

Using High Performance Concrete in Finite Element Modeling of Grouted Connections for Offshore Wind Turbine Structures

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Abstract : Wind energy is one of the most effective renewable sources especially offshore wind energy although offshore wind technology is more costly to produce. It is well known that offshore wind energy can potentially be very cheap once infrastructure and researches improve. Laterally, the trend is to construct offshore wind energy to generate the electricity form wind. This leads to intensive research in order to improve the infrastructures. Offshore wind energy is the construction of wind farms in bodies of water to generate electricity from wind. The most important part in offshore wind turbine structure is the foundation and its connection with the wind tower. This is the main difference between onshore and offshore structures. Grouted connection between the foundation and the wind tower is the most important part of the building process when constructing wind offshore turbines. Most attention should be paid to the actual grout connection as this transfers the loads safely from tower to foundations and the soil also. In this paper, finite element analyses have been carried out for studying the behaviour of offshore grouted connection for wind turbine structures. ATENA program have been used for non-linear analysis simulation of the real structural behavior thus demonstrating the crushing, cracking, contact between the two materials and steel yielding. A calibration of the material used in the simulation has been carried out assuring an accurate model of the used material by ATENA program. This calibration was performed by comparing the results from the ATENA program with experimental results to validate the material properties used in ATENA program. Three simple patch test models with different properties have been performed. The research is concluded with a result that the calibration showing a good agreement between the ATENA program material behaviors and the experimental results.

Keywords : grouted connection, 3D modeling, finite element analysis, offshore wind energy turbines, stresses

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