A Comparative Experimental Study of Robust Sliding Mode Control Strategies for Underactuated Systems

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Abstract

This paper presents a comprehensive comparative study for the tracking control of a class of underactuated nonlinear uncertain systems. A given nonlinear model of the underactuated system is, at first stage, transformed into an input output form and the driving applied control input of the transformed system is then designed via four sliding mode control strategies, i.e., conventional first order sliding mode control, second order sliding mode, fast terminal sliding mode, and integral sliding mode. At second stage, a ball and beam system is considered and the aforementioned four control design strategies are experimentally implemented. A comprehensive comparative study of the simulation and experimental results is then conducted which take into account the tracking performance, i.e., settling time, overshoots, robustness enhancement, chattering reduction, sliding mode convergences, and control efforts.

Keywords

Author Keywords: Electromechanical system; sliding mode control; Lyapunov method; robust control; nonlinear systems

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