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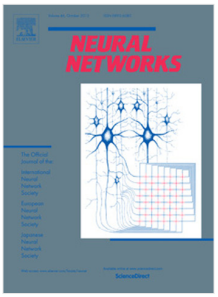

Passivity and stability analysis of neural networks with time-varying delays via extended free-weighting matrices integral inequality

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Passivity and stability analysis of neural networks with time-varying delays via extended free-weighting matrices integral inequality

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Abstract This paper is concerned with the problem of passivity for uncertain neural networks with time-varying delays. First, the recent developed integral inequality called generalized free-matrix-based integral inequality is extended to estimate further tight lower bound of integral terms. By constructing a suitable augmented LKF, an enhanced passivity condition for the concerned network is derived in terms of linear matrix inequalities (LMIs). Here, the integral terms having three states in its quadratic form is estimated by the proposed Lemma. As special cases of main results, for neural networks without uncertainties, passivity and stability conditions are derived. Through three numerical examples, it will be shown that the developed conditions can promote the level of passivity and stability criteria.

Keywords: Passivity, generalized free-matrix-based integral inequality, neural networks, time-delays, stability

1 Introduction

The stability of neural networks has received a great attention during the last decades owing to their excellent extensions in many scientific and engineering fields such as parallel computing, pattern recognition, associative memories, image processing, secure communication, and other scientific areas. For details, see [1-3] and reference therein.

It is well known that time-delay is a natural phenomenon but very important factor that should be considered in mathematical modeling of physical systems because of their occurrence caused by the finite switching speed of amplifiers and signal propagation. Time-delays are often a source of performance degradation such as oscillation and divergence. Since the dynamic behavior of equilibrium points has a major influence on the application of neural networks, considerable time and efforts have been concentrated on stability analysis for dynamic systems with time-delay by many researchers [4-23]. Especially, with the use of Lyapunov-Krasovskii theorem and some mathematical techniques, delay-dependent sta-

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