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Adaptive observer-based $H_\infty$ FTC for T-S fuzzy systems. Application to cart motion model.

(English) Zbl 1454.93128


Summary: In this paper, an adaptive observer-based fault-tolerant control (FTC) strategy is proposed for a class of Takagi-Sugeno (T-S) fuzzy systems with both actuator and sensor faults under external disturbances. FTC approach is developed to compensate the actuator faults and to stabilize the faulty system. Furthermore, using $H_\infty$ optimization technique, an adaptive fuzzy observer is developed, not only to achieve a simultaneous estimation of system states, sensor and actuator faults, but also to attenuate the influence of disturbances. In terms of linear matrices inequalities (LMIs), sufficient conditions of the existence of observer and controller are derived. We overcome the drawback of two-step algorithm by proposing a single-step one which allows to solve only the strict LMIs. Therefore, the obtained results present an acceptable compromise between conservatism reduction and computational complexity. Finally, two numerical examples which one of them is an application to a cart motion model are presented to demonstrate the usefulness of the proposed method.

MSC:

93C40 Adaptive control/observation systems
93C42 Fuzzy control/observation systems
93B53 Observers

Keywords:

adaptive fault-tolerant control; Takagi-Sugeno fuzzy systems; adaptive fuzzy observer; cart motion model

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