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论文与报告

基于混杂系统方法的一类采样数据系统鲁棒故障检测

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摘要
针对具有连续时间过程噪声和离散时间测量噪声的采样数据系统, 提出了一种新的鲁棒故障检测直接设计方法. 首先利用具有有限跳变的线性系统作为残差产生器, 采样数据系统的鲁棒故障检测设计问题被描述成采样数据滤波问题, 然后给出有限跳变线性系统有界实引理的线性矩阵不等式(LMI)表达形式, 基于此, 推导出采样数据系统鲁棒故障检测滤波器的存在条件及设计参数, 并将所提方法推广到具有结构不确定性的采样数据系统上. 所设计的滤波器能够保证残差与故障之间误差最小, 并对过程噪声、测量噪声、结构不确定性等因素鲁棒. 最后, 通过数值仿真对所提方法的可行性进行了验证.

关键词 鲁棒故障检测 采样数据系统 线性矩阵不等式 有界实引理

分类号

A Hybrid System Approach to Robust Fault Detection for a Class of Sampled-data Systems

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Abstract
In this paper, a novel direct design methodology of robust fault detection for a class of sampled-data systems with both continuous-time process noise and discrete-time measurement noise is presented. First, by using a linear system with finite discrete jumps as residual generator, the design of robust fault detection filter is formulated as a sampled-data filtering problem. Then, a bounded real lemma for the linear system with finite discrete jumps is developed in terms of linear matrix inequalities (LMIs). Based on this, a sufficient condition for the existence of the fault detection filter as well as the design parameters is derived. Furthermore, the case of sampled-data systems with model uncertainties is extended. The designed fault detection filter cannot only make the error between residual and weighted fault as small as possible but also exhibit robustness to all uncertainties including continuous-time process noise, discrete-time measurement noise, and model uncertainties. Finally, simulation results are provided to demonstrate the feasibility of the proposed method.

Key words Robust fault detection sampled-data systems linear matrix inequality (LMI) bounded real lemma

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