

THE USE OF FINITE ELEMENT ANALYSIS WITHIN OFFSHORE GEOTECHNICS – AN INDUSTRY OVERVIEW

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ABSTRACT

Finite element analysis (FEA) software has developed significantly over recent years and has become a valuable tool in solving offshore geotechnical engineering problems. Geotechnical engineering consultants now use FEA software packages on a regular basis to solve complex problems.

This presentation gives an overview of the application of FEA by Fugro GeoConsulting in offshore geotechnics. Recent studies are presented in which FEA has been used to solve complex problems, primarily in the offshore oil and gas sector. This presentation focuses firstly on jack-up rig installations, and secondly on excess pore pressure predictions from high accumulation sedimentation rates.

FEA is used to determine the behaviour of the soil during jack-up rig installations. Repeated installation of jack-up rigs alongside fixed platforms creates spudcan depressions on the seafloor. We present two such case studies where several jack-up rigs have left depressions on the seafloor and the interaction of the spudcans with these existing depressions could potentially result in sliding and/or rotation during installation. We have carried out three-dimensional FEA to assess the effect existing seafloor depressions have on the installation behaviour of the spudcans, for several sites in the North Sea. We also present two further case studies where we have performed FEA to predict the soil displacements at the platform piles from spudcan installation and subsequently the bending moment and stress utilisation factors of the pile.

High sedimentation accumulation rates and low permeability soils result in the build-up of excess pore pressure within soils. Consequently we have also performed FEA in which the sedimentation process is modelled to predict the evolution of excess pore pressure over time and this is also presented.

SUGGESTED THEMES

Offshore Geotechnics, Jack-up Rigs, Soil Modelling