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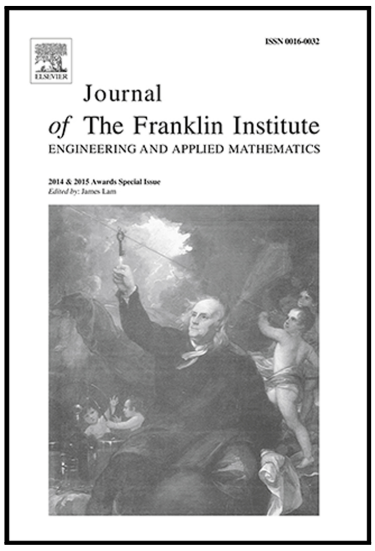

Switched filtering for networked systems with multiple packet dropouts

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ACCEPTED MANUSCRIPT

Switched filtering for networked systems with multiple packet dropouts*

Yafeng Guo†

Abstract

This paper is concerned with the state estimation problem for networked systems in presence of packet dropouts in both sensor-to-filter and controller-to-actuator channels. The considered stochastic packet dropouts are independent and Bernoulli distributed. Based on an auxiliary linear-minimum-variance (LMV) filter and hard-decision, a switched filter is proposed for state estimation. The proposed filter is proved to have better estimation performance than the existing LMV filter. A sufficient condition on stability of the switched filter for time-invariant systems with constant controller outputs is also given. Unlike the exiting stability conditions for LMV filters, the proposed one does not require that the estimated plant is stable. Simulation results show the advantage and the effectiveness of the developed filter and its stability condition.

Keywords. Networked systems; State estimation; Packet dropout; Stability.

I. Introduction

During the last decades, the rapid development of information technology promotes the improvement of the modern large-scale systems, which help in boosting productivity. Meanwhile, many new problems around the modern large-scale systems are also emerging for theoretical and applied research. For example, in modern industry, data generated by machines and devices, cloud-based solutions, business management, etc, has reached a total volume of more than 1000 Exabytes annually and is expected to increase 20-fold in the next ten years [1]. This is often referred to as big data. Big data, being generally unstructured and heterogeneous, is extremely complex to handle via traditional approaches. In [1], the challenges and trends of big data are discussed for modern industry. As one of the most popular data-driven approaches for complicated large-scale process, PLS is improved in [2] for fault diagnosis. In [3], a data-driven process monitoring approached is proposed based on modified orthogonal projections to latent structures. In [4], performance monitoring for vehicle suspension system is investigated via fuzzy positivistic C-Means clustering based on accelerometer measurements. In [5], an adaptive fuzzy control approach is presented for a class of complex nonlinear systems with time-delay and unmodeled dynamics.

Besides big data, another important feature of the modern large-scale systems is the introduction of communication network (networked systems). Compared with the conventional systems whose components are generally connected via a point-to-point way, the networked systems have many advantages

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