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论文

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时变时滞非线性系统自适应神经网络控制

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Adaptive neural control of nonlinear time-varying delay systems

摘要

图/表

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摘要

对于一类具有未知时变时滞和虚拟控制系数不确定严格反馈非线性系统,基于后推设计提出一种自适应神经网络控制方案.选取适当的Lyapunov-Krasovskii泛函补偿未知时变时滞不确定项,通过构造连续的待逼近函数来解决利用神经网络对未知非线性函数进行逼近时出现的奇异问题.通过引入一个新的中间变量,保证了虚拟控制求导的正确性.仿真算例表明,所设计的控制器能保证闭环系统所有信号是半全局一致终结有界的,且跟踪误差收敛到零的一个邻域内.

关键词: 严格反馈非线性系统, 后推, 自适应控制, 神经网络控制, 时变时滞

Abstract :

Based on backstepping, an adaptive neural network control scheme is proposed for a class of perturbed strictfeedback nonlinear systems with unknown time-varying delays and virtual control coefficients. By choosing appropriate Lyapunov-Krasovskii functionals, the unknown time-varying delay uncertainties can be compensated for. The continuous approximation functions are constructed to solve the singularity problem which occurs when neural networks are used to approximate the unknown nonlinear functions. By introducing a new intermediate variable, the derivative of virtual control is guaranteed to be right. Simulation results show that the proposed controller can guarantee that all the signals in the closed-loop system are semi-global uniformly ultimately bounded, and the tracking error converges to a neighborhood of zero.

Key words : strict-feedback nonlinear systems backstepping adaptive control neural network control time-varying delay

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