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ROBUST STABILITY AND STABILIZATION FOR SINGULARLY PERTURBED CONTROL SYSTEMS

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Abstract. *This paper deals with the problems of robust stability analysis and robust stabilization for a class of uncertain linear singularly perturbed systems with norm-bounded time-varying uncertainties. We develop ε-independent methods for solving the problems by using the existing results of robust stability and robust stabilization for singular systems under certain conditions. The proposed methods are given in terms of linear matrix inequalities.*

Keywords: Robust stability, Robust stabilization, Singular system, Singularly perturbed system

1. **Introduction.** Singularly perturbed control systems (SPCS for brevity in this paper) are commonly encountered in engineering. In the past decades, a great deal of interest has been devoted to SPCS [1-3].

The SPCS model is in the explicit state variable form in which the derivatives of some of the system states are multiplied by a small positive parameter. In many practical cases, SPCS models are often simplified via neglecting the small parameter and thus the corresponding reduced singular control system (SCS for brevity in this paper) models are obtained [4]. However, among most of the work in the literature, the design of controllers for SCS does not take account of its applicability to original SPCS. This is the concerned topic of this paper.

The stability of SPCS has been intensively studied, see for example, [1,5] and the references therein. In recent years, the research on the robust stability of uncertain SPCS has drawn much attention [6-17]. The stability bound for SPCS is obtained in [9,10,13]. In [6,7,10,11], composite controllers are constructed for uncertain SPCS. However, the basis of the design of composite controller is the decomposition of the SPCS into the reduced-order slow and fast subsystems [1], thus their results could only be applied to standard SPCS (for information on standard and non-standard singularly perturbed systems please refer to [3]). In [16], a robust stabilizing controller is constructed based on the exact decomposition of algebraic Riccati equation.