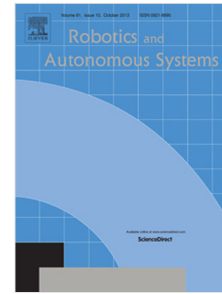


## Accepted Manuscript

Discrete-time second order sliding mode with time delay control for uncertain robot manipulators

Yassine Kali, Maarouf Saad, Khalid Benjelloun, Abdelilah Fatemi



PII: S0921-8890(16)30594-2

DOI: <http://dx.doi.org/10.1016/j.robot.2017.04.010>

Reference: ROBOT 2830

To appear in: *Robotics and Autonomous Systems*

Received date: 26 September 2016

Revised date: 7 March 2017

Accepted date: 20 April 2017

Please cite this article as: Y. Kali, et al., Discrete-time second order sliding mode with time delay control for uncertain robot manipulators, *Robotics and Autonomous Systems* (2017), <http://dx.doi.org/10.1016/j.robot.2017.04.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Discrete-Time Second Order Sliding Mode with Time Delay Control for Uncertain Robot Manipulators<sup>☆</sup>

Yassine Kali<sup>a,\*</sup>, Maarouf Saad<sup>b</sup>, Khalid Benjelloun<sup>a</sup>, Abdelilah Fatemi<sup>a</sup>

<sup>a</sup>*Ecole Mohammadia d'Ingénieurs, Automatic and Industrial Informatics Laboratory,  
Mohammed V University, Rabat, Morocco*

<sup>b</sup>*Ecole de Technologie Supérieure, Department of Electrical Engineering, Montreal, QC H3C  
1K3, Canada*

---

## Abstract

Control of uncertain nonlinear systems is one of the main topics in automation, control problem. However, uncertainties caused by uncertain parameters, load variations, unmodeled dynamics and external disturbances affect the control performance. This paper investigates the problem of high accuracy joint space trajectory tracking. A discrete-time second order sliding mode combined with time delay estimation is designed to make the joint positions track a desired trajectory with high accuracy. In addition, sufficient condition assuring convergence of the error to zero in finite time based on Lyapunov theory is presented. Experiments on a 7-DOF ANAT robot arm are presented to verify the performance of the proposed controller.

*Keywords:* Discrete-time, Second order sliding mode, Time delay estimation, Uncertainties, Robot manipulators.

---

## 1. Introduction

Nowadays, robot manipulators are present in different areas. This is why the design of robust controller to ensure high accuracy positioning and repeatability

---

<sup>☆</sup>This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

\*Corresponding author

*Email addresses:* y.kali88@gmail.com, yassinekali@research.emi.ac.ma (Yassine Kali), maarouf.saad@etsmtl.ca (Maarouf Saad), bkhalid@emi.ac.ma (Khalid Benjelloun), fatemi@emi.ac.ma (Abdelilah Fatemi)

Download English Version:

<https://daneshyari.com/en/article/4948736>

Download Persian Version:

<https://daneshyari.com/article/4948736>

[Daneshyari.com](https://daneshyari.com)