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基于模糊模型的鲁棒自适应重构飞行控制

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Robust Adaptive Reconfigurable Flight Control Based on Fuzzy Model

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摘要 提出了一种基于模糊模型的歼击机鲁棒自适应重构控制方案。整个控制方案基于T S模糊模型,将歼击机各飞行状态的局部线性调节器与鲁棒自适应神经网络重构控制器相结合,避免了传统的增益预置方法中控制律在不同工作点之间切换造成的参数突变对系统性能的影响,可以保证系统在全局上拥有局部工作点具有的期望性能,证明了重构系统的全局闭环渐近稳定性。所提出的带有补偿项的完全自适应RBF神经网络,通过在线自适应调整RBF神经网络的权重、函数中心和宽度,提高了神经网络的学习能力,同时通过自适应补偿项来在线估计神经网络的近似误差边界,可以有效地在线修正建模误差、外扰及操纵面故障等因素的影响,保证系统的操纵品质。仿真结果表明了所提出方法的有效性。

关键词： T-S模糊模型 重构控制 自适应神经网络 歼击机 鲁棒性

Abstract: A robust adaptive reconfigurable flight control method is presented based on fuzzy model. Based on T-S fuzzy model, the overall control scheme is constructed by combining all local linear regulators and robust adaptive neural network reconfigurable controllers. The global asymptotic stability of closed-loop reconfigurable system is proved. It provides the solution to overcome the drawback of the conventional gain scheduling that the parameter change may be rather abrupt across the boundaries of the region, and the control law does not globally posses the desirable properties designed at local operating point. The learning ability of proposed full adaptive RBF neural network is improved through adaptive tuning of the weights, centers and widths on line. And the compensate component of RBF neural network is designed to on-line estimate the bound on the neural network approximate error. It can be used to cancel the effect caused by the modeling error, disturbance or system failure, and maintain the handling qualities of the system. Simulation shows that the reconfigurable method receives a good effect.

Keywords: T-S fuzzy model reconfigurable control adaptive neural network fighter robustness

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