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STRONG DISCONTINUITY IN A CRITICAL STATE DOMAIN

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ABSTRACT

The possibility to realistically simulate pile penetration into soil has recently gained attention from several authors. *Lagrangian* pile driving simulations ([2][5][8]), presented achievements of contact mechanics, though omitting the information about the actual deformation state in the soil. Including information obtained using other methods, e.g. *shallow strain path method* [6] or *Eulerian like* simulation [4], issues exposed as critical for successful simulation are treatment of contact and a robust description of large deformations in the surrounding soil. In heavily over-consolidated soils, the latter includes distinctive localized failure in shape of radial and circumferential cracks.

In geomechanics, localisation have often been treated in a non-local plasticity framework in order to avoid mesh dependency. These techniques are usually implemented into standard finite element formulations and are consequently restricted by loss of precision or even convergence when the elements are distorted. An alternative approach based on the strong discontinuity (e.g. [1]) offers a convenient finite element implementation within the framework of embedded discontinuity approaches.

The aim of the research is the incorporation of finite element embedded strong discontinuity in a critical state type model domain for 3D finite strain geotechnical simulations. For this purpose, the article discusses the capability of the selected material model to capture the localization phenomenon with respect to the initial state of material. The theoretical formulation and a numerical algorithm for the implementation of the SDA are presented.

The numerical procedure is tested on a conventional triaxial compression simulation. Examples illustrate the performance and numerical robustness of the model and the post peak softening and localized behaviour of the soil. The investigation is performed in order to determine cases when the use of strong discontinuity enhances the quality of results. Finally, the possibilities of application in complex models, such as pile driving simulation, are discussed.

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