# EXPERIMENTAL APPLICATION TO A WATER DELIVERY CANAL OF A DISTRIBUTED MPC WITH STABILITY CONSTRAINTS

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In this work, a novel distributed MPC algorithm, denoted D-SIORHC, is applied to upstream local control of a pilot water delivery canal. The D-SIORHC algorithm is based on MPC control agents that incorporate stability constraints and communicate only with their adjacent neighbors in order to achieve a coordinated action. Experimental results that show the effect of the parameters configuring the local controllers are presented.

## INTRODUCTION

Model predictive control (MPC) is a tool for controller design that is generally recognized as a powerful mean to control various types of processes [1] and, in particular, water delivery canals. Indeed, since MPC is an optimization based design technique, it has features that are suitable for this type of application. In the first place, through an appropriate choice of the functional to optimize, MPC directly links the controller design with the objective of saving water. Furthermore, there are several ways to obtain decentralized versions of MPC, an important issue since water delivery canals are large, space distributed, systems. Some examples are provided in [2, 3, 4, 5].

In this article, a novel distributed MPC algorithm, denoted hereafter as D-SIORHC, is applied to local upstream water level control of a pilot water delivery canal. The D-SIORHC algorithm is based on local MPC control agents that communicate only with their neighbors in order to achieve a coordinated action. Each local control agent manipulates the canal gate to which it is associated such as to drive the corresponding local upstream level to the desired target value, but taking into account the control moves of their neighbors.

Local control agent MPC algorithms minimize a quadratic cost function using linear models, under the constraint that the plant state vanishes at a number of coincidence points locate in time close to the end of the prediction horizon [6]. Under appropriate conditions on the number of coincidence points, these constraints ensure stability of the local control loops, in case they are isolated [7].

When several local control agents are simultaneously connected to different plant inputs, they may yield competitive actions that destabilize the overall system. In order to prevent this undesirable effect, the actions of the different local control agents must be