

ABSTRACT

CHALLAPA MOLINA, Nataly Ines. *Modeling and Sliding Mode Control of the Water Content for Precision Irrigation*. 103f. Dissertation (Master Degree in Electronic Engineering) - Faculty of Engineering, University of the State of Rio de Janeiro (UERJ), Rio de Janeiro, 2017.

This thesis proposes control strategies for irrigation control. The objective is to control the water content in the soil. The dynamic model of water propagation in the soil is represented by the Richards partial differential equation. One of the analyzed control strategies applies proportional and integral (PI) actions. The transfer function of the Richards equation is used for PI controller analysis, unlike previous approaches found in the literature. Two other sliding mode control (SMC) strategies are developed to control the mean water content and water content at a specified depth. For these purposes, unusual sliding manifolds are proposed. It was considered the non-collocated SMC of partial differential equations, that is, where the sensor and the actuator are at different positions, which was also not found in the literature. Their stability properties are analyzed using Lyapunov functions and the Mikhailov frequency criterion of stability. The performances of the controllers are evaluated by simulations, which lets verify that the SMC makes the water content of the soil immune to disturbances due water evaporation.

Keywords: irrigation control; Richard equation; partial differential equations; sliding mode control; PI control.