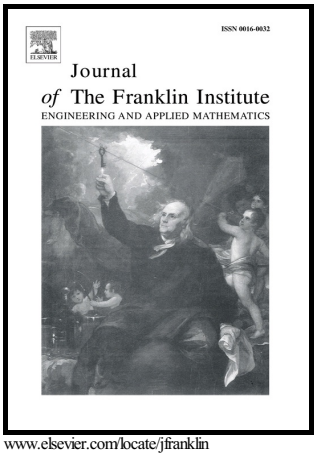

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Output feedback control of networked systems with a stochastic communication protocol

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Abstract

This paper addresses an output feedback control problem for a class of networked control systems (NCSs) with a stochastic communication protocol. Under the scenario that only one sensor is allowed to obtain the communication access at each transmission instant, a stochastic communication protocol is first defined, where the communication access is modelled by a discrete-time Markov chain with partly unknown transition probabilities. Secondly, by use of a network-based output feedback control strategy and a time-delay division method, the closed-loop system is modeled as a stochastic system with multi time-varying delays, where the inherent characteristic of the network delay is well considered to improve the control performance. Then, based on the above constructed stochastic model, two sufficient conditions are derived for ensuring the mean-square stability and stabilization of the system under consideration. Finally, two examples are given to show the effectiveness of the proposed method.

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 over a communication network [1, 2]. Despite NCSs have many advantages, such as simple installation, reduced maintenance time and low cost in comparison with the traditional control systems, the introduction of the communication networks can cause system performance deterioration and even instability [3, 4, 5]. With an increasing demand of NCSs in a wide range of areas, such as, environmental monitoring, smart grids and industrial automation, much effort has been made in the stability and stabilization of NCSs, see, for example [6, 7, 8] and the references therein.

Notice that in the existing literature, it is generally supposed that all the sensors could get access to the communication network to transmit the sampled data simultaneously. However, this assumption is not always satisfied in the communication networks. Since the multi data sampled by the distributed sensors is transmitted over a bandwidth-limited network, the data collisions are unavoidable [9, 10]. Fortunately, there are some fruitful results to tackle this problem. For example, a control and communication co-design strategy has been proposed in [11] under consideration of the network-induced delay, in which the communication approach can be regarded as a static protocol. It should be pointed out that this protocol is not

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