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Artificial Neural Network Modeling and Genetic Algorithm Based Optimization of Hydraulic Design Related to Seepage under Concrete Gravity Dams on Permeable Soils

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Abstract : Hydraulic structures such as gravity dams are classified as essential structures, and have the vital role in providing strong and safe water resource management. Three major aspects must be considered to achieve an effective design of such a structure: 1) The building cost, 2) safety, and 3) accurate analysis of seepage characteristics. Due to the complexity and non-linearity relationships of the seepage process, many approximation theories have been developed; however, the application of these theories results in noticeable errors. The analytical solution, which includes the difficult conformal mapping procedure, could be applied for a simple and symmetrical problem only. Therefore, the objectives of this paper are to: 1) develop a surrogate model based on numerical simulated data using SEEPW software to approximately simulate seepage process related to a hydraulic structure, 2) develop and solve a linked simulation-optimization model based on the developed surrogate model to describe the seepage occurring under a concrete gravity dam, in order to obtain optimum and safe design at minimum cost. The result shows that the linked simulation-optimization model provides an efficient and optimum design of concrete gravity dams.

Keywords : artificial neural network, concrete gravity dam, genetic algorithm, seepage analysis
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