Experimental and Numerical Investigation of Sliding Behavior of Soil-Foundation Interfaces

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Abstract:

A series of small-scale experiments are conducted at Idaho National Laboratory (INL) to investigate nonlinear sliding behavior at the soil-foundation interface that ideally represents a nuclear power plant containing building. A concrete structure model with dimensions of 250 by 250 by 100 mm rests on Ottawa sand deposited in a rigid soil container with dimensions of 1200 by 1200 by 1200 mm. The experiments are performed under lateral monotonic loading by varying vertical pressure load exerted at the foundation level. The experimental data are used to validate the commercial finite element (FE) software, ABAQUS, and the open-source seismic analysis software, MASTODON (Multi-hazard Analysis for STOchastic time DOmaiN phenomena), developed at INL. Upon validation, the numerical model is further scaled up to evaluate scaling effects of the foundation, and validated with additional experimental data available from a medium-scale model with dimensions of 500 by 500. by 250 mm tested at University at Buffalo. Further efforts are made to explore highly nonlinear sliding behavior of a full-scale model and the associated scaling effects are discussed.