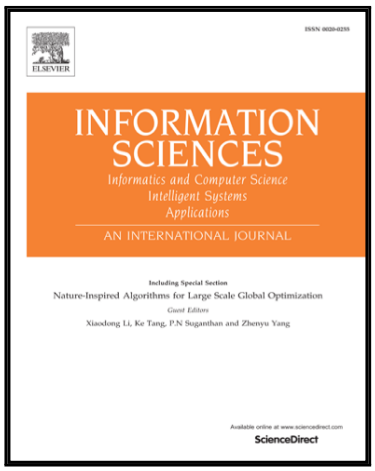

Further results on passivity analysis for uncertain neural networks with discrete and distributed delays

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Further results on passivity analysis for uncertain neural networks with discrete and distributed delays

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Abstract

The problem of passivity analysis of uncertain neural networks (UNNs) with discrete and distributed delay is considered. By constructing a suitable augmented Lyapunov-Krasovskii functional(LKF) and combing a novel integral inequality with convex approach to estimate the derivative of the proposed LKF, improved sufficient conditions to guarantee passivity of the concerned neural networks are established with the framework of linear matrix inequalities(LMIs), which can be solved easily by various efficient convex optimization algorithms. Two numerical examples are provided to demonstrate the enhancement of feasible region of the proposed criteria by the comparison of maximum allowable delay bounds.

Keywords: neural networks, delay, passivity, Lyapunov-Krasovskii functional, integral inequality

1. Introduction

In the past several years, various neural network models have been investigated due to their extensive applications in areas of pattern recognition, signal processing, associative memories, optimization problems and even mechanics of structures and materials [8,40]. It should be noted, due to the finite switching speed of amplifiers, time-delay occurs in many neural networks regardless how small it may be. Precisely time-delay is a main factor that can cause performance degradation and/or the instability of neural networks. Thus, delay-dependent stability and stabilization problem for neural network with time-delays receives considerable attention than delay-independent ones because the information on the size of time-delay is utilized in delay-dependent criteria, which lead to reduce the conservatism of stability and stabilization criteria [1,2,4,5,14,15,21-26,29-31,34,39,41,43].

On the other hand, the passivity theory originated from circuit theory plays an important role in the stability analysis of dynamical systems [11,20,37,46], which relates the input and output to the storage function. It has been extensively applied in many physical systems such as networked control, fuzzy control, sliding mode control and signal processing. Therefore, the study on passivity analysis for UNNs with time-delays has been widely investigated

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