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Vulnerability Assessment of Reinforced Concrete Frames Based on Inelastic Spectral Displacement

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Abstract : Selecting ground motion intensity measures reasonably is one of the very important issues to affect the input ground motions selecting and the reliability of vulnerability analysis results. In this paper, inelastic spectral displacement is used as an alternative intensity measure to characterize the ground motion damage potential. The inelastic spectral displacement is calculated based modal pushover analysis and inelastic spectral displacement based incremental dynamic analysis is developed. Probability seismic demand analysis of a six story and an eleven story RC frame are carried out through cloud analysis and advanced incremental dynamic analysis. The sufficiency and efficiency of inelastic spectral displacement are investigated by means of regression and residual analysis, and compared with elastic spectral displacement. Vulnerability curves are developed based on inelastic spectral displacement. The study shows that inelastic spectral displacement reflects the impact of different frequency components with periods larger than fundamental period on inelastic structural response. The damage potential of ground motion on structures with fundamental period prolonging caused by structural soften can be caught by inelastic spectral displacement. To be compared with elastic spectral displacement, inelastic spectral displacement is a more sufficient and efficient intensity measure, which reduces the uncertainty of vulnerability analysis and the impact of input ground motion selection on vulnerability analysis result.

Keywords : vulnerability, probability seismic demand analysis, ground motion intensity measure, sufficiency, efficiency, inelastic time history analysis
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