Merits of the Maximum Entropy Meshless Method for Coupled Analysis of Offshore Problems

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ABSTRACT

Despite the recent advances in meshless analysis methods, their application in tackling offshore geotechnical problems is relatively limited. In meshless methods the problem domain is discretised by a set of nodes and, unlike the traditional finite element method, the connectivity between the elements and nodes does not exist. This means that the meshless methods may outperform the finite element method in problems including excessively large deformations, discontinuities or strain localisation. On the other hand, the shape functions in meshless methods are not usually simple polynomial functions which are explicitly evaluated at an arbitrary point. These functions are commonly obtained by solving a complex and relatively time-consuming optimisation problem, significantly affecting the overall computational time. This issue may become even more serious when the shape functions need to be updated during each time step of the analysis. In this study, we attempt to address the efficiency and performance of one of the recently developed meshless methods for solving offshore problems where the solid displacements are coupled with the pore fluid pressures. This method is based on the principle of Maximum-Entropy [1], and its performance is presented by comparing its results with those obtained by the finite element method, considering small as well as large deformations. This is achieved by studying the consolidation and bearing capacity of soil under an offshore foundation, using various nodal discretisations and boundary conditions. The results indicate that, for the problems considered in this study, the Maximum Entropy Meshless method (1) can provide a stable solution regardless of the domain discretisation density, and (2) outperforms the finite element method by reducing the computational time but achieving the same accuracy.

REFERENCES

[1] M. Nazem, M. Kardani, B. Bienen and M. Cassidy, “A stable Maximum-Entropy Meshless method for analysis of porous media”, *Comput. Geotech.*, Vol. **80**, pp. 248–260, (2016).