

# Uniformly Distributed Simplex Sliding-Mode Control

Student: Keh-Tsong Li      Advisor: Yon-Ping Chen

Department of Electrical and Control Engineering  
National Chiao-Tung University

## ABSTRACT

This dissertation presents a novel control technology for multi-input systems, called uniformly distributed simplex sliding-mode control (UDSSMC), to deal with matched disturbances. The UDSSMC is mainly designed based on the uniformly distributed simplex set, which contains vectors of unit magnitude and distributed uniformly in the control space. Two approaches are proposed to obtain the uniformly distributed simplex set easily and directly. By employing the uniformly distributed simplex set, a new concise scheme is introduced to quickly determine the sub-region where the system trajectory currently stays and a specific smoothing strategy is presented to ameliorate the chattering problem caused by switching functions. Most importantly, it is theoretically shown that the upper-bounded matched disturbances can be eliminated by UDSSMC. Furthermore, a grey prediction is adopted to forecast the matched disturbances and thus no prior information concerning their upper bounds are required. Finally, the success of UDSSMC is demonstrated by the tracking control of robotic manipulators.