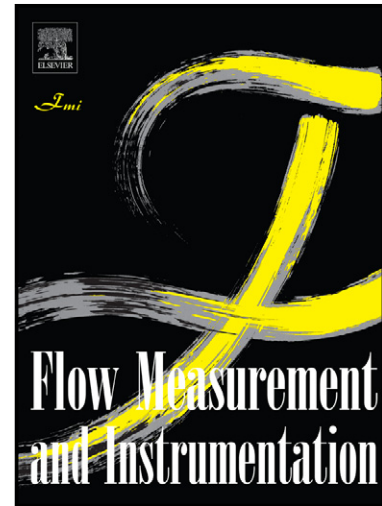


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Analysis of hydraulic characteristics for hollow semi-circular weirs using artificial neural networks

Inaam A. Juma ¹, Dr. Hamid H. Hussein ², Mohammed F. Al-Sarraj ³

ABSTRACT

Weirs are small overflow dams used to alter and raise water flow upstream and regulate or spill water downstream watercourses and rivers. This paper presents the application of artificial neural network (ANN) to determine the discharge coefficient (C_d) for a hollow semi-circular crested weirs. Eighty five experiments were performed in a horizontal rectangular channel of 10m length, 0.3m width and 0.45m depth for a wide range of discharge. The results of examination for discharge coefficient were yielded by using multiple regression equation based on dimensional analysis. Then, the results obtained were also compared using ANN techniques. A multilayer perceptron MLP algorithm FFBP network was developed. The optimal configuration of ANN was [2,10,1] which gave mean square error (MSE) and correlation coefficient (R) of 0.0011 and 0.91 respectively. Performances of ANN model reveal that the C_d could be better estimated by ANN technique in comparison with C_d obtained using statistical approach.

Keywords— hollow semi-circular crested weirs, discharge coefficient, artificial neural network (ANN).

1. Introduction

Weirs are small overflow dams used to alter and raise water flow upstream and regulate or spill water downstream watercourses and rivers. On the other hand, weirs take the form of barriers across the river that causes water to pool behind them, but allow water to flow over the top Wikipedia [1]. In many hydraulic structures semi-circular crest weirs are primarily used. It is the simplest type for discharge measurements and regulation of open channels. Advantages of a circular-crested weirs compared to the other weirs include simplicity of design, stable overflow patterns, larger discharge coefficient and the associated lower costs Heidarpour et al. [2]. Noori and Hayawi [3] studied the hydraulic characteristics of flow over semi-circular sharp crested weirs and showed that at constant values of relative weir radius, the discharge coefficient decreases with the increase of relative upstream head while discharge coefficient increases with the decrease of weir height. Chanson and Montes [4] studied the flow characteristics effects over circular weirs and found that the over flow properties are significantly affected by the upstream flow condition and the radius of curvature has no effect on the discharge coefficient. Baheri and Heidarpour [5] simulated the flow over circular crested weirs with an irrigational vortex to determine the discharge coefficient for circular crested weirs and found that the method produces the main features of weir flow reasonably well. Schmocker et al. [6] studied the effect of weir face angles on circular crested weir flow, they determined the discharge

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