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控制理论与实践

基于RMMAC的集成主动容错飞行控制

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摘要： 针对主动容错飞行控制系统设计问题,提出一种基于改进鲁棒多模型自适应控制(robust multiplemodel adaptive control,RMMAC)的故障检测与控制重构集成设计方法。建立了飞行器传感器和执行器故障的数学模型,介绍了改进鲁棒多模型自适应控制算法的结构和实现步骤。某无尾飞机重构飞行控制的仿真结果表明,在执行器故障情况下,基于改进RMMAC的集成主动容错飞行控制系统能够快速准确地辨识故障,并依据故障信息更新局部控制器权值,实现控制重构,提高了飞机可靠性、安全性和生存能力。

关键词： 主动容错飞行控制 鲁棒多模型自适应控制 控制重构 无尾飞机

Integrated active fault tolerant flight control based on RMMAC

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Abstract: To study the active fault tolerant flight control,a modified robust multiple model adaptive control(RMMAC) methodology is presented.The mathematical models of both sensor and actuator faults are built firstly.Then the design procedure and features of the modified RMMAC method are introduced,and the proposed method is applied to the design of active fault tolerant flight control which integrates fault detection and control reconfiguration for a tailless aircraft.The simulation results show that the method can recognize the fault of actuators quickly and implements the reconfigurable control based on the probability computation of local controllers,so that the reliability,safety and survivability of the aircraft are improved.

Keywords: active fault tolerant flight control robust multiple model adaptive control control reconfiguration tailless aircraft

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参考文献：

[1] 郑应平.控制科学面临的挑战:专家意见综述[J].控制理论与应用,1987,4(3):1-9.

[2] Patton R J.Fault tolerant control:the 1997 situation[C]//Proc.of IFAC Symposium on Fault Detection,Supervision and Safety for Technical Process,Hull,England,1997:1033-1055.

[3] Zhang Y M,Jiang J.Bibliographical review on reconfigurable fault tolerant control system [C]//Proc,of IFAC Symposium on Fault Detection,Supervision and Safety for Technical Process,Washington D C,USA,2003:265-276.

[4] Zhang Y M,Jiang J.Issue on integration of fault diagnosis and reconfigutable control in active fault-tolerant control systems[C]///Proc.of IFAC Symposium on Fault

Detection,Supervision and Safety for Technical Process,Beijing,P.R.China,2006:265-276.
[5] Fekri S.Robust adaptive MIMO control using multiple-model hypothesis testing and mixed-synthesis[D].Institute Superior Technique,Lisbon,Portugal,2006.
[6] Fekri S,Michael Athans,Antonio Pascoal.Robust multiple model adaptive control (RMMAC):A case study[J].Int.Journal of Adaptive Control and Signal Processing,2007,21 (1):1-30.
[7] Fekri S,Michael Athans,Antonio Pascoal.Issues,progress,and new results in robust adaptive control[J].2006,20(10):519-570.