SIMULATION OF TRANSIENT FLOWS IN IRRIGATION CANALS: AUTOMATIC AMIL RADIAL GATES

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ABSTRACT: The computer model SIMCAR for simulation of upstream controlled canal systems was developed. The model solves the gradually varied unsteady flow in a branched canal-network, regarding the singularities: AMIL radial gates, siphons, transitions and confluences. The model is based on the Saint-Venant system of equations, which are solved by a four-point linear finite-difference implicit scheme weighted in time and space. The final linear system of equations is solved by the double-sweep algorithm. A numerical approach for submerged and free discharge at the gates are presented.

INTRODUCTION

A main goal for management of an irrigation system is to deliver water as close as possible to demand, with equity and maximum efficiency. The delivery schedules must consider the desired delivery rates and delivery times and the time required for water to travel to the delivery locations.

Upstream control is the most commonly used regulation method of irrigation canals (Cunge and Woolhiser, 1975). This is also the case of Portugal, where most systems are regulated by constant upstream level AMIL radial gates providing good operating conditions for Neyrpic orifice modules offtakes (Kraatz and Mahajan, 1975). This type of regulation is appropriate for systems with rigid delivery schedules. Because there are no storage reserves in the canals so the discharge distribution must be predicted and programmed in advance (Cunge and Woolhiser, 1975). In Portugal, social reasons led to substitute rotation by restricted arranged schedules. Management became more complicated and conveyance and distribution efficiencies drastically decreased (Rijo and Pereira, 1987; Rijo, 1990).

AMIL automatic gates ensure a more regular discharge distribution along the canal, but does not solve the problem of prediction. The programming of releases depends upon a good knowledge of the propagation times of discharges along the channel. Some of the main systems are empirically operated relying on personal judgement. Any error in the programming, will necessarily cause either water losses (in the case study here presented, the losses are 60% of the releases in the main and secondary networks (Rijo, 1990)) or dissatisfaction of users, because of insufficient water. To overcome these problems, the hydraulic simulation model SIMCAR which represents the existing system, including the influences of the AMIL gates, was developed (Rijo, *et al.*, 1991).

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