Controlling higher-mode seismic responses in reinforced concrete core wall buildings

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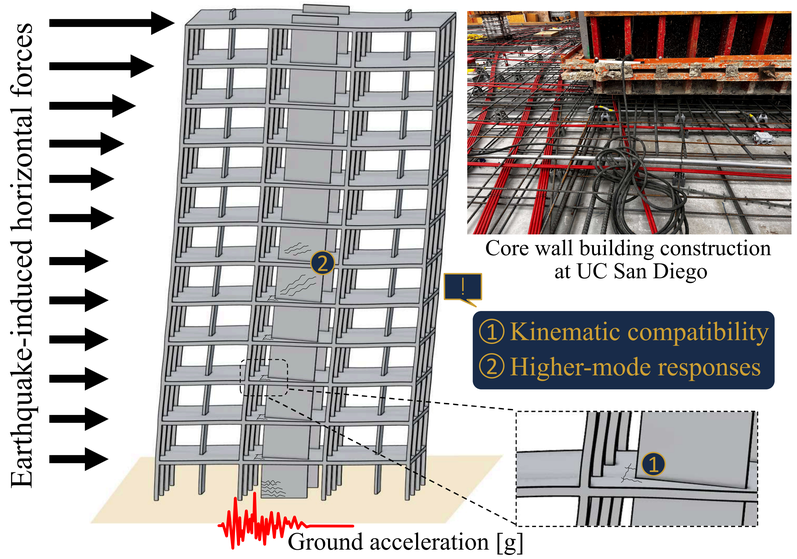
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Motivation

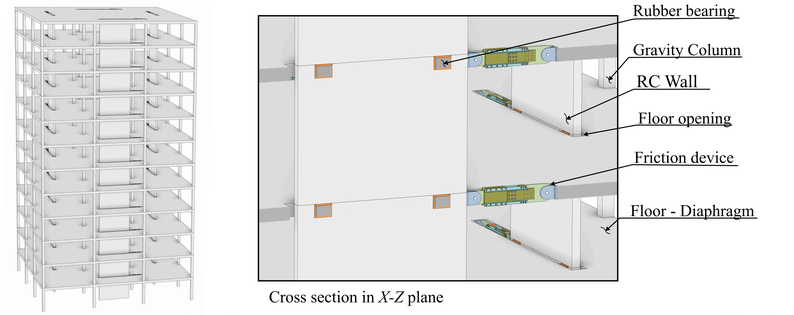
Control the higher-mode effects in the seismic responses in reinforced concrete core wall buildings to accelerate their post-earthquake functional recovery.

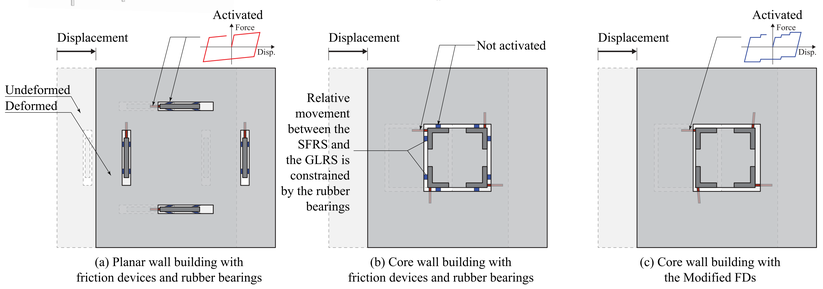
Typical reinforced concrete building with planar walls



Core wall building construction at UC San Diego

Force-limiting deformable connections allow controlled transfer of forces between gravity and seismic force resisting systems.





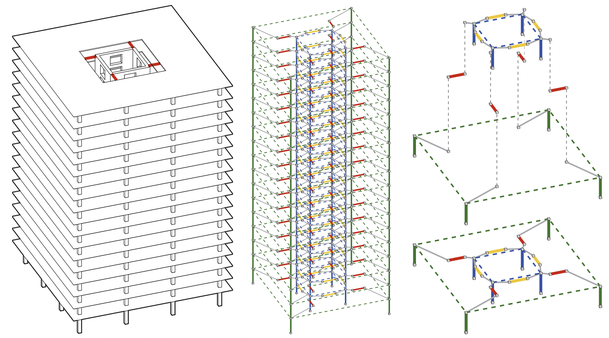
(a) Planar wall building with friction devices and rubber bearings

(b) Core wall building with friction devices and rubber bearings

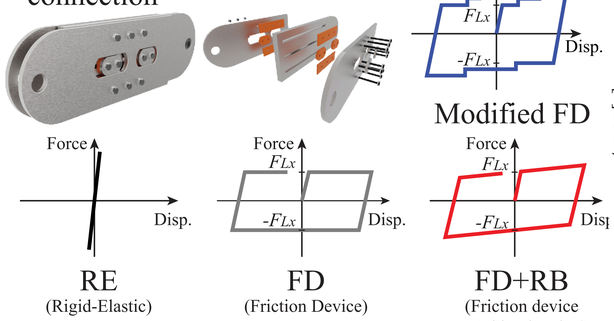
(c) Core wall building with the Modified FDs

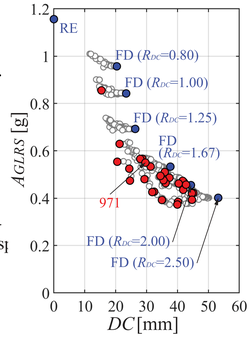
Modeling Approach

Three-dimensional Opensees model of an 18-story reinforced concrete core wall building.

