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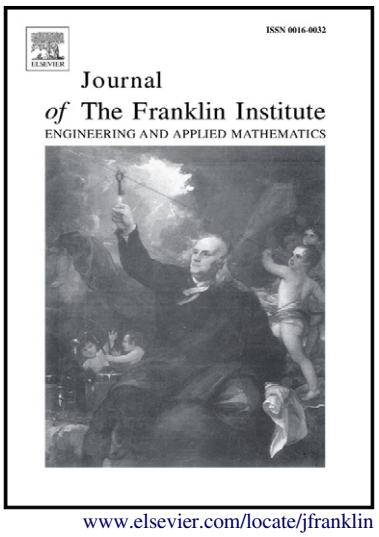

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Optimal tracking performance for non-square plant models with input disturbance and feedback channel noise*

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Abstract

In this paper, the optimal tracking performance for linear time invariant (LTI) and non-square plants was investigated. An H_2 norm of error signal between the reference input and the output of system is used as the tracking performance index. Due to the limitations of non-square plants in tracking reference input signals, two-degrees-of-freedom controller was adopted to control the system. The reference input under consideration is a step signal and there exists input stochastic disturbance and feedback channel noise. Explicit expression is given to show that the tracking performance in this kinds of systems is critically dependent on the intrinsic characteristics of the given plant, including the locations not the directions of the nonminimum phase zeros and unstable poles, which is different from the plants that have the same input and output dimensions. It is also shown that the input disturbance and feedback channel noise may degenerate the tracking performance. Finally, computer simulation is provided to illustrate the analytical results.

Keywords Optimal tracking performance; Non-square plant; Nonminimum phase zeros; Unstable poles

1 Introduction

Recently, many researchers pay their much attention to the study of networked control systems (NCSs), which mainly involve two important aspects, stability and performance [1-5]. In NCSs, the controller, the actuator and the plant to be controlled exchange message via the communication channel, wired or wireless. Thus, issues such as time-delay [6-7], packet dropouts and disordering [8], noise [9] and other factors [10-11] in communication channel will inevitably bring about adverse effects on the stability and performance of NCSs, still can bring about a system to break down even.

Stability analysis of NCSs has been actively studied with different assumptions on the model of communication channel. For noiseless data rate limited channels, the minimal data rate for stabilization of linear systems has been derived in [12-14]. Stabilization of linear stochastic systems over Eraser channel by Linear Quadratic Gaussian (LQG) controllers was studied in [15]. From an alternative approach, an additive white Gaussian noise (AWGN) channel model was considered in [16] and data-driven predictive control for networked control systems is investigated in [17]. On the study of performance of NCSs, Guan etc.[18] model the bandwidth of communication channel with a low pass Butterworth filters of order one and investigated

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