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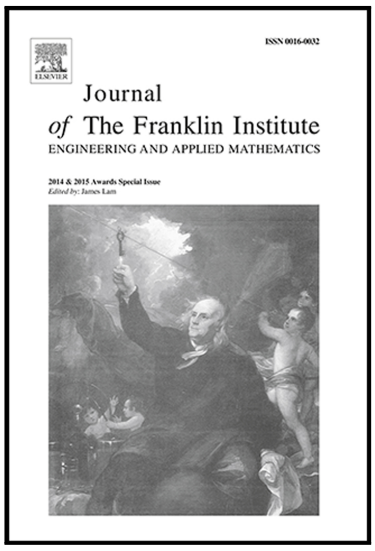

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Improved approaches on adaptive event-triggered output feedback control of networked control systems

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Abstract

This paper studies the static output-feedback control in a class of networked control systems. Different from the existing results, the transmission of control signals is based on a novel adaptive event-triggered scheme, where the adaptive thresholds depend on the dynamic error of the system rather than predetermined constants as the traditional ones. The amount of the releasing data is regulated by the adaptive thresholds that play an essential role in decision of whether releasing the sampled data or not. Through fully using the information on network-induced delay and introducing two adjusting parameters, an augmented Lyapunov-Krasovskii (L-K) functional is constructed. Especially, some novel Wirtinger-based integral inequalities are utilized to reconsider those previously ignored information, which can help reduce the conservatism. Furthermore, a novel constructive method is developed to obtain the controller gain by solving the achieved linear matrix inequalities (LMIs). Finally, three numerical examples are given to illustrate the efficiency of the presented results.

Key words: networked control systems (NCSs); static output feedback control; adaptive event-triggered strategy; network-induced delay

1 Introduction

Control systems communicating over a certain digital network are referred as networked control systems (NCSs), where the components, i.e., the sensors, controllers, and actuators are distributed and connected to a controlled plant through a communication network. Compared with the traditional point-to-point connected control systems, the main advantages of NCSs are described as easy maintenance, low cost, and increasing system flexibility. Thus, a large number of demands of NCSs have appeared in a wide range of areas, such as environmental monitoring, smart grid, teleoperation control, and industrial automation. However, since the utilization of communication networks can cause network-induced delay, which may cause system performance to be poor or even unstable, a great deal of efforts have been exerted to the research on stability and stabilization of NCSs [5-36].

Note that in many situations, since digital controllers are more preferable than continuous-time ones because they are only executed at discrete time instants, the sampled-data controller was widely utilized [1-4]. Especially, it is generally supposed that all the sensors should get access to the communication network to transmit the sampled data. Thus many results on NCSs were put forward based on time-triggered communication [5-8]. Yet, this transmission scheme may lead to inefficient utilization of limited network resources. As a result, in order to mitigate the unnecessary waste of limited network resources, a novel event-triggered technique was presented and widely improved to study the NCSs [9-36], which was verified to be more effective than time-triggered one. The main idea is mainly based on designing a pre-set triggering condition to decide whether the sampled data can be sent or not [10-13,14-36].

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