Civil Infrastructure Researches, Vol. 6, Issue.2, Winter 2021, pp. 107-121

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Investigation of Discharge Coefficient of Triangular Duckbill Labyrinth Weirs Using Fluent Software and Gray Wolf and Elections Algorithms

Labyrinth weirs are important hydraulic structures for water level regulation and flow control in canals, rivers, and reservoirs. Due to the uneven distribution of hydraulic head on the weir crest, the discharge coefficient changes along the labyrinth weirs are noticeable. For optimal use of this type of weir, it is necessary to estimate the discharge coefficient. In this regard, in this study, using a data set including 120 experimental data collected by Kumar et al. (2011) and numerical (simulated by FLUENT software using k-ε RNG turbulence model) to optimally estimate the discharge coefficient of triangular-duckbill labyrinth weir embedded in a rectangular channel 0.28 m wide, 12 m long and 0.41 m high was addressed using modern gray wolf meta-heuristic (GWO) and election (EA) algorithms. To investigate the effect of discharge coefficient, angles of 30, 60, 90, 120, 150 and 180 degrees with weir height of 10 cm were selected and the flow conditions in all cases were considered as subcritical, turbulent and falling flow. The objective function is the sum of the squares of the difference between the computational flow and the observations defined as the minimum. Comparison of the results of GWO and EA algorithms and FLUENT software with values of R2=0.96 and NRMSE=0.052 in comparison with the observed values, shows a good agreement between the observed and computational values.

Keywords: Flow Control, Optimization, Meta-Heuristic Algorithms, Turbulence Model.

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Received 11 May 2021, Revised 11 June 2021, Accepted 13 June 2021.
DOI: 10.22091/cer.2021.6942.1250