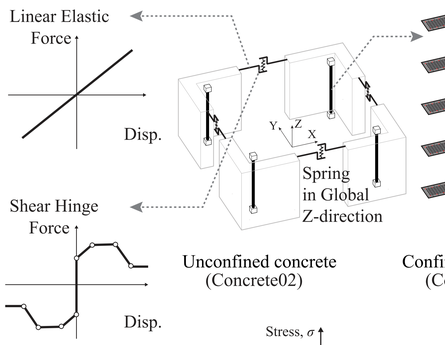


Force-limiting deformable connection

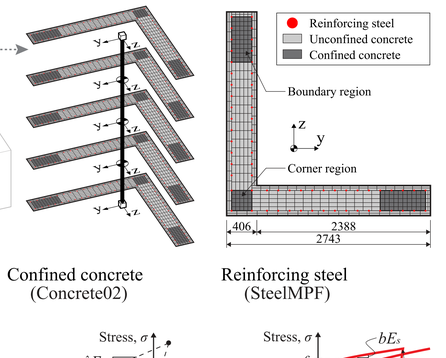




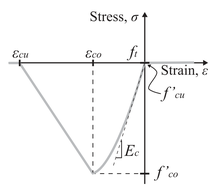
Coupling beam



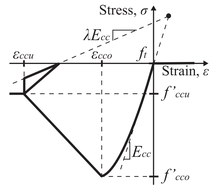
Core wall pier



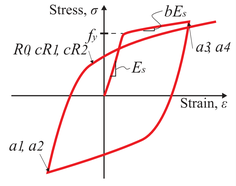
Unconfined concrete (Concrete02)



Confined concrete (Concrete02)

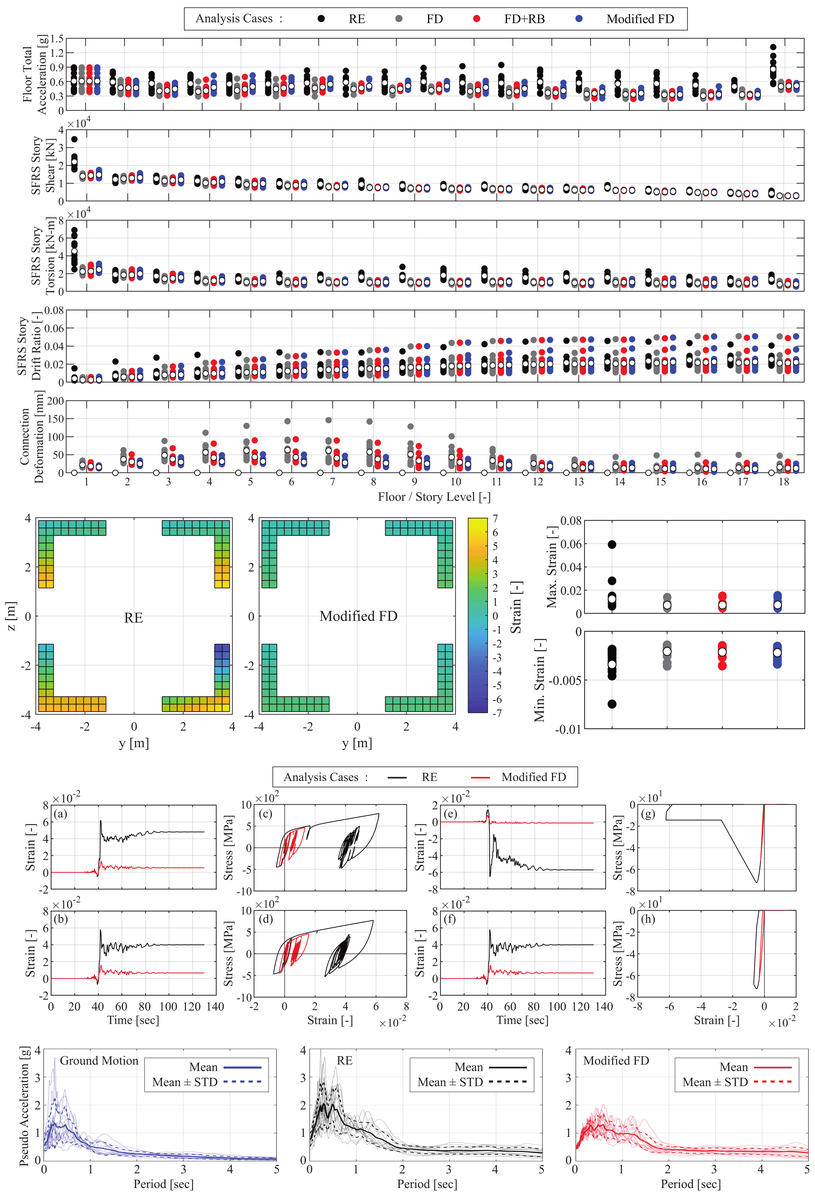


Reinforcing steel (SteelMPF)



Numerical Earthquake Simulation Results

Numerical earthquake simulations of the building model are performed considering eleven design-level far-field ground motions. The seismic response of the building model with the force-limiting connections is compared with the seismic response of the building model with conventional monolithic connections.



Selected References

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3. Chen K., Tsampras G., Lee. K. (2023), Structural connection with predetermined discrete variable friction forces, *Resilient Cities and Structures*
4. Mayorga CF, Tsampras G. (2024) Reinforced concrete wall buildings with force-limiting connections: Modeling effects and uncertainty propagation, *Earthquake Engng Struct Dyn*.
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