International Journal of Innovative Computing, Information and Control
Volume **5**, Number **10(A)**, October **2009**

 ISSN 1349-4198
pp. **3013–3024**

ROBUST STABILITY ANALYSIS OF UNCERTAIN NEUTRAL FUNCTIONAL SYSTEMS

Zhixin Tai[1], Xingcheng Wang[1] and Dianhui Wang[2]

[1]Department of Automation
School of Information Science and Technology
DaLian Maritime University
DaLian, 116026, P. R. China
taizhixin01@163.com; xc_wang@dl.cn

[2]Department of Computer Science and Computer Engineering
La Trobe University
Melbourne, VIC 3086, Australia
dh.wang@latrobe.edu.au

Received May 2008; revised October 2008

Abstract. *This paper presents criteria on robust stability of a class of neutral functional systems with uncertainties. Upper bounds of uncertain parameters, which guarantee the stability of the uncertain system, have been estimated using matrix norm or spectral radius. These criteria generalize some existing results on the stability analysis of neutral delay-differential systems. Numerical examples are given to illustrate our results.*
Keywords: Neutral functional systems, Stability criteria, Spectral radius, Uncertainty

1. **Introduction.** Stability analysis of dynamical systems play a key role in control system design. As uncertainties present, upper bound estimations of uncertain parameters involved in the system are essential. The main implication behind the stability analysis is to define feedback gains, so that the resulting closed-loop system will have a larger robust stability bound. Current studies on neutral delay-differential systems have received considerable attention due to the extensive applications, such as in lossless transmission lines [1, 2], engineering control [2-4] and population ecology [5]. Many results on stability analysis for such systems have been established using the Lyapunov approach, characteristic equation method and state solution methods. The existing results can be categorized into two types, *delay independent* and *delay dependent*. Several delay-independent and delay-dependent sufficient conditions on asymptotic stability of the systems were presented in [6-19]. More recently, exponential stability criteria for discrete-time switched linear systems with time-delay are presented in [20]. Chen et al. [21] provide new robust stability conditions of cellular neural networks with time-varying discrete and distributed delays. In [22], Sun et al. address robust adaptive control technique to deal with norm-bounded uncertain neutral systems with unknown bounds.

Although there are a lot of reports about stability analysis including robust stability for neutral systems, however, only limited works concerning the stability of linear neutral functional differential systems are presented [23-26]. Moreover, to the best of the authors' knowledge, the issue of robust stability of uncertain neutral functional differential systems remains open, which motivates this paper. In practice, system model always contains some uncertainties due to external unknown noise, environmental influence and uncertain or slowly varying parameters, etc. Uncertainties can make differences to dynamics of