Editorial

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The International Conference on Physical Modelling in Geotechnics is the quadrennial meeting for physical modellers in the global geotechnical community. The importance and success of this event – having run nine times since the first meeting in 1988 in Paris – has reinforced the need for and position of this journal, but has also led to a series of intervening meetings in Europe and in Asia. These conferences, Eurofuge and Asiafuge, provide opportunities for geotechnical physical modellers to meet more regularly and to disseminate advances in physical modelling techniques and to highlight where physical modelling has improved our understanding of complex geotechnical problems.

This themed issue draws attention to the most recent Asiafuge conference, hosted by Tongji University in Shanghai, China, from 30 November to 2 December 2016. Invitations were extended to authors of notable, high quality papers from the conference to submit extended versions of those papers for possible inclusion in a dedicated issue in this journal. Issue 2 of 2020 is dedicated to the four papers that were recommended for publication after the peer-review process. Two of the four papers cover geotechnical design problems, the long-term performance of the foundation of an offshore wind turbine and the effects of tunnelling on pile foundations. The third paper provides performance data for a new hybrid foundation type and the final paper communicates the performance of a new in-flight hydraulic shaker on the Zhejiang University geotechnical centrifuge. This range of topics reflects the main focus of physical modellers, particularly centrifuge modellers, which is to understand the performance of geotechnical problems for which there is little prior experience or guidance, to quantify and validate the performance of new geotechnical concepts and to advance the control and acquisition techniques used in our experiments.

The paper by Jeong *et al.* (2020) investigates the response of a suction caisson (or bucket) to vertical cyclic loading. Such loading arises when suction caissons are used as the foundations for an offshore wind turbine supported by a jacket structure. Critical design aspects include non-verticality of the turbine and changes in foundation stiffness, as these affect system performance. These potential issues are considered by Jeong *et al.* (2020) in a series of centrifuge tests of a suction

caisson in saturated sand. An important finding in the work is the detrimental tensile cyclic loading condition that can arise for the windward caisson, as also considered by Bienen *et al.* (2018), albeit that the paper by Jeong *et al.* (2020) considered drained conditions whereas Bienen *et al.* (2018) considered partially drained conditions. Both are relevant to design, and studies of this nature are timely as the offshore wind industry is paying more attention to the use of these foundation types – for example, Ørsted's Borkum Riffgrund 2 offshore windfarm in the North Sea.

The paper by Wang *et al.* (2020) moves onshore, considering the effect of tunnelling on existing pile foundations in normally consolidated clay. Evidently this is a potential issue for densely populated cities as more tunnels are required to accommodate the increase in light-rail transport demanded by increasing populations. The potential for the tunnelling to have an adverse effect on existing piled foundations – and hence the structures that they support – is a concern that is well suited to investigation through centrifuge modelling. This approach, together with three-dimensional finite-element analyses, was adopted by Wang *et al.* (2020). The centrifuge modelling techniques include fluid removal from the model tunnel to simulate volume losses from tunnelling and measurements of the axial strains in short piles (and the pile head settlement) located at different lateral distances from the tunnel centreline. The main contribution of the paper is insight into the load-transfer characteristics along the pile, which differ according to the location of the pile relative to the tunnel. Finite-element analyses extend the experimental investigations to different pile–soil relative stiffnesses, resulting in an algebraic expression that provides a basis for obtaining a first-order estimation of the maximum induced pile axial force due to tunnelling.

Staying onshore, Panchal *et al.* (2020) report results from centrifuge experiments that compare the response of a hybrid foundation – comprised of deep sheet piles capped with a shallow foundation – with conventional cast-in-situ concrete piles. Experimental campaigns such as these can provide value in assessing the merit of new foundation concepts. This relatively simple study concludes that although sheet piles provide relatively low axial load carrying capacity, arranging them as an 'enclosed geometry' leads to significant capacity

increases. The results indicate that if the basal area of the hybrid foundation is equal to that of the solid circular pile (modelling the single concrete pile), the axial capacity will be comparable. Of more interest were comparisons between different sheet pile hybrid foundation geometries, with a square geometry (in cross-section) providing twice the capacity of a circular geometry, and with perforations along the pile wall providing further capacity increases. As with all good research, the study provides answers but uncovers more questions.

The final paper (Zhou *et al.*, 2020) in this issue focuses on centrifuge technology, describing the performance of the in-flight hydraulic shaker on the Zhejiang University geotechnical centrifuge. The focus of the paper is on developing a robust and reliable method to obtain a targeted motion response in centrifuge shaking-table experiments. Zhou *et al.* (2020) utilise a non-linear analytical model for a centrifuge shaking table using structural dynamics and linear control theory. The paper investigates various environmental and control parameters that have an effect on the frequency response functions (FRFs), leading to the FRF cluster model that is used together with a simple feed-forward control procedure to tune the demand motion. Performance of the proposed procedure is demonstrated by way of a suite of shaking tests that show good agreement between the demand and achieved table accelerations.

I would like to offer my appreciation to the authors, to the Asiafuge organising committee, to the reviewers and to our editorial board, who have collectively made this themed issue possible. I trust that you enjoy reading these papers and hope that the journal will continue to highlight the fine contributions that are made at these (now bi-annual) meetings of the geotechnical physical modelling community.

REFERENCES

- Bienen B, Klinkvort RT, O'Loughlin CD, Zhu F and Byrne B (2018) Suction caissons in dense sand, part II: vertical cyclic loading into tension. *Géotechnique* **68**(11): 953–967, <https://doi.org/10.1680/jgeot.16.P282>.
- Jeong YH, Kim JH, Manandhar S *et al.* (2020) Centrifuge modelling of drained pullout and compression cyclic behaviour of suction bucket. *International Journal of Physical Modelling in Geotechnics* **20**(2): 59–70, <https://doi.org/10.1680/jphmg.18.00044>.
- Panchal JP, McNamara AM and Goodey RJ (2020) Sheet pile groups as an alternative foundation solution to cast-in-situ concrete piles. *International Journal of Physical Modelling in Geotechnics* **20**(2): 83–96, <https://doi.org/10.1680/jphmg.18.00053>.
- Wang H, Leung CF, Yu J and Huang M (2020) Axial response of short pile due to tunnelling-induced soil movement in soft clay. *International Journal of Physical Modelling in Geotechnics* **20**(2): 71–82, <https://doi.org/10.1680/jphmg.18.00045>.
- Zhou YG, Meng D, Ma Q *et al.* (2020) Frequency response function and shaking control of the ZJU-400 geotechnical centrifuge shaker. *International Journal of Physical Modelling in Geotechnics* **20**(2): 97–117, <https://doi.org/10.1680/jphmg.19.00029>.