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Finite Element Modeling and Nonlinear Analysis for Seismic Assessment of Off-Diagonal Steel Braced RC Frame

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Abstract : The geometric nonlinearity of Off-Diagonal Bracing System (ODBS) could be a complementary system to covering and extending the nonlinearity of reinforced concrete material. Finite element modeling is performed for flexural frame, x-braced frame and the ODBS braced frame system at the initial phase. Then the different models are investigated along various analyses. According to the experimental results of flexural and x-braced frame, the verification is done. Analytical assessments are performed in according to three-dimensional finite element modeling. Non-linear static analysis is considered to obtain performance level and seismic behavior, and then the response modification factors calculated from each model's pushover curve. In the next phase, the evaluation of cracks observed in the finite element models, especially for RC members of all three systems is performed. The finite element assessment is performed on engendered cracks in ODBS braced frame for various time steps. The nonlinear dynamic time history analysis accomplished in different stories models for three records of Elcentro, Naghan, and Tabas earthquake accelerograms. Dynamic analysis is performed after scaling accelerogram on each type of flexural frame, x-braced frame and ODBS braced frame one by one. The base-point on RC frame is considered to investigate proportional displacement under each record. Hysteresis curves are assessed along continuing this study. The equivalent viscous damping for ODBS system is estimated in according to references. Results in each section show the ODBS system has an acceptable seismic behavior and their conclusions have been converged when the ODBS system is utilized in reinforced concrete frame.

Keywords : FEM, seismic behaviour, pushover analysis, geometric nonlinearity, time history analysis, equivalent viscous damping, passive control, crack investigation, hysteresis curve
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