38 , 39]. However, to the best of our knowledge, there are very few results on finite-time boundedness and robust control of the impulsive switched systems, which motivates the present study. The paper is organized as follows. In Section 2 , problem formulation and some necessary lemmas are given. In Section 3 , based on the dwell time approach, finite-time boundedness and finite-time performance for switched impulsive systems are addressed, and sufficient conditions for the existence of a robust finite-time state feedback controller are proposed in terms of a set of matrix inequalities. Numerical examples are provided to show the effectiveness of the proposed approach in Section 4. Concluding remarks are given in Section 5. The notations used in this paper are standard. The notation means that is a real positive definite matrix; stands for a block-diagonal matrix; and denote the maximum and minimum eigenvalues of matrix , respectively;.

Chapter 2 : CiteSeerX â€” Citation Query Regularization Method for Optimally Switched and Impulsive Sys

*Switched and Impulsive Systems: Analysis, Design and Applications (Lecture Notes in Control and Information Sciences) [Zhengguo Li, Yengchai Soh, Changyun Wen] on www.nxgvision.com *FREE* shipping on qualifying offers. In this volume the important concept of switched and impulsive control is discussed, with a wide field of applications in the analysis and control of complex systems.*

Optimal control of switching surfaces by Y. Abstract â€” This paper studies the problem of optimal switching surface design for hybrid systems. In particular, a formula is derived for computing the gradient of a given integral performance cost with respect to the switching surface parameters. The formula reflects the hybrid nature of the system The formula reflects the hybrid nature of the system in that it is based on a costate variable having a discrete element and a continuous element. A numerical example with a gradient descent algorithm suggests the potential viability of the formula in optimization. Show Context Citation Context The problem addressed here is how to characterize the gradient of the cost functional with respect to the switching-surface control parameters, and then use them in optimization algorithms. The optimal impulsive control problem for a system with a single discrete delay is studied. In such systems the control consists only of a sequence of modulated impulses, the control variables being the impulse times and their magnitudes. It is assumed that the systems considered all have It is assumed that the systems considered all have a refractory period, in the sense that once an action is taken, it takes a non-infinitesimal amount of time before a subsequent action can be taken. Necessary conditions for a stationary solution are derived and shown to extend those of the delay free case. This optimal impulsive control problem is not unrelated to the optimal switching problem Branicky et al. We assume that the systems considered all have a refractory period, in the sense that once an action is taken, it takes a non-infinitesimal amount of time before a subsequent action can be taken. This paper proposes an algorithmic framework for optimal mode switches in hybrid dynamical systems. The problem is cast in the setting of optimal control, whose variable parameter consists of the switching times, and whose associated cost criterion is a functional of the state trajectory. The number of switching times and hence of switching modes is also a variable which may be unbounded, and therefore the optimization problem is not defined on a single metric space. Rather, it is defined on a sequence of spaces of possibly increasing dimensions. The paper characterizes optimality in terms of sequences of optimality functions and proposes an algorithm that is demonstrably convergent in this context. More generally, they characterize situations where a controller has to switch attention among various subsystems, or collect data sequentially from a number of sensory sources. Recently there has b This paper concerns an optimal control problem defined on a class of switched-mode hy-brid dynamical systems. These switch-ing surfaces are paramet These switch-ing surfaces are parameterized by finite-dimensional vectors called the switching parameters. The optimal control problem is to minimize a cost functional, defined on the state trajectory, as a function of the switching parameters. The paper derives the gradient of the cost func-tional in a costate-based formula that reflects the special structure of hybrid systems. It then uses the formula in a gradient-descent algorithm for solving an obstacle-avoidance problem in robotics. Optimal control problems on switched-mode dynamical systems typically i The problem of optimal switching of a multi-mode time delay system is considered. The class of multi-mode systems consists of systems where the control variables are the switching times in a sequence of fixed vector fields. We assume that the systems considered all have a refractory period Necessary conditions for a stationary solution are derived for systems with a single or commensurate delays, and shown to extend those of the delay free case in Egerstedt et al. The result is amenable to numerical solution using gradient methods Xu et al.