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Generalized Limit Equilibrium Solution for the Lateral Pile Capacity Problem

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Abstract : The determination of lateral pile capacity per unit length is a key aspect in geotechnical engineering. Traditional approaches for assessing piles lateral capacity in cohesive soils involve the application of upper-bound and lower-bound plasticity theorems. However, a comprehensive solution encompassing the entire spectrum of soil strength parameters, particularly in frictional soils with or without cohesion, is still lacking. This research introduces an innovative implementation of the slice method limit equilibrium solution for lateral capacity assessment. For any given numerical discretization of the soil's domain around the pile, the lateral capacity evaluation is based on mobilized strength concept. The critical failure geometry is then found by a unique optimization procedure which includes both factor of safety minimization and geometrical optimization. The robustness of this suggested methodology is that the solution is independent of any predefined assumptions. Validation of the solution is accomplished through a comparison with established plasticity solutions for cohesive soils. Furthermore, the study demonstrates the applicability of the limit equilibrium method to address unresolved cases related to frictional and cohesive-frictional soils. Beyond providing capacity values, the method enables the utilization of the mobilized strength concept to generate safety-factor distributions for scenarios representing pre-failure states.

Keywords : lateral pile capacity, slice method, limit equilibrium, mobilized strength
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