Modeling of liquefaction using dynamic two-phase FEM with UBC3D-PLM model

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ABSTRACT

Soil liquefaction is a geotechnical process describing a transition of fully saturated loose sand from a solid to a liquefied state due to sudden or cyclic loading. It occurs when a state of zero effective stress is reached, thereby eliminating soil shear strength. This state transition process can initiate flow slides, i.e. a downward movement of a large amount of soil along a submerged slope, and therefore, lead to severe damage such as the collapse of a dike or dune section. Accurate modeling of liquefaction is crucial for prediction and possible prevention of such damages. In order to make the first step towards a reliable simulation of liquefaction-related phenomena, a dynamic two-phase velocity-based formulation of the finite element method [Van Esch, 2011] in conjunction with the elastoplastic UBC3D-PLM constitutive model is investigated. The utilized constitutive model is a 3D version of the UBCSAND model and has been shown to be well-suited for modeling of soil liquefaction under cyclic loading [Galavi, 2013].
For a shaking table case study that describes a column of saturated sand subjected to loading as found in earthquakes, the model prediction is compared with the experimental data reported in [Byrne, 2004]. The results demonstrate good agreement between the considered approach and laboratory measurements. Furthermore, numerical aspects of convergence of the used approach are investigated in order to refine it.

REFERENCES

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