Investigating the installation of innovative suction caisson anchors to support offshore renewable energy structures, a feasibility study

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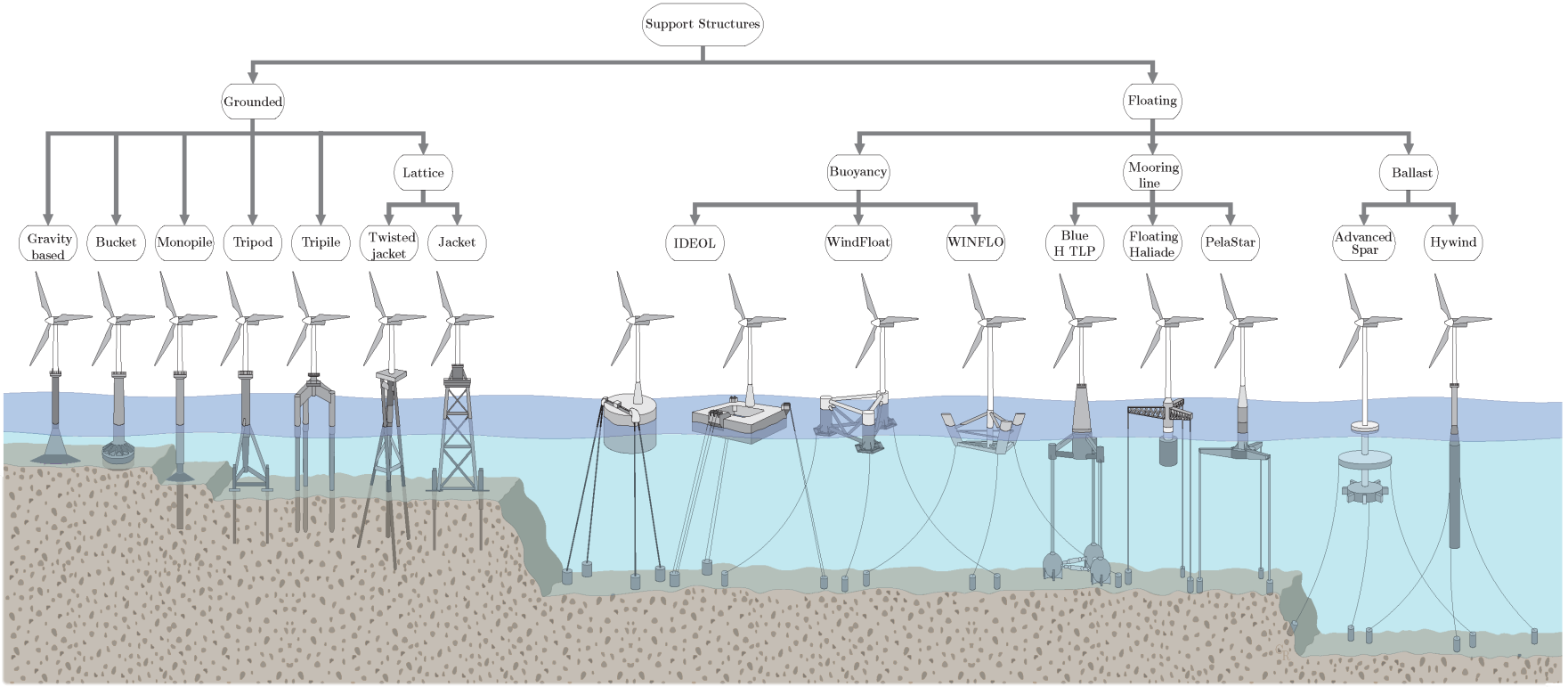

[1] Rodrigues et al. (2016) energies, 9, 216.

Proposed solutions

Project Aims

The main aim of this study is to examine and understand the installation process of a series of innovative suction caisson foundations relative to that of standard suction caisson using a series of finite element (FE) analysis and small scale experiments.

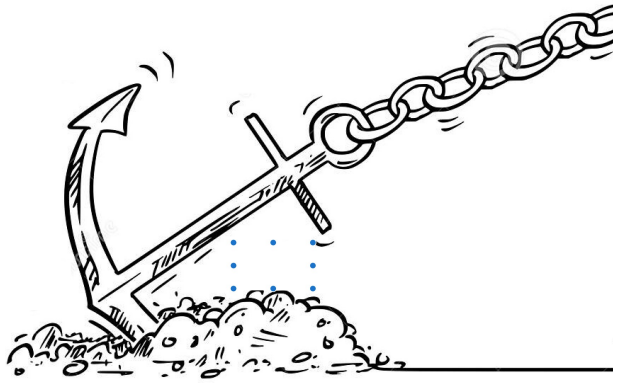

Figure 1: Anchors are traditionally used to secure vessels

Proposed solutions

Inspired by the shape of anchors that are used to secure vessels (Figure 1), a number of structurally enhanced anchor designs are proposed (Figure 2) with potentially enhanced pull-out and bearing capacity when compared against standard/conventional suction caisson anchors. Within this phase of the study, installation of the proposed foundations are studied.

