International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **8**, August **2010**

ICIC International ©2010 ISSN 1349-4198
pp. 3631–3640

FAULT DETECTION FOR CONTINUOUS-TIME NETWORKED CONTROL SYSTEMS WITH NON-IDEAL QOS

Zhou Gu[1,2], Daobo Wang[1] and Dong Yue[3]
[1]College of Automation Engineering
Nanjing University of Aeronautics Astronautics
29 YuDao Street, Nanjing, 210016, P. R. China
guzhouok@yahoo.com.cn; dabo_wang@njnu.edu.cn

[2]School of Power Engineering
[3]Institute of Information and Control Engineering Technology
Nanjing Normal University Nanjing
78 Bancang Street, Nanjing, 210042, P. R. China
medongyue@163.com

Received February 2009; revised July 2009

Abstract. *Fault detection for continuous-time Networked control systems (NCSs) with non-ideal network Quality of Service (QoS) is studied in this paper. An integrated index $\eta(t)$ which related to network-induced delay, data dropout and error sequence is presented to describe QoS. Then the problem of Network-based Fault Detection Filter (NFDF) design is transformed as an H_∞ optimization problem for linear systems with interval time-varying delay. A delay-dependent sufficient condition is derived by using Layapunov-Krasovskii approach and an associated solution of the problem can be obtained by solving a set of linear matrix inequalities (LMIs). To avoid the conservatism caused by magnifying $\eta(t)$ to η_M in deriving the results, the convexity of the matrix function is employed . A simulation example is given to demonstrate the effectiveness of the proposed method.*
Keywords: Fault detection filter (FDF), NCS, Convexity of matrix

1. **Introduction.** Networked Control Systems (NCSs) have been an active research topic in recent years. They differ from traditional control systems in that the connections of their components are via shared communication networks instead of point-to-point wiring. The use of the shared communication networks between control system components is mainly motivated by lower cost, easier maintenance and higher reliability of the closed-loop systems [1]. However, the introduction of networks also brings some new problems and challenges, such as a dropout, a limited bandwidth, a network induced time delay and an information loss by reasons of encoding and quantization [2, 3, 4], which reduce performance of the stystem, moreover, unexpected faults may emerge.

Fault detection and identification(FDI) schemes for dynamic systems have received more and more attention in the last two decades [5, 6, 7, 8], principally due to the increasing demand for higher performance, as well as due to higher safety and reliability standards. The early indication of failures can help to avoid major plant breakdowns and catastrophes.

However, due to their special characteristics, to the best of our knowledge, fault detection technique for networked control systems has only gained some initial research, especially for continuous-time NCSs, which are not only theoretically interesting and challenging, but also very important in practical applications. The discrete-time NFDF are studied in [9, 10, 11, 12] and the references therein. *L.Ma et al.* [13] and *M. Zhong et al.*