Local automatic control modes in an experimental irrigation canal

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Abstract. The paper presents two local PI automatic control modes developed, tuned and verified in an experimental automatic canal. The canal was used as a physical model and it will support further studies on canal automation domain. The control algorithms are installed in local PLC's with the objective of controlling the water depths immediately upstream and downstream of the corresponding check gates. The strategy adopted to tune the PI controllers was to compare the frequency response of the state space model, which relies on the linearized Saint-Venant equations, with a simple model considering each canal pool as a reservoir (reservoir model). The obtained results for the control gains were validated by field tests. A few simulation results are also presented as well as the experimental facility and the main configuration of the SCADA developed for the canal supervision and monitoring.

Key words: canal automation, downstream control, irrigation canal, local automatic control, PI controller, upstream control

Introduction

It is nowadays clear and well accepted that water is becoming a scarce natural resource. In the near future, this scarcity will present one of the biggest problems that modern societies have to face.

Irrigation is the main water user and so intelligent management of open-channel conveyance and delivery systems are necessary to achieve higher water savings within a short period of time.

The main purpose of an automatic canal control is to optimize the water supply in order to match the expected or aleatory demands at the offtake level. In real situations and with traditional management tools, an open-channel water conveyance and delivery system is very difficult to manage, especially if there is a demand-oriented operation (Clemmens 1987).

Remote monitoring and control systems are becoming more and more cost-effective water management tools due to the permanent cost reduction and higher accuracies of the dedicated equipment such as computers,