

PID Sliding Mode Control with Sliding Surface Dynamics based Continuous Control Action for Robotic Systems

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Abstract : This paper adopts a continuous sliding mode control scheme for trajectory tracking control of robot manipulators with structured and unstructured uncertain dynamics and external disturbances. In this algorithm, the equivalent control in the conventional sliding mode control is replaced by a PID control action. Moreover, the discontinuous switching control signal is replaced by a continuous proportional-integral (PI) control term such that the implementation of the proposed control algorithm does not require the prior knowledge of the bounds of unknown uncertainties and external disturbances and completely eliminates the chattering phenomenon of the conventional sliding mode control approach. The closed-loop system with the adopted control algorithm has been proved to be globally stable by using Lyapunov stability theory. Numerical simulations using the dynamical model of robot manipulators with modeling uncertainties demonstrate the superiority and effectiveness of the proposed approach in high speed trajectory tracking problems.

Keywords : PID, robot, sliding mode control, uncertainties

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