ABSTRACT:

Multi-layer neural networks have been used in this paper for modeling nonlinear behaviour of an embankment dam under earthquake excitations. In this study Bakun dam which is the second tallest Concrete-Faced Rockfill Dam (CFRD) in the world and located in east Malaysia has been modelled by the proposed algorithm. First the Bakun dam has been numerically analyzed for it's nonlinear behaviour under earthquake excitation to generate numerical data to be used in the training of the neural networks. To this end the dam has been subjected to a Local synthetic excitation so that the generated data could be rich enough for the training of a general neuro-modeller of the dam response. The neuro-modeller has then been trained on the generated data to learn the hysteretic behaviour of the dam implicitly. Then the neural network has been tested on a number of earthquakes including very strong earthquakes for verification. The results obtained in this study prove that the method has been successful regarding the generalization capabilities of the trained neuro-modeller where other earthquakes than those used in its training have been used in its testing. One significant benefit of using this algorithm is in cases where it is desired to use collected data from tests on experimental models or through monitoring of the response of a dam to prepare a suitable model for predicting its response under any earthquake. The main benefit is the time of analysis which can be reduced by this method. Once the neuro-modeller is trained, it can predict the response of the dam to any earthquake without the need to be updated. In the NL-FEA soilstructure interaction and fluid-structure interaction have been included to improve the accuracy of the numerical data for training the neural system.