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OPTIMAL DESIGN OF CASCADE SPILLWAY USING META-HEURISTIC ALGORITHMS: COMPARISON OF FOUR DIFFERENT ALGORITHMS

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Abstract

In the present research, four meta-heuristic algorithms named Genetic Algorithm (GA), Gravitational Search Algorithm (GSA), Particle Swarm Optimization (PSO), and Artificial Bee Colony (ABC) have been used for optimal design of cascade spillway to minimize the construction cost. Usually, the traditional design methods such as Vittal and Porey (VP) method or experimental modeling are used to solve this problem leading to infeasible or near optimal solution. The main novelty of this paper is to use effective methods to solve this complex highly constrained problem. Therefore, due to unique features of meta-heuristic algorithms, these algorithms are used here to minimize the construction cost of cascade spillway as the energy dissipater structure. As the case study, cascade spillway of Tehri dam in India had been chosen. The algorithms results have been compared together and with the VP results. Comparison of the results show the effectiveness and affectivity of these algorithms to solve this optimization problem. In other words, when three-stepped spillway are considered, the results are improved with 16.16%, 16.4%, 17.73% and 17.63% respectively using GA, GSA, PSO and ABC algorithms and in the same manner, for four-stepped spillway, the results are improved 14.5%, 16.1%, 16.45% and 16.05% respectively using GA, GSA, PSO and ABC algorithms in comparison with the VP results.

Keywords: cascade spillway, energy dissipater structures, meta-heuristic algorithm, optimal design, Tehri dam

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