



## 论文摘要

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## 一类非线性系统的快速鲁棒故障诊断

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**摘要:** 结合在线估计器和滑模观测器方法, 基于所给出的一种新的自适应学习算法, 提出了一种针对非线性不确定系统的鲁棒故障诊断方法. 滑模观测器可以消除建模不确定性的影响以得到准确的状态估计, 而在线估计器可以实时估计故障的大小. 在此, 基于李亚普诺夫函数, 在理论上证明了所给出的状态和参数估计误差都是一致有界的; 针对三容水箱DTS200所做的仿真实验, 其结果验证了该方法的可行性. 研究表明, 由于滑模项的引入, 使得该方法的故障检测时间大大缩短, 其性能比Polycarpou所提出的在线估计器方法的性能要好.

**关键词:** 非线性系统; 故障诊断; 自适应; 滑模观测器

## Fast and robust fault diagnosis of a class of nonlinear systems

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**Abstract:** In recent years, robust fault diagnosis of nonlinear systems has become one of the most difficult problems in the fault diagnosis community. By combining the Polycarpou's approximator with sliding mode observers, a novel approach to robust fault diagnosis of a class of nonlinear uncertain systems is proposed in this article, in which a new adaptive learning algorithm we proposed is applied. Exact state estimates are obtained by the sliding mode observers, which can eliminate the impact of modelling uncertainties, and meanwhile, the online approximator is used to estimate the fault amplitude in real time. By use of Lyapunov function, it is proved that the errors of state and parameter estimates are consistently bounded. Simulation results on a three tank system DTS200 demonstrate the effectiveness of the proposed approach. In addition, the fault detection time of the proposed approach is greatly shortened due to the introduction of the sliding mode, which is superior to the wellknown online approximator method proposed by Polycarpou.

**Key words:** nonlinear systems; fault diagnosis; self-adaptive; sliding mode observer

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