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Passive control of the seismic response of reinforced frame buildings: Influence of base frame characteristics on overall seismic performance of controlled structures

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A research has been conducted in order to optimize both the slip load in friction dampers and the distribution of friction dampers along the height of reinforced concrete frames. The response of friction damped frames to seismic action has been investigated and compared to the behavior of both moment-resisting frames and braced frames in order to see if friction dampers add any improvements to the response. DRAIN-2DX has been used to run non-linear analyses for two models, a short four-stored frame and a taller eight-stored frame. Three design earthquakes have been used in order to widen the problem and reach a more general solution. The effect of friction dampers on the behavior of the frames has been investigated in terms of displacements, inter-stored drifts, shear forces and energy dissipation, taking the braced frame as a reference frame. Moreover, the design of passive control systems has been related to the properties of diagonal members in dual frames in order to study their effect on the efficiency of friction dampers. It has been found that the incorporation of friction dampers significantly improves the response of moment-resisting frames, yet improvements have been found to be less substantial when it comes to the stiffer braced frames. However, friction dampers dissipate great amounts of energy in controlled frames compared to the other two models (bare and dual) due to their highly non-linear dissipative behavior. This means that little damage occurs in main frame elements, i.e., beams and columns as they behave elastically during seismic action, which protects structural frames when subjected to strong earthquake motion. It has also been found that energy dissipation is greater for the shorter four-stored frame. Moreover, doubling the cross-sectional area of diagonal members has been found to improve the response of the four-stored frame, yet not substantially. For the above mentioned reasons, the use of friction dampers is advised for both four and eight stored frames in order to reduce damage.

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