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DELAY-DEPENDENT STABILIZATION OF SINGULAR LINEAR SYSTEMS WITH DELAYS

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Abstract. *This paper deals with the class of continuous-time singular linear systems with time delay in the state vector. Delay-dependent sufficient conditions on stability and stabilizability are developed. A design algorithm for a memoryless state feedback controller which guarantees that the closed-loop dynamics will be regular, impulse free and stable is proposed in terms of the solutions to linear matrix inequalities (LMIs).*
Keywords: Singular systems, Continuous-time linear systems, Linear matrix inequality, Stability, Stabilizability, State feedback

1. **Introduction.** This paper deals with the class of singular continuous-time linear systems which has attracted a lot of researchers from mathematics and control communities. It is also referred to as descriptor systems, implicit systems, generalized state-space systems, differential-algebraic systems or semi-state systems [3, 8]. Singular systems are more appropriate to describe the behavior of some practical systems in different fields (see [3]). Many problems for the class of continuous-time and discrete-time singular linear systems have been tackled and interesting results have been reported in the literature. Among these contributions we quote those of [12, 18, 16, 4, 7, 13, 14, 15, 11, 2], and the references therein.

Some practical systems that can be modelled by singular systems under study in this paper may have time-delay in their dynamics which may be the cause of instability and performance degradation of such systems (see [1]). Therefore, more attention should be paid to this class of systems. To the best of our knowledge, the class of continuous-time singular systems with time delays has not yet been fully investigated. Particularly, delay dependent sufficient conditions, from the authors' knowledge, have not been reported in the literature.

This paper deals with the problems of stability analysis and stabilization for singular continuous-time linear systems with time delays. Firstly, we develop a delay-dependent sufficient condition, which guarantees that the system is regular, impulse free and stable.