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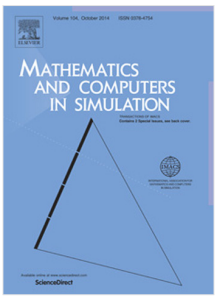

Robust dissipativity analysis for uncertain neural networks with additive time-varying delays and general activation functions

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Robust dissipativity analysis for uncertain neural networks with additive time-varying delays and general activation functions

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Abstract This paper deals with the problem of delay-dependent robust dissipativity analysis for uncertain neural networks with additive time varying delays by using a more general activation function approach. Different from previous literature, some sufficient information on neuron activation function and additive time-varying delays have been considered. By constructing a suitable Lyapunov-Krasovskii functionals (LKFs) with some new integral terms, and estimating their derivative by using newly developed single integral inequality that includes Jensen's inequality and Wirtinger-based integral inequality as a special case. A new delay-dependent less conservative global asymptotic stability and dissipative criteria have been established in the form of linear matrix inequalities (LMIs) technique. The effectiveness and advantages of the proposed results is verified by available standard numerical packages.

Keywords: *Neural networks, Dissipativity analysis, Lyapunov-Krasovskii functionals, Additive time-varying delays, Integral inequalities.*

1 Introduction

As is known to all, neural networks (NNs) have been received growing research interest for their wide-ranging applications in the diverse practical systems involving signal processing, pattern recognition, combinatorial optimization and other scientific fields [1]-[4]. All of these applications tediously depends on the dynamical performance. On the other side, the time delays commonly affects the system behaviors like as the unstable, poor performance, and oscillation [5], [6]. Therefore much efforts need to study the dynamical behaviors of NNs with time delays, deeply. Thus, many approaches based on various tools to evaluate the stability analysis of NNs with time delays, and a large number of related results have been informed on this issue based on Lyapunov stability method via LMIs technique [1]-[51].

Generally, the time delays in state variable was assumed to appear in simple or singular form. Recently, the authors in [14], have been introduced a novel system model which contains successive time-varying delay components in the sense of state vector. The proposed system in [14], may be employed in several application sectors such as remote control and networked control systems (NCSs). In NCSs, sometimes signal transferred between two nodes may be double segments of systems. Thus, a system with two time delay components have been considered in [14], by variable transmission properties [16], [17]. In NCSs, this kind of time delays may have strong application experience compared than single delay ones. Since it is not reasonable to associate them together. This attention motivates us to introduce multiple time delays into the stability problems. Thus, the concept of additive time-varying delays have been received an extensive attention in the field of stability analysis of NNs [15]-[25]. There are many researchers much effort has been devoted to study stability of NNs with additive time delays, good results have been published in the last few years [15]-[25]. In [15], the authors proposed the stability criteria for generalized NNs including Markov jump parameters and additive time delays by using free-weighting matrix method. In [19], by introducing a novel augmented LKFs with the information on the additive time delays of system, improved stability criteria have been proposed. Recently, the robust delay-dependent stability criteria for uncertain neural networks with two additive time-varying delay

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