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STABILIZATION FOR A CLASS OF UNCERTAIN MULTI-TIME DELAYS SYSTEM USING SLIDING MODE CONTROLLER

Shaocheng Qu[1,2], Zhiqiu Lei[1], Quanming Zhu[2] and Hassan Nouri[2]

[1]Department of Information and Technology
Central China Normal University
No. 152, Luoyu Road, Wuhan 430079, P. R. China
qushaocheng@mail.ccnu.edu.cn; leizhiqiu@mails.ccnu.edu.cn

[2]Bristol Institute of Technology
University of the West of England, Frenchay Campus
Coldharbour Lane, Bristol, BS16 1QY, UK
{ quan.zhu; Hassan.Nouri }@uwe.ac.uk

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Abstract. *The stabilization for uncertain multi-time delays system is studied by using sliding mode control method. The uncertain system is assumed to have unmatched parameter uncertainties as well as matched input uncertainties. A virtual feedback strategy is presented to design the sliding surfaces, and then a relaxed delay-independent sufficient condition of design for sliding mode surfaces is proposed. A sliding mode controller is developed, which can ensure convergence of the system trajectory to the sliding surfaces. The overall asymptotical stability of the closed-loop system is guaranteed. Simulations illustrate the effectiveness of the proposed methodology.*
Keywords: Time delay system, Sliding mode control, Robust control, LMI

1. **Introduction.** Time delays frequently occur in many practical systems, such as chemical process, nuclear reactor, manual control, long transmission communication [1]. Its existence usually leads to system's poor performance or instability. Hence, stabilization of time delay system has received considerable attention in the past several decades [1-13]. One of the solutions for uncertain time delay system is to use sliding mode control strategy (SMC). SMC has been proved to be an effective robust control strategy for incompletely modelled and uncertain system. An SMC system has various attractive features such as fast response, good transient performance, and robustness with respect to matched parameter uncertainties and external disturbances on the sliding plane. Owing to its robustness and ability to handle nonlinear system, SMC has found wide application to automotive systems, electrical motor control [4].

Recently, sliding mode control strategy (SMC) of time delay system has received increasing attentions [5-16]. Many efforts have been made to obtain delay-independent conditions [5-7]. Usually, it is difficult to obtain delay-independent conditions of design of controller for many practical systems. In fact, delay-independent conditions of design of controller for some systems could not be obtained.

At the same time, delay-independent conditions are too strict for many systems and considered as more conservative than delay-dependent conditions. So more and more attentions are focused on how to obtain delay-dependent conditions of design of sliding mode controller [8-11].

On the other hand, the delay-independent methods, although being conservation, are sometimes more suitable for some practical applications [17]. Generally speaking, time