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DELAY-DEPENDENT CONTROL FOR LARGE-SCALE SYSTEMS BASED ON A NEW DECENTRALIZED DYNAMIC FUZZY CONTROL ARCHITECTURE

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Abstract. *A delay-dependent guaranteed cost controller design method for nonlinear interconnected uncertain large-scale systems with time delays which can be represented by extended Takagi-Sugeno (T-S) fuzzy models is presented. A new decentralized dynamic fuzzy controller architecture with dual index rule base is proposed in the form of an observer-based state feedback incorporating dynamic output feedback, which makes it possible to improve system stability and satisfy the desired guaranteed cost performance simultaneously under the circumstance that not all states are available. Based on less conservative delay-dependent Lyapunov functional approach, some sufficient conditions for the existence of controller are provided in terms of LMI dependent on the upper bound via substituting vector method. The upper bound of time-delay can be obtained using convex optimization such that the system can be stabilized for all time delays whose sizes are not larger than the bound. A minimization problem procedure is also proposed to search the suboptimal upper bound of guaranteed cost function. Finally, the better control performances of the proposed method are shown by the simulation examples.*
Keywords: Large-scale systems, Delay-dependent, Observer-based, Output feedback, Guaranteed cost control, Decentralized controller, T-S fuzzy model, Time delays

1. **Introduction.** Over the past decade and before, the properties of interconnected large-scale systems (such as power systems) have been widely studied and many different approaches have been proposed to stabilize these systems [1-6]. In these studies, even if their subsystems have tractable models and interact with respective neighbors in a simple and predictable fashion, the interconnected large-scale systems often display rich and complex nonlinear behavior. Thus linearization technique and linear robust control are obviously incompetent for the large-scale systems. Many nonlinear control methods also have been proposed in controller design for the large-scale systems. But the nonlinear control schemes are so complicated that they are unsuitable as well unfeasible for real applications. In practice, in many cases it is very complicated and difficult, even impossible, to obtain the accurate models of large-scale systems. The inherent nonlinearities in large-scale system become major sources of model uncertainties. Moreover, due to the