Structural identification using fuzzy modified wavelet neural network

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Structural identification is one of the most important issues in structural engineering. The goal of structural system identification research is to develop a mathematical model for a structural system based on a set of inputs and corresponding output measurements. When structures are damaged during a strong ground motion changes occur to their dynamic characteristics. Structural system identification used to determination of structural properties such as stiffness, natural periods and frequencies and assess damage severity and location. There are two fundamentally different approaches for the solution of the system identification problem: parametric method and nonparametric method. The dynamic time-delay fuzzy-wavelet neural network has been applied successfully to structural identification. In this study, a fuzzy modified wavelet neural network with internal feedback is designed and suggested for using in structural identification. The internal feedback is applied by implementation of feedback in second layer, it adds memory to the network and can help improving a dynamic behavior of system and cause to achieve better accuracy even with simple network. In existing training algorithm such as Levenberg – Marquardt, the network's parameters are modified based on the human's experiences. In this study, a hybrid learning algorithm, modified Levenberg – Marquardt - least squares algorithm, is developed for estimating the parameters of the fuzzy WNN model and to improve the performance of the algorithm, a fuzzy inference system is used for adjusting the training parameter.The initialization of parameters of the network is also an important factor in training process. The initialization of the adjustable parameters of the network has significant impact on the convergence. Hence in this study a clustering algorithm is used for initialization of the translation parameters of the wavelets. For initialization of the bias parameters, the least square method was used. Other parameters initialized randomly. The proposed network was used for identification of five story steel frame that simulated in abaqus with the excitation of luma- prieta earthquake and three other earthquakes. The acceleration of these earthquakes obtained from the data based that is available in (www.peer.berkeley.edu).

Keywords: Wavelet, recurrent wavelet neural network, fuzzy logic.