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Development of a Design Guideline for Pile Foundations Subjected to Liquefaction-Induced Lateral Spreading

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Development of a Design Guideline for Pile Foundations Subjected to Liquefaction-Induced Lateral Spreading
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Problem Statement
Past earthquakes confirmed that seismically-induced kinematic loads from soil lateral spreading and inertial loads from structure can cause severe damages to pile foundations. The research questions are:
- How to combine inertial and kinematic loads in design of pile foundations in liquefied soil?
- How the combination of inertia and kinematics changes with depth?
- How this combination is affected by long-duration earthquakes?
- How this combination affects inelastic demands in piles?

Background
Current design codes provide varying recommendations on the combination of inertia and kinematics.

Centrifuge Model
Five centrifuge tests were performed on pile-supported wharves in liquefied soils by Dickenson, McCullough and Schlechter, using the geotechnical centrifuge at UC Davis. (McCullough et al. 2001)

Interaction of Inertia and Kinematic
The comparison of recorded bending moments and estimated from LPILE in all five centrifuge tests, proposed below load combinations to estimate bending moments at different depths

Future Works
- Perform numerical analysis in FLAC2D and validate against centrifuge data
- Evaluate the effects of long duration earthquakes and pile inelasticity on the combination of inertial and kinematic demands
- Propose design guidelines for piles in liquefied soils

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