International Journal of Innovative
Computing, Information and Control
Volume **5**, Number **10(B)**, October **2009**

 ISSN 1349-4198
pp. 3303–3311

DIGITAL CONTROL DESIGN OF DECENTRALIZED STOCHASTIC SINGULARLY-PERTURBED LARGE-SCALE ACTUATOR TYPE SYSTEMS WITH MULTIPLE TIME-VARYING DELAYS

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Received September 2008; revised February 2009

Abstract. *This paper develops an optimal robust control algorithm for finding digital control of decentralized stochastic singularly-perturbed large-scale actuator type systems with multiple time-varying delays. Due to the derived algorithm concerns at each moment, the found controller is also suitable in the time varying condition. Moreover, this type of system possesses the fast response characteristics of the subsystems. The system order can be reduced and the analysis process can be simplified. This noise-disturbed, time varying and multiple delay system can be often seen in practical computer controlled large-scale systems such as electric power systems, communication networks, cyber networks, and aerospace systems. Finally, the optimal cost is also obtained.*
Keywords: Control design, Decentralized, Stochastic, Singularly-perturbed, Multiple time-varying delays

1. **Introduction.** Composing a state feedback control for singularly perturbed systems by feedback control of slow and fast systems has always been one of the most important issues in control design for singularly perturbed systems [l,2]. A singularly perturbed system converges to the slow system in the graph topology as the small parameter tends to zero. Computer controlled systems are just this kind of structure, due to the fast data processing of CPU. The problem of time-delay systems has been explored because delay is commonly encountered in various engineering systems, such as long transmission lines, electric networks, biological, artificial neural networks, chemical processes, and communication. Its existence may produce undesirable system responses. Basin et al. solve the optimal filtering problem for linear systems with multiple state and observation delays [3]. Also, Mahmoud et al. establish new results for the problems of dissipative analysis and state-feedback synthesis of singular time-delay systems. But when the system control design is concerned with digital control, time-varying control, and multiple delays, the developed methods of [3] and [4] do not suitable to apply in such case. [5,6] develop control algorithms in the same system, but similarly these algorithms are not able to