

Numerical simulation of flow at the vicinity of a hydraulic jump with higher order scheme

Abstract— It is essential to develop a numerical model which could accurately predict the flow depth before and after the hydraulic jump. Therefore, in this study, a numerical model is developed to simulate flow at the vicinity of a hydraulic jump occurring in a straight rectangular open channel. The numerical model consists of a set of one-dimensional depth-averaged continuity and momentum equation. The Constrained Interpolation Profile (CIP) scheme, which is a higher-order numerical scheme, was used to solve the advection term in the governing equations. The numerical model was first verified against the analytical solution of dam-break flow problem of inviscid fluid. Close agreement was observed between the numerical and analytical results. The numerical model was then validated against the experimental data. The flow profile at the location before and after the hydraulic jump structure for flow with Froude number between 2.3 to 7.0 could be reproduced numerically with good accuracy. The location of hydraulic jump could also be predicted by the model.

Keywords— Depth-averaged equation, Constrained Interpolation Profile (CIP) scheme, Numerical model, Hydraulic jump