

State Estimation for Uncertain Stochastic Fuzzy T-S Models with State-Dependent Noises

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Abstract

In this study, state estimation problem for the stochastic T-S fuzzy model with state-dependent noises on the system matrix and the output matrix is attacked. First, we derive sufficient conditions for a class of standard fuzzy state observers to ensure that the state estimation error is mean square bounded. The observer gain matrices in the fuzzy observer can be obtained by solving a linear matrix inequality (LMI). Then, the robust H^∞ fuzzy filtering problem is considered to minimize the worst-case ratio of the power of state estimation error to that of the external noises. The H^∞ observer gain matrices can be obtained by solving two linear matrix inequalities. To further improve estimation performance, we study the optimal Kalman fuzzy filtering problem with known statistical information of the process noise and the measurement noise. It is shown that the minimum-variance estimation for the uncertain stochastic T-S fuzzy model is actually a linear estimation problem from the viewpoint of conditional expectation. The structure of the developed optimal Kalman fuzzy filter also very resembles that of the conventional Kalman filter.

Keyword : stochastic T-S fuzzy model, H^∞ fuzzy filter, Kalman fuzzy filter