SUBCRITICAL FLOW COMPUTATION IN AN OPEN-CHANNEL NETWORK WITH DIVIDING JUNCTIONS AND SLUICE GATES

An Abstract

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ABSTRACT

This study focuses on the development of an integrated analytical-numerical solver to model subcritical open channel flows in a channel network, which includes dividing channel junctions, flow through a sluice gate, and gradually varied flow transition between gate and gate, or gate and junction. The fundamental equations describing flows in a channel junction and a sluice gate of a trapezoidal cross section are derived. The flow rates and corresponding water depths in each branch channel for various cases of given discharges in the upstream main channel and the geometric features of the main channel and the branch channels are computed. The correlation of water depths between upstream and downstream of a control gate for water flows through it is also investigated. The gate opening for a needed flow rate can be determined. The results for a channel junction with a 90° branch channel are compared to published analytical and experimental work. Good agreements have been obtained. Our results indicate that the maximum relative error of water depth at main channel extension is 4.35 %, and at branch channel is 7.49 %, respectively. Also, our results show that the average percentage error at main channel and branch channel are 7.57 % and 4.23 %, respectively. Finally, the rectangular and trapezoidal sections water depth at downstream of the main channel decreases and flow rate increases while water depth increases and flow rates decreases at branch channel.