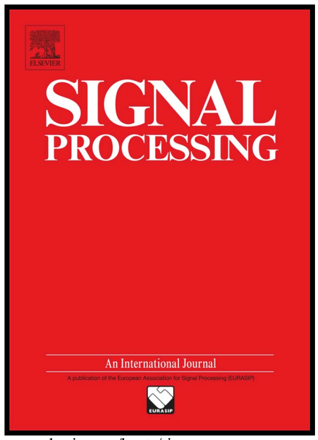

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Distributed fusion filter for networked stochastic uncertain systems with transmission delays and packet dropouts

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Abstract

This paper is concerned with the distributed fusion filtering problem for networked stochastic uncertain systems with white multiplicative noises. The measured data of each sensor are transmitted to the local processor over different communication channels with different one-step delay and packet dropout rates. At each moment, the local processor may receive one or two data packets or nothing. Local filters at individual local processors are transmitted to the fusion center to produce a fusion filter. First, a new augmented model with a lower-dimension state vector is developed. Based on the new augmented model, the local optimal linear filter is designed in the linear minimum variance sense. Then, the cross-covariance matrices between any two local filtering errors are derived to compute the fusion weights. At last, the distributed fusion filter is obtained based on the well-known fusion algorithm weighted by matrices in the linear minimum variance sense. Moreover, the steady-state behavior of the proposed distributed fusion filter is analyzed.

Keywords: Distributed fusion filter, random delay, packet dropout, multiplicative noise, steady state.

1. Introduction

In recent years, state estimation problem has become a hot research topic for systems with various uncertainties due to the partially or completely unknown parameters and environmental disturbances. The uncertainties can be approximated mathematically by an additive noise or a multiplicative noise. These systems are widely used in target tracking, detection, signal processing and other areas. The results include the nonlinear polynomial filters [1-3], robust filter [4] and the least mean square optimal linear filter [5].

On the other hand, in many practical systems such as networked control systems and sensor networks, there often exist data random delays and dropouts in information exchange over unreliable communication links. Hence, the