

ROBUST STABILIZATION OF STATE DELAYED T-S FUZZY SYSTEMS WITH INPUT SATURATION VIA DYNAMIC ANTI-WINDUP FUZZY DESIGN

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ABSTRACT. *This paper considers the robust stabilization problem for Takagi-Sugeno fuzzy systems with time-varying delays subject to input saturation. The purpose is the design of dynamic anti-windup fuzzy controllers ensuring convergence of all admissible initial states within the domain of attraction. Delay-dependent conditions for the existence of solutions to this problem are obtained. A simulation example is also presented.*

Keywords: Dynamic anti-windup controller, Input saturation, T-S fuzzy models, Time delays

1. Introduction. In many control systems, the input saturation is often the cause of performance degradation or even instability [9, 17]. Generally, studies on the analysis and synthesis of control systems with input saturation using anti-windup compensation have followed two main approaches; that is, static anti-windup and dynamic anti-windup compensation approaches. Compared with static anti-windup compensators, dynamic anti-windup compensators offer more degree of freedom in the control synthesis procedure [5], which, in general, leads to less conservative solutions for the performance of the closed-loop system.

Time delays are frequently encountered in many practical engineering systems [8, 12]. Note that most of anti-windup results are mainly focused on systems without delays [3, 6]. Recently, the anti-windup compensator for time-delay systems was addressed [7, 11, 14, 19]. In [7, 14], the static anti-windup compensation for time-delay systems was studied, while the synthesis of dynamic anti-windup compensator for time-delay systems was considered in [11, 19].

The Takagi-Sugeno (T-S) fuzzy system model [13, 16] is one of the most popular fuzzy system model in the model-based fuzzy control [1, 4]. Recently, the controller design problem of T-S fuzzy systems subject to input saturation has attracted lots of attention [2, 15, 20]. For continuous-time T-S fuzzy systems with time-varying delays, the fuzzy control problem was developed in [15] via static anti-windup approach. However, stability analysis and control synthesis of uncertain T-S fuzzy systems with time-varying delays