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ON IMPROVEMENT OF ROBUST STABILITY CONDITIONS FOR DISCRETE-TIME POLYTOPIC SYSTEMS

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Abstract. This paper presents an improved robust stability condition for uncertain discrete-time systems with convex polytopic uncertainties. This condition is expressed in terms of a set of linear matrix inequalities, which guarantee the existence of a parameter-dependent quadratic Lyapunov function for the given uncertain system. Examples are provided to demonstrate the reduced conservatism of the proposed condition.

Keywords. Convex polytopic uncertainty, discrete-time systems, linear matrix inequality, parameter-dependent Lyapunov function, uncertain systems.

1 Introduction

During the past decades, considerable attention has been devoted to the problem of robust stability analysis of uncertain systems [1, 11]. One of the popular ways to deal with this issue is the technique based on the concept of quadratic stability, which requires to find a fixed Lyapunov function to check the stability of an uncertain system. A great number of robust stability results based on the quadratic stability approach have been proposed in the literature; see, e.g. [1, 10, 12] and the references therein. Usually, the use of Lyapunov functions only gives sufficient conditions of robust stability. Therefore, quadratic stability can lead to conservative results.

One of the many effective ways to improve robust stability conditions is the use of parameter-dependent Lyapunov functions. Many results based on this approach have been reported. For example, in the context of discrete-time systems with real convex polytopic uncertainties, a relative less conservative robust stability result was proposed in [4] in terms of a set of linear matrix inequalities (LMIs) defined at the vertices of the uncertainty domain. The essence in the derivation of this result consists in the introduction of some