

ABSTRACT

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Control strategies for precision irrigation are proposed. The objective is to develop, analyze and test methods to automatically control the water content in the soil. Sliding mode control (SMC) is applied to regulate the water content in the soil with robustness to parametric uncertainties and disturbances. The dynamics of water infiltration in porous media (soil) is modeled by the Richards equation, which is a nonlinear parabolic partial differential equation (PDE). Two control objectives are considered: control of the average moisture in a layer near the surface and control of the moisture at a specified depth. SMC strategies are proposed, highlighting the use of a controller with proportional and integral actions connected in cascade for the case of non-collocated sensor and actuator. Simulation results indicate the performance of these control systems and the rejection of external disturbances such as water evaporation or rain.

Keywords: Sliding Mode Control. Partial Differential Equation. Richards Equation. Nonlinear Dynamics. Cascade Control. Non-Collocated Control. Irrigation Control.