7th International Conference on

Electrical , Electronic Engineering and Smart Grids

Discrete Adaptive Fuzzy Non-singular Terminal Sliding Mode Control For Robot Manipulator

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Abstract

In this paper, a novel discrete adaptive fuzzy non-singular terminal sliding mode control for robot manipulator using voltage control strategy is presented. Robot manipulators are nonlinear multivariable systems with high couplings and various uncertainties. Several methods have already been proposed for controlling adaptive fuzzy robot manipulators but they face many challenges because of robot dynamic complexity. In this thesis, fuzzy non-singular terminal sliding mode control with adaptive control is used. The advantage of this method is that adaptive fuzzy control systems are designed on the basis of guaranteeing stability. Because in practical implementation the control law is carried out using digital processors, in this thesis, the simulation is performed in discrete-time mode. Also designing adaptive fuzzy discrete-time controller is performed by voltage control strategies. The proposed method doesn't require a system model and reduces the chattering and lead to converge the system tracking error to zero in limit time. Also this control method is robust against external disturbance. Simulation studies are performed on a SCARA robot. Stability analysis and simulation results show the effects of this method.

Keywords: "Adaptive fuzzy control, Non-singular terminal sliding mode, Discrete-time control, Robot manipulator, voltage control strategy"

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