A contact element for the cyclic behaviour of soil pile interaction

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ABSTRACT

In geotechnical engineering, the main parameter for the performance of structures such as reinforced walls or deep foundations is often the shaft bearing capacity. In numerical analysis, important advancements have been made on studying the behaviour of the soil and the retaining structures separately. Still many questions arise when it comes to the contact zone between soil and geotechnical elements. In this respect, a key open issue for the simulation of structures undergoing cyclic loading conditions is the reproduction of the complex geomechanical phenomena (e.g. dilatance/contractance, friction fatigue, etc.) taking place at the interface.

For most industrial applications due to lack of quantitative expressions for such behavior, the discontinuity has often been idealized as being smooth with simple Coulomb friction (de Coulomb 1821). Even with Coulomb law, due to non-linearity, FEM is still not advanced at the point where contact friction aspects are fully reproduced. Therefore in this paper a constitutive law (PZ Generalized Plasticity) (Pastor, Zienkiewicz, and Chan 1990) which takes the cyclic behavior of soil into account is considered. It has been adapted for the implementation in a zero thickness contact element according to (Beer 1985). The study case will be a 2D axisymmetric problem of a pile and its surrounding soil. A cyclic vertical load will be applied on the top of the pile. A comparison of Generalized Plasticity law for contact with a Classic elasto-plastic law will be shown.

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