

短文

控制增益符号未知的不确定非线性系统鲁棒自适应控制

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摘要:

针对一类控制增益函数及符号均未知的不确定非线性系统, 基于反推滑模设计方法, 提出一种鲁棒自适应神经网络控制方案. 结合Nussbaum 增益设计技术和神经网络逼近能力, 取消了控制增益函数及符号已知的条件, 用积分型Lyapunov 函数避免了控制器奇异性问题, 并通过引入神经网络逼近误差和不确定干扰上界的自适应补偿项消除了建模误差和不确定干扰的影响. 理论分析证明了闭环系统所有信号半全局一致终结有界, 仿真结果验证了该方法的有效性.

关键词: 不确定非线性系统; 反推滑模控制; 神经网络; 鲁棒自适应控制

Robust adaptive control for uncertain nonlinear systems with unknown control gain signs

Abstract:

A robust adaptive neural network control scheme for a class of uncertain nonlinear systems with unknown control gain function and its signs is proposed based on backstepping sliding mode control design. The control scheme eliminates the condition that a priori knowledge of the control gain function and its signs to be known by combination of Nussbaum gain design technique and the approximation capability of neural networks. The controller singularity problem is avoided by employing the integral Lyapunov functions, and the influence of modeling error and uncertain disturbances is minimized by introducing the adaptive compensation term for the upper bound of both neural networks approximation error and uncertain disturbances. By theoretical analysis, all the signals in the closed loop systems are guaranteed to be semi-globally uniformly ultimately bounded. Finally, the simulation results show the effectiveness of the proposed method.

Keywords: uncertain nonlinear systems; backstepping sliding mode control; neural networks; robust adaptive control

收稿日期 2010-09-13 修回日期 2010-12-12 网络版发布日期 2012-02-13

DOI:

基金项目:

空军工程大学科研创新基金

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