**NUMERICAL SIMULATIONS OF SOIL-FOUNDATION-STRUCTURAL SYSTEMS SUBJECTED TO SEISMIC LOADING**

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**RESEARCH STATEMENT/MOTIVATION**

The effectiveness of the structural fuse mechanisms, used for seismic energy dissipation in structures, depends on their capacity, ductility, energy dissipation, isolation, and self-centering characteristics. Shallow foundations supporting buildings and bridges can also be designed to possess many of these desirable characteristics to improve the performance of the structural system during seismic loading. This research involves nonlinear dynamic finite element simulations of frame-shear wall-foundation systems to study the effectiveness and advantages of combined energy dissipation mechanisms in structural elements and beneath foundation.

**RESEARCH METHODS**

OpenSees finite element framework is used to analyze the behavior of shear wall-moment frame-foundation-soil system for earthquake shaking. Since the shear wall is rigid compared to the frame structure and supporting soil, it is modeled by a rigid elastic beam-column element. Beam elements with inelastic fiber hinges are able to simulate the physical behavior of beams in finite element analysis. Nonlinear beam-column elements represent the behavior of columns. The behavior of the foundation soil in the zone of influence and the interaction between footing and supporting soil during seismic shaking are simulated by the contact interface model, available in OpenSees.

**MAJOR RESULTS and CONCLUSIONS**

Finite element simulations will be carried out for some of the moment frame-shear wall-footing structures tested in centrifuge experiments to study the effect of foundation rocking on the behavior of different structural elements, such as, beams, columns, and beam column joints as well as footing-soil system. Energy dissipation at the footing-soil interface due to rocking and sliding, and the reduced force demands on the structure will be compared to the adverse effects on the structure, such as, permanent deformations of foundation and the maximum drift ratio of the structure. The findings of these analyses will help improve the performance of structural systems during seismic loading.

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