Abstract:
Concrete-filled steel tube (CFST) columns have features such as reduced construction costs and more dilation and carrying capacity to reinforced concrete columns. Therefore, CFST columns have been increasingly adopted in many modern structures such as bridges and high-rise buildings due to the beneficial composite action between steel tube and concrete core. Correct calculation of the axial ultimate strength of these columns can provide an appropriate assessment for the design and evaluation of the strength of these structures. Experimental and codes models may provide a proper prediction of the axial ultimate strength of CFST columns. But these models have used a limited number experimental samples have been used to predict the axial ultimate strength of these sections, which are mainly obtained regression analysis. Therefore, the use of prediction models is not widespread in the most reasonable range. On the other hand, Experimental and codes models have limitations in the strength of steel and concrete, as well as the ratio of diameter to thickness. In this thesis, perceptron multilayer Artificial Neural Network (ANN) are used to predict the axial ultimate strength of CFST columns. Also, a parametric study was conducted to investigate the effect of different variables on the behavior of these columns using artificial neural network. ANN has been trained using input variables such as geometric properties of samples (height, diameter and thickness of steel wall), and mechanical properties of steel and concrete (yield stress steel and compressive strength of concrete cylinders). In the modeling structure, various types of columns with cross-sections such as circular, rectangular, square and circular columns with external confinement have been used. The results of the prediction of ANN model have been compared with modeling error statistics and coefficient of correlation between predictive and experimental data with several empirical models and design codes. ANN algorithms with coefficient of 0.993 for circular sections, coefficient of 0.982 for circular columns with external confinement and coefficient of 0.992 for box columns have shown the best coefficient of correlation for comparison with other empirical and codes models. Also, artificial intelligence-based algorithms lead to an improvement in the root-mean-squar error and mean absolute error is about 80% and 25% respectively for circular columns, 165% and 100% for circle columns with external confinement and 60% and 60% for box columns in Compared with the best results of other predicted models. On the other hand, for columns with high and high strength materials, there is a significant difference in the prediction of ultimate strength between neural network algorithms and other models. Therefore, the use of ANN is a simple and efficient tool for proper and precise design CFST columns.

Key Words:
Concrete-filled steel tube column, Axial ultimate strength, Artificial Neural Network, external confinement, Modeling

University of Zabol
Graduate school
Faculty of Engineering
Department of Civil Enginering

The Thesis Submitted for the Degree of M.Sc (in the field of Civil Engineering-Structure Engineering)

Prediction of ultimate strength for concrete-filled steel tube columns using Artificial Neural Network

Supervisor
Dr. B. Keshtegar

Advisor
Dr. H. Rahdar

By
M. H. Yaqoubi

Summer 2018