

Adaptive fuzzy backstepping control for flexible manipulator with time delay and uncertain parameters

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Considering time delay and uncertain parameters, the adaptive fuzzy backstepping control for a flexible manipulator is studied. Firstly, the dynamic equation of the flexible manipulator with time delay is established and written into a state space form. To handle the input delay, the state variable is augmented by differential equation with control input, and the standard state equation without explicit time delay is deduced and obtained. In the backstepping design, we use fuzzy logic systems directly to approach unknown nonlinear functions existing in the system. Based on the adaptive backstepping control approach, a fuzzy adaptive backstepping controller with adaptive parameters is constructed. The stability of the close-loop control system is guaranteed by Lyapunov stability theory. Finally, Simulation results indicate that the time-delay controller presented in this paper can effectively deal with time delay in the system.

Keywords: flexible manipulator; adaptive control; time delay

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