Analysis of suction piles for mooring floating structure foundations in clay soil at deepwater levels

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Abstrak

Oil and gas exploration is increasingly moving to deepwater locations to meet the increasing energy demands. In this environment, floating structures with suction pile foundations are commonly used because their the cost-effectiveness. Some studies have been conducted to examine the behavior of suction piles in clays, but the clay conditions considered are typically normally consolidated and lightly overconsolidated. In this paper, the behavior of suction piles in underconsolidated clays and underconsolidated-normally consolidated clays adopted from actual deepwater soil conditions. The evaluation was performed using geotechnical 3D finite element software Plaxis. Suction piles with two different aspect ratios (L/D = 2 and 6) were considered, and the focus was on the effect of load angles (0? to 90?) and the effects of padeye position (0.5 L to 0.9 L). For short piles, the load angles had a relatively insignificant effect on the overall ultimate resistance, while for long piles, the angles affected the overall resistance considerably with a decrease in resistance up to about 50 percent. This different behavior could be explained from the observed pile deformation patterns. The padeye positions affected the pile resistances significantly as well with a decrease in resistance up to about 30 percent. Nevertheless, it can be concluded that the overall behavior of suction piles in a combined clay conditions is practically similar to that of piles in normally consolidated and overconsolidated clays.