论文

漂浮基空间机器人的基于模糊神经网络的自适应补偿控制

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摘要：

针对自由漂浮状态的空间机器人模型不确定性及其动力传动机构的摩擦死区非线性,将一种自适应模糊小脑模型关联控制(FCMAC)补偿策略用于轨迹跟踪及补偿问题.利用模糊神经网络并引入GL矩阵及其乘法算子"."分别对执行机构中的摩擦死区及系统模型不确定部分进行自适应补偿,其补偿误差及外界扰动通过滑模控制器来消除.基于Lyapunov理论证明了闭环系统跟踪误差的有界性.仿真表明控制器可以达到较高精度,且能满足实时性要求.

关键词：　模糊神经网络　　GL矩阵　　空间机器人　　自适应控制

Adaptive compensation control of free-floating space robot based on fuzzy neural network

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Abstract:

Considering trajectory tracking of free-floating space robot with uncertainties and friction blind section non-linearity, we propose an adaptive fuzzy CMAC compensation control algorithm. The control scheme uses fuzzy neural network to establish modeling online, and imports GL matrix and multiplication operator "." into neural network to distinguish parameters of system and friction blind section non-linearity. The control scheme can guarantee the stability of closed loop system and the asymptotic convergence of tracking errors. Neural network approach errors and outside disturbance can be eliminated by sliding model controller. Based on a standard Lyapunov theorem, we prove that all signals in the closed-loop are bounded. The simulation results show that the controller can achieve high control precision and meet the requirement of real time.

Keywords: fuzzy neural network　　GL matrix　　space robot　　adaptive control

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