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A GENERALIZED LMI-BASED APPROACH TO THE GLOBAL ASYMPTOTIC STABILITY OF DISCRETE-TIME DELAYED RECURRENT NEURAL NETWORKS

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Abstract. *The global asymptotic stability for discrete-time delayed recurrent neural networks is concerned. By using the linear matrix inequality method and Lyapunov-Krasovskii functional, some sufficient conditions are provided for ensuring the global asymptotic stability of the unique equilibrium point of the networks. Compared with the methods given in the earlier literature, our method presented here is simpler and more straightforward. An example is provided to show the usefulness of the results.*
Keywords: Global asymptotic stability, Discrete-time delayed recurrent neural networks, Linear matrix inequality, Lyapunov-Krasovskii functional

1. **Introduction.** Stability of continuous-time recurrent neural networks (RNNs) and delayed recurrent neural networks (DRNNs) has attracted increasing attention due to its key role in the practical applications such as pattern recognition, associative memories, optimization. So far, many stability criteria for global asymptotic stability or global exponential stability of continuous-time RNNs and DRNNs have been provided in the literature, see, for example, [1]-[12] and references therein. However, when implementing the continuous-time neural networks for computer simulation or computation, it is necessary to formulate a discrete-time version which is an analogue of the continuous-time neural networks. As pointed out in [10], the discrete-time analogue may not preserve the dynamics of their continuous-time counterparts. Due to this reason, it is crucial to study the stability of discrete-time RNNs and discrete-time delayed RNNs. Recently, the stability of discrete-time delayed RNNs has received much attention, and some sufficient stability conditions for discrete-time delayed RNNs have been presented, readers can refer to [10]-[16]. In this paper, by using linear matrix inequality (LMI) technique, a new global asymptotic stability result for discrete-time delayed RNNs is given. The main advantages of the present method are firstly that it is simple and needs no tuning of parameters, and secondly that it can be efficiently solved numerically utilizing interior-point algorithms [17]. Furthermore, the derived results are less conservative than those given in the earlier references and can give a direction for the hardware implementation of the recurrent neural networks. A numerical simulation is illustrated to show the efficiency of our result.