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Bathymetery and flow numerical simulation in curved channels by adjusting the different passing discharge of flow

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Abstract

The bend presence caused changes in flow patterns. In the present study, using Fluent software, flow pattern and bathymetery simulated in 120° sharp bend in the four different discharges. For verification of the numerical model, first, a 90° sharp bend is simulated and compared with available experimental results. Then 120°bend will be evaluated. In curved channels, with increasing discharge of flow, the superelevation percentage of the water surface in the section located before the bend is decreasing. In the 60° cross section, the dimensionless amount of changes in water level, in discharge 4.5, 9, 12 and 15 liter per second, are respectively, 0.109, 0.108, 0.09 and 0.079 that with the discharge increasing, are ascending. In the interior sections of the bend, the transverse slope of the water surface in the inner half-width always is greater than outer half-width of the channel, So this slope is non-linear in sharp bends.

Keywords: 120° sharp bend, bathymetery, water surface height, discharge adjustments, numerical model, Fluent.

1. Introduction

By entering flow in to the bend, transverse gradient at the water surface due to the centrifugal force created as water surface elevation along the outer wall of the bend increased and Along the inner wall of the bend, the elevation decreases. The difference between these two level is called the superelevation or billow (Safarpur et al. 2008; Akhtari and aAbrishami 2009) [1, 2].

Various factors in the flow pattern change of the bend, Distribution of velocities component and water surface profiles are involved that their study for a comprehensive understanding of the behavior of the flow in channels and Natural rivers with bend will support. The radius of curvature of the channel and hydraulic conditions governing the flow are some of these conditions. Flow behavior in sharp bends is much more complex than mild bends due to the sharp bends, the flow is affected the effects of the bend. Therefore, in the present study were selected sharp type of the channel.

Other factors affecting the flow pattern, the entrance flow conditions is in the upstream channel.Hydraulic conditions (depth and passing flow discharge) also causes a change in water surface elevation in banks Upon flow arrival to the bend. So, the Study on water level changes to the design and implementation of the curved channel, Channel walls and side banks of the channel are important.

De Vriend and Geoldof (1983) performed the experimental research on a 90° mild bend. They reported the transversal profiles of the water surface along the bend, are linear but changes in the water level in the upstream and downstream of the bend and effect of the bend on them did not study [3]. Steffler et al. (1985) were performed on the transverse profiles of water level studies in a 270° bend. are based on laboratory findings, are reported the distribution of transversal profile of water surface along the bend is linear and the relationships to predict this profiles are presented, but they did not check this profiles for the inlet and outlet of the bend [4]. In 2001 Blanckaert and Graf conducted extensive experimental research on a 120° sharp bend with movable bed. They studied the cells of the secondary flow, turbulent flow parameters such as