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Seismic Site-Response Analysis using MASTODON

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Abstract

Nonlinear behavior of soils during a seismic event has a significant role on seismic site response. Site-response analyses for critical structures are increasingly being performed using one-dimensional nonlinear site-response methods as well as finite-element methods, leveraging the advances in constitutive modeling and computational capacities. This paper demonstrates how MASTODON (Multi-hazard Analysis for STOchastic time-DOmaiN phenomena), a finite-element framework recently developed at Idaho National Laboratory (Coleman et al 2017), equipped with I-soil (Numanoglu, in progress), a nonlinear hysteretic soil model developed to capture soil behavior during cyclic loading, is used to conduct a shear-beam-type site-response analysis on a 20 m deep soil domain. An illustration of the soil profile model and the backbone curves of the soil layers is shown in Fig. 1. Geometry definition and discretization, soil model parameters description and selection, initial and boundary conditions and constraints application, and post-processing quantities of interests such as response histories, response spectra and stress-strain responses along the soil profile are described in detail.

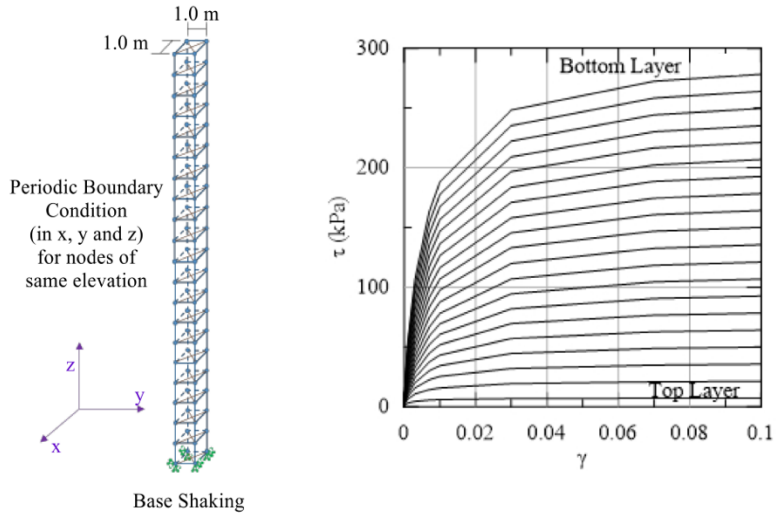

Figure 1. 20 m deep soil column with ground motion applied at the base in the x direction (left) and backbone stress-strain curves for the 20 soil layers (right) with each soil layer being 1 m deep (reprinted from Baltaji et al. (2017)).

References

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