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AN LMI APPROACH TO THE COMPUTATION OF LOWER BOUNDS FOR STABILITY MARGINS OF 2D DISCRETE SYSTEMS

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Abstract. This paper develops an LMI approach to computing lower bounds for the stability margin of 2D discrete systems described by Roesser's state space model. A new asymptotic stability condition for 2D discrete systems expressed in an LMI is proposed. Based on this, the stability margins of 2D discrete systems are presented. Illustrative examples are presented to demonstrate that the result obtained in this paper is less conservative than those in the literature. It is also shown that the results developed for the Roesser model can be extended to the Fornasini-Marchesini models.
Keywords. 2D discrete systems, stability margin, linear matrix inequality (LMI).

1 Introduction

Two-dimensional (2D) discrete systems have attracted much interest in the past years due to their theoretical importance and extensive applications [11, 12, 15, 22]. In the design of 2D discrete systems, an important concern is to ensure their stability. Therefore, the problem of stability analysis for 2D discrete systems has received considerable attention, various approaches have been proposed and many results on this issue have been reported in the literature, see e.g. [4, 5, 14, 19, 23] and the references therein. However, stability alone is not enough to ensure satisfactory performance of a 2D system, which can be either a 2D digital filter or a 2D control system. It is also desirable in practical applications to know whether the 2D system remains stable when a stable 2D system is subject to parameter uncertainties. This