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Editorial: Special issue on offshore structure–soil interaction

As the offshore industries move from shallow to deep waters in excess of 1000 m, there has been rapid development of ocean engineering practices. Innovations in theoretical and applied mechanics have been essential in this shift and in underpinning the exploitation of offshore oil and gas and renewable energy resources worldwide. Understanding and predicting physical mechanisms of structure–soil interactions are vital for the stability and safety of offshore engineering structures. Accordingly, in this special issue of *Theoretical & Applied Mechanics Letters* (TAML), eight letter-papers are published to present recent advances in analytical & numerical analysis and in physical modeling of offshore structure–soil interactions in marine environments. They all provide examples of how enhanced understanding of mechanics can impact on applied projects.

The eight papers cover a wide range of offshore applications, including the ∼20 m diameter "spudcan" foundations of mobile jack-up drilling rigs, pile foundations for traditional oil and gas, as well as new age offshore wind farms, drag and plate anchors for mooring in deep water, and in predicting the stability of submarine pipelines.

The failure mechanisms of a spudcan footing penetrating next to an existing footprint are investigated experimentally in the drum centrifuge of the University of Western Australia [1]. In the field of Bohai Gulf (Bay) of China, the excess pore pressure was recorded during driving a super-long pile into the seabed, and the corresponding pile–soil interaction mechanism in the process of pile-segment extension are analyzed [2]. The effect pile–soil interaction on the natural frequency of a monopile-supported offshore wind-turbine structure is investigated with case study and the interpreting of small-scale model tests [3].

Plate anchors have been used to anchor deep-water floating installations, and have an advantage in water depths exceeding 1000 m as they can be used in a taut configuration. Experimental investigation of the pull-out capacity of the plate anchor with clayey soils under cyclic loading is reported [4]. The pull-out capacity under cyclic loading is also investigated numerically, where the cyclic loading induced elasto-plastic deformation of the soil skeleton and the accompanying generation/dissipation of the excess pore water pressure is simulated using a coupled model with combination of the bounding-surface plasticity model with Biot's consolidation theory [5].

As the conduits of oil and gas, submarine pipelines are the lifeblood in any offshore developments. Two papers in this special issue show directly how theoretical mechanics can be applied offshore. The pipe–soil interaction for on-bottom stability of the submarine pipelines in the Gulf of Mexico during recently-occurred hurricanes is assessed with an in-house developed dynamic finite element program [6]. A two-dimensional numerical model is applied to study the coupling effect of the pipeline vibration on the seabed scour [7]. Similar wave–seabed interaction issues greatly impact the design of foundations around marine infrastructures. A coupled numerical model for wave–seabed interaction is proposed to realize both wave and seabed processes in a COMSOL multi-physics program and to calculate the wave and seabed response simultaneously [8].

We would like to take this opportunity to express our great appreciation to all the authors for their contributions to this special issue. Furthermore, we sincerely acknowledge the reviewers for providing helpful comments and constructive advices.

We trust that these eight papers are of interest to the academic community and industry practitioners alike. We believe they provide excellent examples of how improvements in fundamental and applied mechanics can influence the design of the infrastructure that underpins modern communities.

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