USE OF INCREMENTAL DYNAMIC ANALYSIS TO ASSESS THE PERFORMANCE OF STEEL MOMENT-RESISTING FRAMES WITH FLUID VISCOUS DAMPERS

by

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(ABSTRACT)

This thesis presents the results of a study that uses Incremental Dynamic Analysis to assess the seismic performance of steel moment-resisting frames with fluid viscous dampers subjected to earthquake ground motions. The study systematically investigated the effects of linear and nonlinear dampers on the response of steel moment-resisting frames to earthquakes that varied in intensity and type. Both near-field and far-field motions were considered. Two different types of nonlinear dampers were investigated; one had a hardening and the other had a softening force-velocity relationship. The nonlinear dampers were calibrated to the linear dampers so that there was a basis of comparison. Maximum damper displacement is one of the parameters of the calibration, and it was varied to investigate its effect on structural response. Several nonlinear inelastic time history analyses were performed to obtain responses, such as peak base shear, peak interstory drift, or residual displacement index, which were plotted versus earthquake intensity to create individual IDA curves. Sets of related IDA curves provide a useful summary of the structural behavior for a wide range of variables. IDA curves for the tests with different damping types are presented. The results show that for both near-field and far-field ground motions the nonlinear dampers with a hardening force-velocity relationship are best suited to reduce undesirable drifts and residual displacements; however, these reductions come at the cost of high base shear forces.

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