ABSTRACT

A robust fault detection and isolation scheme is proposed for uncertain continuous linear systems with discrete state delays for both additive and multiplicative faults. Model uncertainties, disturbances and noises are represented as unstructured unknown inputs. The proposed scheme consists of a Luenberger observer for fault detection and a group of adaptive observers, one for each class of faults, for fault isolation. The threshold determination and fault isolation are based on a multi-observer strategy. Robustness to model uncertainties and disturbances can be guaranteed for the scheme by selecting proper thresholds. All the signals, i.e., the fault estimate and the state and output estimation errors of each isolation observer can be shown to be uniformly bounded, and the estimate of the fault by the matched observer is shown to be satisfactory in the sense of extended $L_2$ norm. Furthermore, the sensitivity to fault and the fault isolability condition are analyzed also in the paper. Simulations of a heating process for detecting and isolating an actuator gain fault and an additive fault show the proposed scheme is effective.

KeyWords: Fault detection and isolation, fault identification, linear retarded time-delay systems, uncertain systems, adaptive observers.