

Early prediction of PGA and Sa using ANN

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In order to perform on-site earthquake early warning, in this study, we develop a novel approach to predict the peak ground acceleration (PGA) and pseudo-spectral acceleration (Sa) using the first few seconds of P-wave features. The Fourier spectrum amplitude (FSA) and phase (FSP) are handled separately and then combined together to predict the acceleration time history, then the PGA and Sa can be estimated accordingly. The FSA is predicted using the artificial neural network (ANN) with the predominant period, peak acceleration amplitude, peak velocity amplitude, peak displacement amplitude, cumulative absolute velocity, integral of the squared velocity, and FSA of the first three seconds of P-wave as input. The mean and standard deviation of the group delay time of phase spectrum of each separated frequency range decomposed by wavelet transform is employed as the prediction target, then the FSP can be generated using these mean and standard deviation of the group delay time. The FSP is predicted using another ANN model using similar P-wave features as the FSA ANN model. The earthquake records of the Taiwan Strong Motion Instrumentation Program from 1992 to 2006 were used to train and validate the proposed approach, and the promising accuracy of PGA and Sa prediction is obtained.

Keywords: Peak Ground Acceleration, Pseudo-spectral Acceleration, Artificial Neural Network