World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Numerical Analysis of the Effect of Height and Rate of Fluid Flow on a Stepped Spillway

Authors : Amir Abbas Kamanbedast, Abbas Saki

Abstract : Stepped spillways are composed of several steps, which start from around the spillway crest and continue to the downstream heel. Recently, such spillways have been receiving increasing attention due to the significant effect of the associated stairs on the flow's rate of energy dissipation. Energy dissipation in the stepped spillways across the overflow can be explained by the watercourse contact with the stairs (i.e., large, harsh surfaces). In this context, less energy must be dissipated at the end of the spillway, and, hence, a smaller (less expensive) energy-dissipating structure is required. In this study, a stepped spillway was simulated using the model Fluent 3, and a standard model was used to model the flow disturbance. For this purpose, the energy dissipation from the stepped spillway was investigated in terms of the different numbers of stairs involved. Using k-ε, the disturbances of the numerical method for velocity and of flow depth at the downstream overflow were obtained, and, then, the energy that was dissipated throughout the spillway was calculated. Our results showed that an increase in the number of stairs can considerably increase the amount of energy dissipation for the fixed, upstream energy. In addition, the results of the numerical analyses were provided as isobar and velocity curves so points that were sensitive to cavitation could be determined.

Keywords : stepped spillway, fluent software, turbulence model of k-ε, VOF model
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020