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Probabilistic Seismic Demand Assessment of Steel Moment Frames with Sideplate Connections

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ABSTRACT

Seismic performance of steel moment frames with side-plate connections has been investigated with emphasis put on earthquake uncertainties. Based on experimental and finite element results, a connection model was proposed and calibrated to represent the side-plate connection behavior. Afterwards, some two-dimensional moment frames were adopted from the designed three-dimensional frame structures which were modeled incorporating the established connection model. To reflect the uncertainties associated with earthquakes, the incremental dynamic analysis procedure was performed. The procedure outcomes, which consist of more than 1500 nonlinear dynamic analyzes, were used to investigate the structures performance in terms such "limit-state frequencies" and "seismic demand hazard curve". The quantified performances may be used in comparing the studied structures with similar other structures and also as a crisis to the prescriptions issued by design guidelines for the structures under consideration.

KEYWORDS

Steel moment frame, sideplate connection, performance-based earthquake engineering, incremental dynamic analysis, limit state frequency, seismic demand hazard curve

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PSHA Hunt & Fill [] "hunt & fill" PSDA () : / $S_a(T_1)$) () $\lambda_{DM}(y) = \int G_{DM|IM}(y|x) \cdot |d\lambda_{im}(x)|$ (y () hunt $\lambda_{DM}(y)$ $\lambda_{im}(x)$ $d\lambda_{im}(x) = \mathbf{x}$ (/) () $d\lambda_{im}(x)$ 1 $G_{DM|im}(y|x)$. NDA х у $G_{DM|im}\left(y|x \right)$. (resolution) PSDA (%) MAF .(hunt) « » IDA λ_{LS} . λ_{LS} IDA $\lambda_{LS} = \int G_{LS|DM}(y) \cdot | d\lambda_{DM}(y) |$) $d\lambda_{DM}$ (y) () y)) (fill PSDA « **»** LS $G_{LS|DM}(y)$ PSDA MAF¹⁰ $G_{LS|DM}(y)$ y ¹¹PSHA PSDA) () PSDA PSHA ($G_{LS|DM}(y)$ у NDA¹² λ_{LS} . $\lambda_{DM}(y)$



$$DI^{-} = \frac{(\theta_{p}^{-}|_{currentPHC})^{\alpha} + (\sum_{i=1}^{n^{-}} \theta_{p}^{-}|_{FHC,i})^{\beta}}{(\theta_{pu}^{-})^{\alpha} + (\sum_{i=1}^{n^{-}} \theta_{p}^{-}|_{FHC,i})^{\beta}}$$
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$$\theta_{p}^{-}|_{FHC,i} \quad \theta_{p}^{+}|_{FHC,i}$$



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$$DI^{+} = \frac{(\theta_{p}^{+} \mid_{currentPHC})^{\alpha} + (\sum_{i=1}^{n^{+}} \theta_{p}^{+} \mid_{FHC,i})^{\beta}}{(\theta_{pu}^{+})^{\alpha} + (\sum_{i=1}^{n^{+}} \theta_{p}^{+} \mid_{FHC,i})^{\beta}}$$
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ANSYS deterioration Probabilistic Seismic Demand Analysis, PSDA Intensity Measure, IM Demand Measure, DM tracking smooth Pushover Mean Annual Frequency Probabilistic Seismic Hazard Analysis Nonlinear Dynamic Analysis closed-form Load and Resistance Factor Design Backbone Curve Damage Index Normalized peak Kratzig Mehanny-Deierlein Hysteretic energy Park-Ang Primary Half Cycle Follower Half Cycle Open System for Earthquake Engineering Simulation Normalised Hysteretic Energy leaning column fragility

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