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ADAPTIVE AND NON-ADAPTIVE MODEL PREDICTIVE CONTROL OF AN IRRIGATION CHANNEL

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Abstract. The performance achieved with both adaptive and non-adaptive Model Predictive Control (MPC) when applied to a pilot irrigation channel is evaluated. Several control structures are considered, corresponding to various degrees of centralization of sensor information, ranging from local upstream control of the different channel pools to multivariable control using only proximal pools, and centralized multivariable control relying on a global channel model. In addition to the non-adaptive version, an adaptive MPC algorithm based on redundantly estimated multiple models is considered and tested with and without feedforward of adjacent pool levels, both for upstream and downstream control. In order to establish a baseline, the results of upstream and local PID controllers are included for comparison. A systematic simulation study of the performances of these controllers, both for disturbance rejection and reference tracking is shown.

1. **Introduction.** Irrigation channels are large, spatially distributed structures in which wave propagation phenomena occur. Due to this, when control design is based on lumped parameter approximation models, the interaction among different sections has to be taken into account. On the other way, multivariable control demands the centralization of the information provided by different sensors that may be long distances apart. This naturally rises the issue of evaluating the performance increase due to the use of multivariable, centralized control, versus partially or totally decentralized schemes requiring simpler algorithms.

Another difficulty is posed by the uncertainty in the dynamic models available. Vegetation growing in the banks, mud accumulation and water losses cause changes in model parameters, making the system time-varying in unpredictable ways. As

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