Selecting and Scaling of Earthquake Accelerograms to Reduce the Scatter in Nonlinear Dynamic Response of Structures

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Abstract

Nonlinear dynamic analysis is known as the most accurate method to evaluate the behavior of structures during an earthquake. To achieve reliable results, this analysis should be based on proper information and assumptions. In this context the selection process of suitable records and their modification, play a vital role.

An effective selection and modification of ground motion as the loads to be used in the analysis can lead to responses with low dispersion in nonlinear structural analysis. This in turn, results in much more trust in the safety of the designed structure. This fact highlights the importance of the current study.

A selection process is realistic when all the affecting parameters are taken into account. These parameters should prove to be of decisive effect when in a specific location a certain number of records extracted from existing resources are considered, or in a more difficult situation, when there is no useful information about past earthquakes. Considering the above facts, in this study a screening process is devised to achieve to the record set of interest. This screening process is a three-stage operation as the Coarse-, Medium-, and Fine-Screen. The process begins from a large inventory of seismic events and rationally and quickly results in only a handful number of most suitable records. So the coarse screen with respect to ground motion parameters and specifics regional and in the medium screened using five different methods of ground motion and in fine screen used conditional mean spectrum and advanced intensity measure methods. The remained records are modified such that to minimize the scatter in the results of nonlinear dynamic analysis of the structure under study. As the scale factor is multiplied by different methods in the amplitude accelerations spectral. Numerical examples of application of the proposed method are also provided illustrating the effectiveness and efficiency of the process.

Keywords: ground motion, selection, modification, nonlinear dynamic analysis, scatter.