Project proposal template
Graduate School studentships
March 2015

Project title	Nonlinear Dynamic Response Prediction of Offshore Wind Turbines
First Supervisor	Dr — Hamid Zolghadrzadeh- Jahromi
Second Supervisor	
School	Civil Engineering and Construction
Other member of supervisory team (no more than three KU supervisors in total)	
Specific requirements beyond 2:1 degree	The project will be suitable for an applicant with a good knowledge of Structural/Civil Engineering. Experience of numerical modelling and finite

Project summary

(max 4,000 characters)

Nonlinear Dynamic Response Prediction of Offshore Wind Turbines

Developing alternative sustainable sources of energy is a vital engineering challenge of today. In this context, offshore wind turbine structures play a crucial role and as a result, their construction is expected to grow exponentially in the feature.

From both safety and economy viewpoints, a critical component of offshore wind turbine structures is the connection of the structure to the ground, and in particular cyclic load transfer to the surrounding soil subdomain. Offshore wind turbine structures are subjected to strong cyclic loading (wind, turbine and wave loads), which requires the consideration of fluid-soil-structure interaction (FSSI) for realistic response prediction. In fact, a greater understanding of the behaviour of wind turbine structure-foundation interaction will inevitably lead to cheaper construction, which in turn, will make offshore wind turbines a more sustainable solution. The nature of the interactive structure, soil and fluid sub-systems in such structures defines their multi-physics features. Modelling and discretisation methods of the sub-systems can vary across a wide spectrum, depending on the physical effects to be captured. The treatment of interaction brings more challenge to the problem at different levels, including the coupling algorithms and their implementation for efficient simulation of large scale systems.

This proposal supports multi-disciplinary research concerned with nonlinear and 3D fully coupled FSSI modelling of wind turbine structures. In this respect, the dynamic characteristics of offshore wind turbines with different foundation systems (such as mono-pile and multi-pod foundations) under cycling loading will be investigated. Based on this, 2D novel simplified and design-oriented models for nonlinear response prediction of such structures will be developed. It is envisaged that the successful outcome from this project will provide realistic predictive models for estimating the dynamic characteristics of offshore wind turbine structures (such as their natural frequency, etc.).

The project will be suitable for an applicant with a good knowledge of Structural/Civil Engineering. Experience of numerical modelling and finite element would be beneficial.

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