A DELAY-RANGE-DEPENDENT BOUNDED REAL LEMMA FOR SINGULAR SYSTEMS

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Abstract. This paper is concerned with the delay-dependent bounded real lemma (BRL) for uncertain singular systems with time-varying delay in a range. Firstly, a stability criterion is obtained based on linear matrix inequality (LMI). Secondly, in terms of LMI approach, a delay-dependent BRL is presented to ensure singular time-delay system to be regular, impulse free and robust stable with disturbance attenuation level γ for all admissible uncertainties. Numerical examples are given to show the advantages of the proposed results.

Keywords. Singular systems; Delay-range-dependent; Bounded real lemma; Linear matrix inequality (LMI).

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1 Introduction

It is well known time-delay are frequently encountered in many fields of science and engineering, including communication network, manufacturing systems, biology, economy and other areas [1, 2]. Singular systems, which are also referred to as implicit systems, descriptor systems, have comprehensive practical background [3, 4]. It should be pointed out that when the stability problem for singular systems is investigated, the regularity and absence of impulse (causality) are required to be considered simultaneously. Hence, the stability problem for singular time-delay systems is more complicated than that for traditional linear ones.

Recent research efforts are focused more on the study for delay-dependent singular time-delay systems because many real singular systems are delay-dependent. Therefore, delay-dependent stability criteria for singular time-delay systems is one of the research hotspots and has been investigated by many researchers[5]-[26]. A BRL for singular time-delay systems was provided in [5], and thereby, the robust H_∞ control problem was solved. However, it is noted that the BRL for the singular time-delay systems in [5] is delay-independent, and therefore the obtained result is conservative. Generally,