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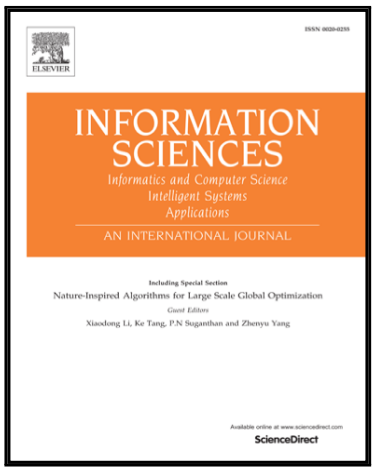

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Improved delay-dependent stability criteria for generalized neural networks with time-varying delays

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Abstract

This paper is concerned with the problem of stability analysis for generalized neural networks with time-varying delays. A novel integral inequality which includes several existing inequalities as special cases is presented. By employing a suitable Lyapunov-Krasovskii functional (LKF) and using the proposed integral inequality to estimate the derivative of the LKF, improved delay-dependent stability criteria expressed in terms of linear matrix inequalities are derived. Finally, four numerical examples are provided to demonstrate the effectiveness and the improvement of the proposed method.

Keywords: Generalized neural networks, Time-varying delays, Lyapunov-Krasovskii functional, Integral inequality

1. Introduction

Neural networks (NNs) have been successfully applied to various science and engineering problems, such as pattern recognition, image processing, associative memories [2], optimization problems and even mechanics of structures and materials [26]. NNs can be classified as static neural networks (SNNs) and local field networks (LFNNs) through choosing neuron states and local field states as basic variables, respectively. Due to the inherent communication time among the neurons and the finite switching speed of amplifiers in hardware implementation of the networks, inevitably time delay exists regardless how small it may be. Precisely the time-delay is an important factor that may cause performance degradation and/or the instability of neural networks. It is therefore that the stability analysis problem of neural networks with time delays has attracted considerable attention in the last few decades, and considerable research results have been presented. The existing stability criteria may well be grouped into delay-independent and delay-dependent ones. In general, the delay-dependent stability criteria are less conservative than the delay-independent ones. For the delay-dependent stability criteria, the maximum delay bound is an important index for checking and evaluating the conservatism of the criteria [38]. In turn, significant research efforts [1,3,5,8-12,14-18,20-22,24,25,27-29,32,33,35-37,39-43] have been devoted to the reduction of conservatism of the delay-dependent stability criteria for neural networks with time delays even when they are fairly small.

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