# Modelling Automatic Upstream Control with SIMCAR

By Manuel Rijo[1], A. Betâmio de Almeida [2] and L. Santos Pereira[3]

## Abstract

The model SIMCAR solves the gradually varied unsteady flow in a branched canal network with upstream control, with particular attention given to the simulation of the AMIL radial gates. It is based on the Saint-Venant system of equations, which are solved by a finite-difference technique with a four-point implicit scheme weighted in time and space. Model calibration and validation are made for the canal network of the Sorraia Irrigation Project, Portugal.

## Introduction

Upstream control is most commonly used in irrigation canals (Clemmens and Replogle, 1989). This is also the case for Portugal, where constant upstream water level AMIL radial gates are utilized in combination with Neyrpic orifice modules (Kraatz and Mahajan, 1975). These systems were designed for rotational delivery schedules but social reasons led to adoption of restricted arranged schedules while night irrigation was abandoned. Management became more complicated and conveyance efficiencies drastically decreased (Rijo and Pereira, 1987; Rijo, 1990). The need to improve the management of the system, avoid water losses and allow modernization of on-farm irrigation practices required improvements in canal operational procedures (Pereira, 1988). The ultimate goal is to change from traditional upstream control to real time management ( Pereira *et al.*, 1990). To achieve these goals a hydraulic simulation model which represents the existing system, including the influences of the AMIL gates was developed (Rijo, 1990).

## Theorical Development

Unsteady, nonuniform flow in irrigation canals can be accurately simulated using numerical solutions of the one-dimensional Saint-Venant equations. In

[1]Prof., Dept. of Agric. Engrg., Instituto Superior de Agronomia, Univ. Técnica de Lisboa, Tapada da Ajuda, 1399 Lisboa Codex, Portugal.

[2]Prof., Dept. of Civil Engrg., Instituto Superior Técnico, Univ. Técnica de Lisboa, Av. Rovisco Pais, 1096 Lisboa Codex, Portugal.

[3]Prof. and Head, Dept. of Agric. Engrg., Instituto Superior de Agronomia.