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Optimized Real Ground Motion Scaling for Vulnerability Assessment of Building Considering the Spectral Uncertainty and Shape

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Abstract : Based on the results of previous studies, we focus on the research of real ground motion selection and scaling method for structural performance-based seismic evaluation using nonlinear dynamic analysis. The input of earthquake ground motion should be determined appropriately to make them compatible with the site-specific hazard level considered. Thus, an optimized selection and scaling method are established including the use of not only Monte Carlo simulation method to create the stochastic simulation spectrum considering the multivariate lognormal distribution of target spectrum, but also a spectral shape parameter. Its applications in structural fragility analysis are demonstrated through case studies. Compared to the previous scheme with no consideration of the uncertainty of target spectrum, the method shown here can make sure that the selected records are in good agreement with the median value, standard deviation and spectral correction of the target spectrum, and greatly reveal the uncertainty feature of site-specific hazard level. Meanwhile, it can help improve computational efficiency and matching accuracy. Given the important infection of target spectrum's uncertainty on structural seismic fragility analysis, this work can provide the reasonable and reliable basis for structural seismic evaluation under scenario earthquake environment.

Keywords : ground motion selection, scaling method, seismic fragility analysis, spectral shape
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