International Journal of Innovative Computing, Information and Control
Volume **7**, Number **4**, April **2011**
ICIC International ©2011 ISSN 1349-4198
pp. 1831–1843

$\mathcal{L}_2 - \mathcal{L}_\infty$ FILTERING FOR TIME-DELAYED SWITCHED HOPFIELD NEURAL NETWORKS

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Received December 2009; revised May 2010

Abstract. *This paper investigates the delay-dependent $\mathcal{L}_2 - \mathcal{L}_\infty$ filtering problem for time-delayed switched Hopfield neural networks. A new type of $\mathcal{L}_2 - \mathcal{L}_\infty$ filter is proposed such that the filtering error system is asymptotically stable with guaranteed $\mathcal{L}_2 - \mathcal{L}_\infty$ performance. The criterion is formulated in terms of linear matrix inequalities (LMIs), which can be checked readily by using certain types of standard numerical packages. A numerical example illustrates the effectiveness of the proposed $\mathcal{L}_2 - \mathcal{L}_\infty$ filter.*
Keywords: $\mathcal{L}_2 - \mathcal{L}_\infty$ filtering, Switched systems, Hopfield neural networks, Linear matrix inequality (LMI), Lyapunov-Krasovskii stability theory

1. **Introduction.** Studying neural networks has been the central focus of intensive research activities during the last decades since these networks have found wide applications in many areas. These include associative memory, pattern classification, reconstruction of moving images, signal processing and solving optimization problems to name a few [1, 2]. These applications greatly depend on the dynamic behaviors of the underlying neural networks. Among several neural networks, Hopfield neural networks [3] are the most popular. They have been studied extensively and successfully applied to many areas such as combinatorial optimization, signal processing and pattern recognition [1, 4, 5]. Recently, by integrating the theory of switched systems with Hopfield neural networks, the mathematical model of the switched Hopfield neural networks was introduced to represent some complex nonlinear systems efficiently [6, 7]. Some stability conditions for switched Hopfield neural networks were investigated in [6, 7]. However, up to now, the dynamic behavior of switched Hopfield neural networks has received very little research attention, despite its potential and practical importance.

In relatively large-scale neural networks, it is often the case that only partial information about the neuron states is available in the network outputs. Therefore, in order to use the neural networks, one often needs to estimate the neuron state through available measurement, and then use the estimated neuron state to achieve certain practical performances, such as systems modeling, signal processing and control engineering. The state estimation problem for neural networks has received some research attentions. Wang et al. first derived a delay-independent criterion for state estimator design of neural networks with time-delay in [8]. The authors in [9] investigated the design of the state estimator of neural networks with time-delay and proposed a delay-dependent condition such that