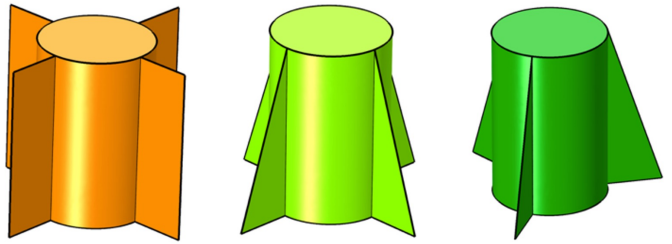

Figure 2: A few examples of flanged anchors

Results

Finite Element Model (FEM)

- A 3D FE model of the problem was developed to predict the amount of suction required to install the flanged caissons at different penetration depth (Figure 3).
- The FEM was validated against published data (Tenby field trial), Figure 4.
- A region inside the caisson cavity subjected to piping was investigated at different stage of the installation.
- The validated FE model was extended to investigate the installation process of various flanged caisson with different flange size and explore the impact of the flanged base size on the installation resistances (Figure 5 shows the results of caissons with three flanges).
- Full details can be found in Mehravar, M., et al. (2023). "Installation performance of structurally enhanced caissons in sand." Computers and Geotechnics, 159, p. 105464. https://doi.org/10.1016/j.compgeo.2023.105464

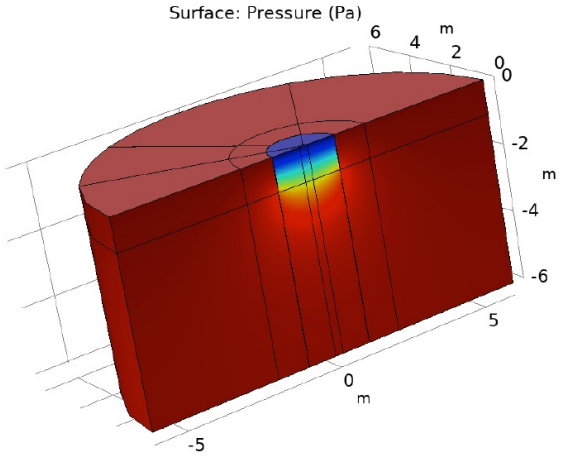

Figure 3: 3D FE model of the proposed foundations to simulate their installation

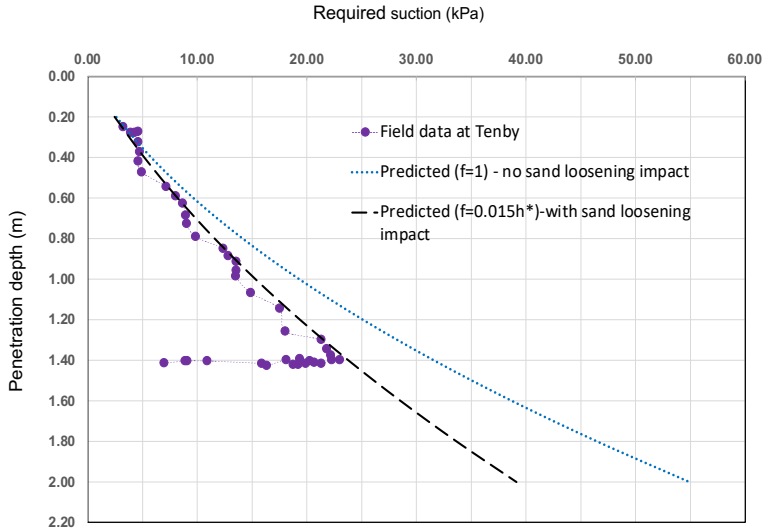

Figure 4: Typical results of the simulations validated against published data

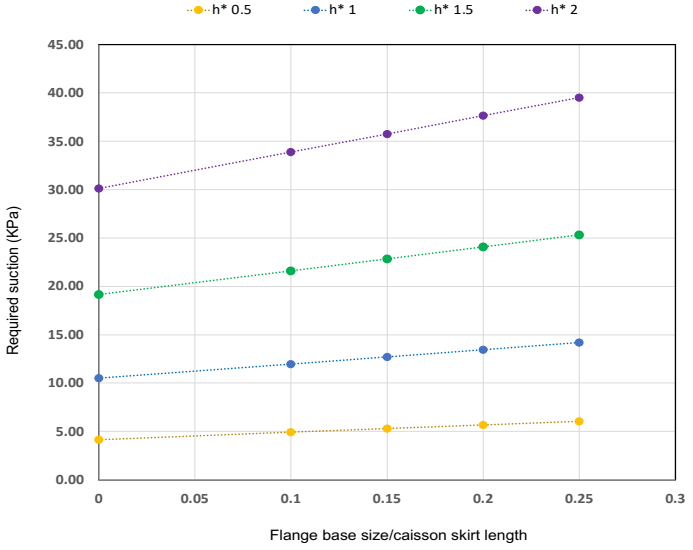

Figure 5: Impact of flange sizes on installation of caisson anchors