A DESCRIPTOR SYSTEM APPROACH TO GUARANTEED COST CONTROL FOR UNCERTAIN NEUTRAL LARGE-SCALE INTERCONNECTED SYSTEMS

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ABSTRACT. *This note investigates the problem of decentralized guaranteed cost control for uncertain neutral large-scale interconnected systems. A novel scheme, viewing the interconnections with time-varying delays as effective information but not disturbances, is developed. Based on this scheme, a descriptor system approach is introduced to derive the robust stabilization criterion of uncertain neutral large-scale interconnected systems and an efficient optimization approach is proposed to minimize the guaranteed cost. An example is given to illustrate the design method of controller and show the advantages of the present results over the existing results.*
Keywords: Descriptor system approach, Neutral large-scale interconnected systems, Decentralized guaranteed cost control, Time-varying delay, Linear matrix inequality (LMI)

1. **Introduction.** Neutral delay system is the general form of delay system and contains delay on the derivative of system variable. There are many physical examples for neutral delay system in practical systems (see,e.g., [1-8]). In [1], an LMI optimization approach is proposed to find the robust non-fragile guaranteed cost controller and minimize the guaranteed cost. But it causes conservatism due to the introduction of constant ω. Tian *et al.* in [2], Zhang *et al.* in [3] and Han in [4] have investigated the robust stability for neutral systems with delays using the method of descriptor model transformation, and obtained less conservative results. But the controller design is not considered in their papers.

On the other hand, with the advent of complex engineering systems, many efforts have been made for the problems of decentralized control for large-scale interconnected systems [9-12]. Mukaidani [9] investigates the stability and stabilization of a class of nonlinear large-scale systems and proposes a suboptimal guaranteed cost controller instead of solving the nonconvex optimization problem. But the scheme of counteracting the interconnections to simplify the problem may cause conservatism. Furthermore, the time delay is invariant and not involved in the interconnections.

To the best of the authors' knowledge, the robust control for uncertain neutral large-scale interconnected systems has not been reported yet, which motivates the present study. In this note, we investigate the decentralized guaranteed cost control for uncertain neutral large-scale interconnected systems with time-varying delays in state, control input