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Load-deflection analysis prediction of CFRP strengthened RC slab using RNN

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Abstract. In this paper, the load-deflection analysis of the Carbon Fiber Reinforced Polymer (CFRP) strengthened Reinforced Concrete (RC) slab using Recurrent Neural Network (RNN) is investigated. Six reinforced concrete slabs having dimension 1800×400×120 mm with similar steel bar of 2T10 and strengthened using different length and width of CFRP were tested and compared with similar samples without CFRP. The experimental load-deflection results were normalized and then uploaded in MATLAB software. Loading, CFRP length and width were as neurons in input layer and mid-span deflection was as neuron in output layer. The network was generated using feed-forward network and a internal nonlinear condition space model to memorize the input data while training process. From 122 load-deflection data, 111 data utilized for network generation and 11 data for the network testing. The results of model on the testing stage showed that the generated RNN predicted the load-deflection analysis of the slabs in acceptable technique with a correlation of determination of 0.99. The ratio between predicted deflection by RNN and experimental output was in the range of 0.99 to 1.11.

Keywords: CFRP; RC; RNN; MATLAB

1. Introduction

Ttraditional analysis models for reinforced concrete (RC) structures are reliable and the behavior of structural elements can be successfully determined by solving several numerical equations. It is observed that the different available calculation methods produce different deflection results (Wium and Eigeaar 2010). Neural networks (NNs) model the impact of input parameters on a set of output conclusions. They apply the influential learn-by-example technique and generalization system to identify the hidden relationships linking the input to their outputs (Hegazy *et al.* 1996). The goal of ANNs is to emulate the human brain's ability to adapt to changing circumstances based on past experiences and the knowledge acquired there from.

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