DECENTRALIZED ROBUST CONTROL FOR UNCERTAIN T-S FUZZY LARGE-SCALE SYSTEMS WITH TIME-DELAY

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Abstract. *This paper addresses the problem of fuzzy robust decentralized control for a class of fuzzy large-scale systems with time-delay based on the Takagi-Sugeno (T-S) fuzzy model. Both fuzzy state feedback decentralized controller and fuzzy observer-based decentralized controller are developed. Sufficient conditions are derived for robust stabilization in the sense of Lyapunov asymptotic stability and formulated in the format of linear matrix inequalities (LMIs). The effectiveness of the proposed fuzzy controller is finally demonstrated through numerical simulations on a fuzzy large-scale system with time-delay.*
Keywords: Fuzzy large-scale systems with time-delay, Fuzzy observer, Fuzzy control, Robust stability

1. **Introduction.** In various practical control systems such as transportation systems, urban planning, economic models, spacecraft dynamics, power systems, industrial processes and others have the form of interconnected dynamical systems. Moreover, in many engineering systems, time delays are frequently encountered, such as the delays due to measurement of the systems variables, physical properties of flow, transmission of information between different parts of dynamical systems and so on. Time delays could be the cause of the instability. Therefore, in the last two decades, decentralized stabilization of large-scale systems with time delay has been widely studied [1,2]. Because of unavoidable uncertainties in the system due to aging of subsystems, modeling errors and approximating model etc,. in general, a mathematical model usually can not be used to describe a dynamical system exactly in many practice problems.

It is well known that T-S fuzzy model is recognized as an effective method in approximating a complex nonlinear system, and there has been rapidly growing interest in fuzzy control of nonlinear large-scale interconnected systems based on T-S fuzzy model in recent years [5-9]. Many researchers and authors utilized T-S model to model the nonlinear large-scale interconnected systems, on the basis of which, the fuzzy decentralized controller, the stability, robustness and control performance issues of fuzzy system have been