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ROBUST STABILITY AND H_∞ PERFORMANCE ANALYSIS OF DISCRETE SINGULAR DELAY SYSTEMS WITH UNCERTAINTIES

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Abstract. In this paper, the robust stability and H_∞ performance of discrete singular delay systems with parameter uncertainties are studied . The parameter uncertainties are assumed to be of a linear fractional form. In terms of linear matrix inequality (LMI), sufficient conditions for robust stability and H_∞ performance are obtained. The results generalize previous work for discrete singular delay systems with norm-bounded parameter uncertainties.

Keywords. Discrete system, delay system, linear matrix inequality (LMI), robust stability, robust stabilization, singular system, uncertainty.

1 Introduction

Singular systems have comprehensive practical background, such as power systems, social economic systems, circuit systems and so on. Singular systems have been extensively studied in the past years. A great number of results based on the theory of regular systems have been extended to the area of singular system[1, 2, 7, 10, 15]. It should be pointed out that the robust stability problem for singular systems is much more complicated than that for regular systems because it requires to consider not only stability robustness, but also regularity and absence of impulses (for continuous singular systems) and causality (for discrete-singular systems)[2] and the latter two need not be considered in regular systems.

Since the time delay is frequently a source of instability and encountered in various systems such as engineering, communications and biological systems etc., the study of delay systems has received much attention and various topics have been discussed over the past years[6, 9].

For continuous singular delay systems, [8] and [12] derived some stability conditions by decomposing the coefficient matrices of the singular delay system. Under some assumptions on the decomposed singular delay system, several stability conditions were obtained in [3] and [4] by using the LMI approach. It is noted that the stability results in [3, 4, 8, 12] were only