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DELAY-DEPENDENT ROBUST FILTERING FOR NETWORKED CONTROL SYSTEMS WITH POLYTOPIC UNCERTAINTIES

Chong Jiang[1,2,3], Qingling Zhang[1,2] and Dexin Zou[3]

[1]Institute of Systems Science
[2]Key Laboratory of Integrated Automation of Process Industry, Ministry of Education
Northeastern University
Shenyang 110004, P. R. China
jiang0941@163.com; qlzhang@mail.neu.edu.cn

[3]Research Center of Sports Social Science
Shenyang Sports University
Shenyang 110102, P. R. China

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Abstract. *This paper investigates the problem of delay-dependent robust filtering for networked control systems, where measurement quantization, signal transmission delay and data packet dropout are considered. The signal transmission delays are assumed to have both an upper bound and a lower bound. The objective of our work is to develop a less-conservative condition to guarantee the closed-loop system asymptotic stability with the prescribed H_∞ performance. Based on the derived H_∞ performance analysis results, the H_∞ filter is designed in terms of linear matrix inequalities. Moreover, the resulting criterion is extended to more general cases, where the parameter uncertainty of system matrices is assumed to be of the polytopic type. Finally, numerical examples are presented to illustrate the effectiveness of the main results.*
Keywords: Networked control systems, Robust H_∞ filter, Polytopic-type uncertainties, Linear matrix inequalities, Quantization

1. **Introduction.** Networked control systems (NCSs) are closed loop feedback systems constituted by real-time network. In NCSs, sensors, actuators and controllers are connected by means of a network or other shared medium, and information transmission among control system components is realized through a commonly shared network medium. Compared with the control system marked by traditional point to point direct link, there are several advantages for NCSs, which are given as follows, but not limited to less wire, less cost of installation, easy maintenance, higher flexibility and reliability, good fault detection ability [1-4]. However, some problems such as network-induced delay, data packet dropout, time-varying sampling period and quantization error are usually arisen due to the limit of bandwidth, so the use of a network may deteriorate the performance or cause instability of NCSs [5-9].

On the other hand, Kalman filtering is one of the celebrated H_2 filtering approaches that is widely used in various fields of signal processing and control. It has been known that the standard kalman filtering algorithms would not guarantee satisfactory performance when there exists uncertainty in the system model. One way to deal with this issue is to use the H_∞-norm, which has been introduced in the robust control setting (see, e.g., [10-14], and the references therein). In NCSs, the use of a network will lead to signal transmission delay, data packet dropout or signal quantization error and may deteriorate the performance or cause instability. So a significant issue is how to design a robust filter for NCSs such that the closed-loop system is asymptotically stable with an H_∞