ABSTRACT

RODRIGUES, Victor Hugo Pereira. *A Global Exact Differentiation Approach for Output-feedback Sliding Mode and Adaptive Control.* 172 p. Master Thesis (Master in Science of Electronic Engineering) - Engineering Faculty, State University of Rio de Janeiro (UERJ), Rio de Janeiro, 2018.

In this thesis, a higher-order sliding mode (HOSM) based global differentiators with adaptive gains is developed to address the tracking control problem using only input-output information of a wider class of nonlinear systems with disturbances and parametric uncertainties. The state of the plant is assumed unmeasured so that a norm state estimator is designed to bound the state-dependent disturbances and dynamically adapt the gains of the proposed differentiator. Stability properties and robust exact tracking can be achieved when the proposed adaptive HOSM based differentiators for output-feedback are applied. Numerical simulations and experiments are presented for different control designs, such as: first-order sliding mode control, first-order sliding mode control with monitoring function, terminal sliding modes, twisting, super-twisting, variable gain super-twisting algorithm, nested sliding mode control, quasi-continuous HOSM finite-time controllers and unit vector control. Moreover, we combine a global differentiator based on HOSM and dynamic gains with classical model reference adaptive control (MRAC) schemes to solve the problem of trajectory tracking via output feedback for uncertain linear plants of arbitrary relative degree. For the first time a closed form is given by MRAC to solve the problem associated to plants of arbitrary relative degree.

Keywords: Sliding Mode Control. Higher Order Sliding Mode. Model Reference Adaptive Control. Norm Observer. Monitoring Function. Exact Tracking. Global and Semi-Global Stability.