Shear strength estimation of the concrete beams reinforced with FRP; comparison of artificial neural network and equations of regulations

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ABSTRACT

In recent years, numerous experimental tests were done on the concrete beams reinforced with the fiber-reinforced polymer (FRP). In this way, some equations were proposed to estimate the shear strength of the beams reinforced with FRP. The aim of this study is to explore the feasibility of using a feed-forward artificial neural network (ANN) model to predict the ultimate shear strength of the beams strengthened with FRP composites. For this purpose, a database consists of 304 reinforced FRP concrete beams have been collected from the available articles on the analysis of shear behavior of these beams. The inputs to the ANN model consists of the 11 variables including the geometric dimensions of the section, steel reinforcement amount, FRP amount and the properties of the concrete, steel reinforcement and FRP materials while the output variable is the shear strength of the FRP beam. To assess the performance of the ANN model for estimating the shear strength of the reinforced beams, the outputs of the ANN are compared to those of equations of the Iranian code (Publication No. 345) and the American code (ACI 440). The comparisons between the outputs of Iran and American regulations with those of the proposed model indicates that the predictive power of this model is much better than the experimental codes. Specifically, for under study data, mean absolute relative error (MARE) criteria is 13%, 34% and 39% for the ANN model, the American and the Iranian codes, respectively.

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