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## Estimating seismic demands for performance-based engineering of steel buildings

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Earthquake engineering practice is increasingly using performance-based procedures for evaluating existing buildings and proposed designs of new buildings. Both nonlinear static and nonlinear response history analyses (RHA) are used for estimating engineering demand parameters (EDPs) in performance-based engineering of steel buildings. Topics related to both analysis procedures are investigated in this paper. In the first part, the original modal pushover analysis (MPA) to estimate seismic demands due to one component of ground motion is extended to consider two horizontal components simultaneously in three-dimensional analysis of steel buildings. Subsequently, seismic demands are computed for six unsymmetrical-plan steel buildings designed in accordance with the 1985 Uniform Building Code (UBC85) and the 2006 International Building Code (IBC06) due to 39 ground motions acting simultaneously in two orthogonal horizontal directions. Comparing these results with those from nonlinear RHA, we demonstrate that MPA provides good estimates of EDPs whereas the procedures specified in the ASCE/SEI 41-13 standard and the Euro-code 8 are not satisfactory for estimating seismic demands for unsymmetrical-plan buildings. The second part of this paper concerns nonlinear response history analysis of buildings. With the goal of developing effective procedures for selection and scaling of multi-component ground motions to be used in nonlinear RHA, a modal-pushover-based-scaling (MPS) procedure is developed in this investigation. Based on the results for medium-rise symmetric-plan and unsymmetrical-plan buildings with ductile steel frames, we demonstrate that the MPS procedure provides much superior results than the scaling procedure specified in the ASCE/SEI 7-10 standard.

### Biography

Juan C Reyes has completed his PhD from University of California, Berkeley. He is an Associate Professor and the Director of the Civil and Environmental Engineering Laboratories at Universidad de los Andes, Colombia, a top South American university. He has published more than 10 papers in ISI indexed journals and is involved in various international associations and research groups.

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