

Study on Influence of Earthquake Temporal Representation on Seismic Response of MDOF Structures by Wavelet Transform

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In this thesis, the influence of seismic acceleration parameters on seismic responses of structures was studied. A stochastic approach was used to investigate correlation between 8 acceleration parameters and 11 maximum responses of structure. Also the filtering effect of records by wavelet transform on the value of correlation was studied. In this stochastic research, in the first stage the generation of artificial earthquake records was pursued. These records were compatible to design spectrum by continuous wavelet transform and using an iterative modification method. To modify the baseline and denoising the accelerogram, a wavelet denoising method was used to correct the drift in velocity and displacement of ground motion. For the generation of artificial records, an optimization method was used to obtain constant parameters of Kanai-Tajimi and Clough-Penzien power spectrum. The object of optimization was to maximize coordination between initial response spectrum of artificial record and the design spectrum. In the second stage, 3 concrete frame with 1, 4 and 8 story were modeled by OpenSees and non-linear dynamic analysis using 3 groups of records was done and the correlation coefficients between the seismic parameters and the maximum responses were obtained. One group of excitation included 100 nonfiltered artificial records and 2 other groups including 100 filtered records generated by two different wavelet filtering methods. The main result is that the spectral intensity parameter, SI is the best parameter for predicting the response of structure, also the maximum velocity of ground motion, PGV has high correlation with seismic responses. By comparing the correlation coefficients for the filtered and non filtered records it seems that SI and PGV have high correlation in both cases and conclude that they have lower dependence on high frequency of record than other parameters. Another important result is that the seismic acceleration parameters from filtered records have overallly higher correlation with responses, especially for the structures with lower natural periods.

Keywords: Artificial earthquake record, correlation, acceleration parameter, wavelet transform, response spectrum, design spectrum, spectral intensity, PGV.