Local Scour at Monopile Foundations Subjected to Lateral Vibrations

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ABSTRACT

Because of the severe adverse environmental impact related to the excessive exploitation of fossil fuel that leads to climate change and environment deterioration, demands for alternative energy have gained significant impetus in the past few decades. One important energy source is wind energy. As a result of the increased utilization of this renewable energy, increasingly more wind farms have been planned and constructed throughout the world. Monopile foundations are the most common foundation type for offshore wind turbines. In the ocean environment, the threat associated with the customary foundation scour attributed to currents and waves is coupled with the presence of lateral vibrations induced by wind. Over the past decades, the scour process induced by flow and pile-soil interactions has been independently investigated by researchers from the fields of hydraulic/coastal engineering and soil mechanics, respectively. Very few studies can be found in published literature on lateral vibration effects on scour at monopile foundations. Based on a series of experiments, this talk presents an improved understanding of the mechanics of current-induced scour at monopiles subjected to lateral vibrations. When compared with a non-vibrating monopile, the results show that scouring around its vibrating counterpart is comparatively faster during its initial stages of development. This is primarily due to soil densification and subsidence induced by monopile-seabed interactions. Increasing both the frequency and amplitude of the monopile vibration would decrease the equilibrium scour depths and scour hole slopes. The reduction of equilibrium scour depth likely is due to the effect of the sediment ratcheting motion that is present on the surface of the scour hole.