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Eccentric undrained load capacity of a deeply embedded ring anchor in clay

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ABSTRACT

A deeply embedded ring anchor (DERA) system has been conceived as a cost-effective solution for mooring arrays of floating offshore wind turbines (FOWTs) to the seabed. Key features of the DERA include its installability in any soil, compact size, applicability to various mooring systems, multiline potential, and robust performance under unintentional loading conditions. While previous preliminary studies on the anchor performance provide useful insights on how the DERA can improve cost-effectiveness with high load capacity, these studies are limited to focusing on optimizing anchor performance under translational horizontal and vertical loading. By contrast, the optimal design of the DERA should also address the eccentrical load capacity in addition to lateral/axial load capacity. Due to its shorter length, the DERA actually has less moment resistance than a conventional caisson, with correspondingly greater sensitivity of horizontal load capacity and optimal load attachment depth to load angle. For this reason, this study develops an appropriate analytical approach to evaluate the effects of eccentric load on the anchor performance by using the upper bound plastic limit analysis (PLA) method. The proposed PLA is validated through comparison to the rigorous three-dimensional finite element (3-D FE) method. In estimating eccentrical undrained behavior of the DERA, this paper conducts a parametric study on how the load attachment depth, the aspect ratio of the anchor, and the load inclination can affect the load capacity of the DERA. The results obtained in this study show that PLA can be a useful analytical approach to evaluating the ultimate load capacity of the DERA in clay.

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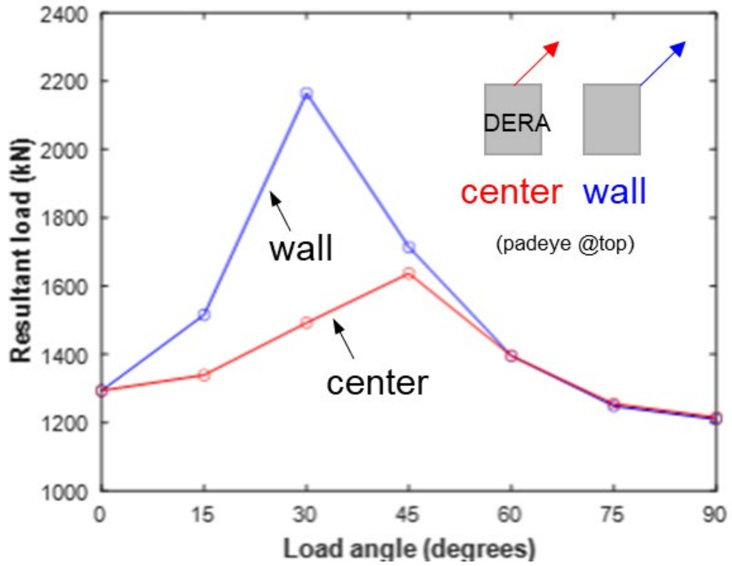

Fig. 1 Effect of load attachment point on the resultant load capacity

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