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基于局部交叠异步切换的网络控制系统故障检测

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Fault detection for the networked control systems with locally over-lapped asynchronous switching law

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摘要

针对存在时变短时延和丢包的网络控制系统故障检测问题, 将非线性对象建模为线性切换系统. 考虑工程中存在的局部交叠切换律, 将切换系统划分为若干局部交叠切换子系统. 同时, 考虑滤波器切换滞后引起的异步切换问题, 进一步将系统增广为局部交叠异步切换系统. 在此基础上, 结合公共Lyapunov 函数和平均驻留时间方法, 以LMI形式给出检测滤波器设计方法. 最后, 通过某网络化飞行器的全包线飞行验证了所提出方法的有效性.

关键词 : 故障检测, 异步切换, 局部交叠, 时延及丢包

Abstract :

For the fault detection problem of the networked control systems with the presence of time-varying short delay and packet dropouts, the dynamics of the nonlinear plant are modeled as a switched system. Considering the locally overlapped switching law in practice, the switched system above is divided into several locally overlapped switched systems. Also, considering the asynchronous switching phenomena between the filters and models, the systems are further augmented to be
locally overlapped asynchronous switched systems. By combing the common Lyapunov function method and the average dwell time method, the fault detection filters are established in terms of LMIs. Finally, numerical examples based on a networked aircraft's full-envelope flight are given to demonstrate the effectiveness of the proposed method.

Key words : fault detection 　 asynchronous switching 　 locally overlapped 　 delays and packet dropouts

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引用本文:

王昭磊 徐利杰 王青 董朝阳. 基于局部交叠异步切换的网络控制系统故障检测[J]. 控制与决策, 2014, 29(11): 1951-1958. WANG Zhao-lei XU Li-jie WANG Qing DONG Chao-yang. Fault detection for the networked control systems with locally over-lapped asynchronous switching law. Control and Decision, 2014, 29(11): 1951-1958.

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