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DELAY-DEPENDENT ROBUST STABILIZATION FOR A CLASS OF UNCERTAIN SINGULAR DELAY SYSTEMS

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Abstract. *This paper focuses on the problem of delay-dependent robust stabilization for a class of uncertain singular time-delay systems. Based on the results of [1], we reconstruct a new Lyapunov-Krasovskii functional and develop an improved delay-dependent criterion for a singular time-delay system to be regular, impulse-free and stable. Based on the criterion, the problem of robust stabilization is studied. The parameter uncertainties considered are norm-bounded and time-varying. In terms of the feasibility condition of linear matrix inequalities (LMIs), a memoryless state feedback controller is designed to guarantee that the resultant closed-loop system is regular, impulse-free and stable for all admissible uncertainties. Finally, some numerical examples are employed to illustrate the effectiveness of the proposed results.*
Keywords: Singular time-delay systems, Delay-dependent, State feedback controller, Robust stabilization, Linear matrix inequality (LMI)

1. **Introduction.** In recent years, increasing attention has been paid to the research of singular time-delay systems [1-16]. One main reason is that singular systems can better describe physical systems than regular ones. Such systems can preserve the structure of practical systems and have extensive applications in power systems, robotic systems and networks. For more results on this topic, we refer readers to see [17,18] and the references therein. Another important reason is that time-delay frequently appears in many physical processes. Usually, time-delay is a source of instability and poor performances. Consequently, much research has been devoted to singular time-delay systems. Generally, stability is of the essence in dealing with control systems. According to whether stability dependence on time-delay or not, the research of singular time-delay systems can be classified into two types: delay-independent [3,9,15,16] and delay-dependent [1,2,4-8,10-14] cases. Generally speaking, delay-dependent conditions are less conservative than the delay-independent ones, especially when the size of delay is small. Recently, a lot of research results of stability analysis and robust controller synthesis for singular time-delay systems have been reported in the literatures, see [1,4,8,9,12-15] and the references therein. In addition to stability, there are various control performance objectives to be considered, such as H_∞ control [2,5,7,10,11], guaranteed cost control [3,6,16] etc.

It is well known that a suitable form of Lyapunov-Krasovskii functional may lead to less conservative delay-dependent stability criterion for a singular time-delay system. Recently, some attempts have been made. Such as Theorem 3.1 in [1], a few of matrix variables were introduced to construct Lyapunov-Krasovskii functional, i.e., matrices P,