

## GUARANTEED COST AND POSITIVE REAL CONTROL OF UNCERTAIN SYSTEMS VIA STATIC OUTPUT FEEDBACK

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**ABSTRACT.** *This paper focuses on the problem of guaranteed cost and positive real control for a class of linear systems which are subjected to mixed structured bounded uncertainty and unbounded unknown nonlinearities in the state equation. Sufficient conditions in terms of linear matrix inequalities (LMIs) and linear matrix equalities (LMEs) are presented for the existence of a static output feedback controller, that makes the resulting closed-loop system quadratically strict positive real and minimizes the upper bound for a given cost function. A numerical example is included to illustrate effectiveness of the theoretic results obtained.*

**Keywords:** Strict positive realness, Uncertain systems, Robust control, Quadratic stability, Linear matrix inequality

**1. Introduction.** The concept of positive realness has played an important role in system and control theory. One of the reasons is that some mechanical systems such as collocated control of a flexible structure satisfy positive real property. Recently the positive real synthesis problem has been studied extensively (See for example, [10], [14], [13], [4]). In the robust control area, many results have been obtained (See for example, [3, 21, 22], [12], [15, 19, 20] and references therein), moreover, work on stability analysis and robust stabilization related to positive real systems can be found in [17], [11]. However, the robust performance of a system is required as well as the robust stability against the uncertainty in the plant model. In particular, the problem of guaranteed cost control of an uncertain system is considered in [1]. This work deals with the guaranteed cost control of a strict positive real system with unbounded nonlinear uncertainty, where both state and output feedback control laws are designed. The work of [9] considers the guaranteed cost control of a linear system with uncertainty which is only norm-bounded. In reality, structured parameter uncertainty often occurs in systems, where repeated scalar block forms account for uncertain physical parameter values and full-block forms may be some unknown bounded nonlinear dynamics. Hence, mixed structured bounded uncertainty and unbounded nonlinear real uncertainty may be a general form of the uncertainty in a real system. In reference [1], the LMI optimization approach combined with line search is introduced, to deal with uncertain systems, but is not applicable when the system is subjected to structured uncertainties.