International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **4**, April **2010**

 ISSN 1349-4198
pp. 1833–1842

NETWORK-BASED H_∞ CONTROL OF SYSTEMS WITH TIME-VARYING SAMPLING PERIOD

Yulong Wang[1] and Guanghong Yang[2]

[1]School of Electronics and Information
Jiangsu University of Science and Technology
2 Meng Xi Road, Jing Kou District, Zhenjiang, 212003, P. R. China
feixiangwyl@163.com

[2]College of Information Science and Engineering
Northeastern University
3 Wen Hua Road, He Ping District, Shenyang, 110004, P. R. China
yangguanghong@ise.neu.edu.cn

Received October 2008; revised March 2009

Abstract. *This paper is concerned with the problem of robust H_∞ controller design for networked control systems (NCSs) with time delay, packet dropout and time-varying sampling period. The considered NCSs may receive more than one control input during a sampling period. A multi-objective optimization methodology in terms of linear matrix inequalities (LMIs) is presented to deal with H_∞ performance optimization for NCSs with time-varying sampling period. The merit of the proposed methods lies in their less computational complexity, which is achieved by avoiding introducing any redundant matrix variables. Even for NCSs which may receive zero or one control input during a sampling period, the proposed design methods are still applicable and less conservative than the existing ones. The simulation results illustrate the effectiveness and less conservatism of the proposed design methods.*
Keywords: Networked control systems (NCSs), Time delay, Packet dropout, Time-varying sampling period, H_∞ control

1. **Introduction.** In many practical systems, the original plant, controller, sensor and actuator are difficult to be located at the same place, they are often connected over network media, giving rise to the so called NCSs. The flexibility and ease of maintenance of a system using a network to transfer information is a very appealing goal. However, computer loads, networks, sporadic faults, etc. may cause time delay, packet dropout and sampling period jitter, etc., which might be potential sources to instability and poor performance of NCSs.

Hespanha et al. [1] reviewed several recent results on estimation, analysis, and controller synthesis for NCSs. By taking into consideration both the network-induced delay and the time delay in the plant, [2] proposed a new controller design method for NCSs, and the correlation between the network-induced delay and the time delay in the plant was also investigated. The problems of stability/stabilization for NCSs in the presence of network-induced delay have received much attention [3]-[8], and [9, 10, 11] studied the problems of stability/stabilization for NCSs with packet dropout. [12] studied the Linear Quadratic Gaussian (LQG) optimal control problem in the discrete time setting, showing that the separation principle holds in the presence of packet dropout. For other methods dealing with time delay specifically, see also [13], [14], etc. In [15], diagnosis of actuator/component faults for a class of networked control systems using adaptive observer