

Title of Diploma Thesis

Dynamic Analysis of a Jacket Supported Offshore Wind Turbine under Extreme Environmental Conditions and Earthquake Loading

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ABSTRACT

This diploma thesis deals with the investigation of the behaviour of jacket foundations for offshore wind turbines under extreme environmental conditions and seismic loading. At first, emphasis was put on the necessity for renewable energy from wind which implies the construction of offshore wind parks while the basic principles of the operation of wind turbines were explained. Subsequently, the most common support structures for offshore wind turbines were described and the selection of jacket concept for this diploma thesis was explained taking into account the trends in this industry. These trends show that in the following years offshore wind parks will be constructed in deeper waters and in earthquake prone countries using bigger wind turbines.

Having determined the loads and the design requirements of such structures in regard to modal behaviour and materials durability, the critical loading combinations were specified according to international standards. Next, the structure was modeled and analyzed for both extreme conditions and seismic loading using MicroSAS II software which is based on the Finite Element Method.

Using the results of the analysis, both tube check and joint check was performed for the jacket structure together with the check of the foundation piles. Next, the support structure was resized in order to sufficiently resist the loads and it was optimized aiming for the minimum cost.

In the end, the results of the analysis were evaluated which led to useful conclusions which can be used in the construction of future offshore wind parks using jacket foundations in earthquake prone countries. In addition, relevant research subjects were proposed for future work.

Keywords: Wind energy, Offshore wind turbines, Jacket foundation, Numerical modeling.