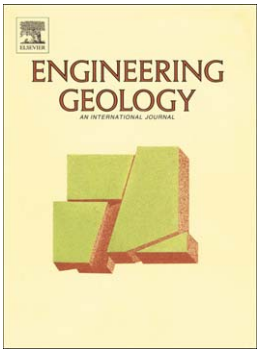

Numerical study on loosely deposited foundation behavior around a composite breakwater subject to ocean wave impact

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Numerical study on loosely deposited foundation behavior around a composite breakwater subject to ocean wave impact

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Abstract

In this study, an integrated model is developed to investigate the potential risk for failure of caisson-type breakwaters caused by liquefaction in its loosely deposited sand foundations. In the present model, the Volume-Averaged Reynolds Averaged Navier-Stokes (VARANS) equations are used for solving flow inside and outside the porous media, while Biot's consolidation equation is used for linking the soil skeleton-pore fluids interactions. A new developed poro-elastoplastic model is implemented to reproduce the behavior of loose sand foundation under cyclic shearing. Verification of the present numerical framework includes (i) comparison with the laboratory experiments in terms of water surface levels around the structure, and the fluctuating component of the pore water pressure inside the rubble mound and seabed foundation; and (ii) comparison with the geotechnical centrifugal wave tests for the wave-induced residual component of pore water pressures in a porous seabed. Based on the present model, the hydrodynamic process and the associated dynamic foundation behavior involved in the interactions between the ocean waves, a composite breakwater and its loose sand foundations was performed and analysed. Particular focus is put on the residual pore pressure development and the resulting liquefaction around the structure under combined actions of both wave and structure rocking motions. Based on the numerical examples presented, under combined actions of

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