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Modal Properties of Offshore Wind Turbines Identified by Full-Scale Testing

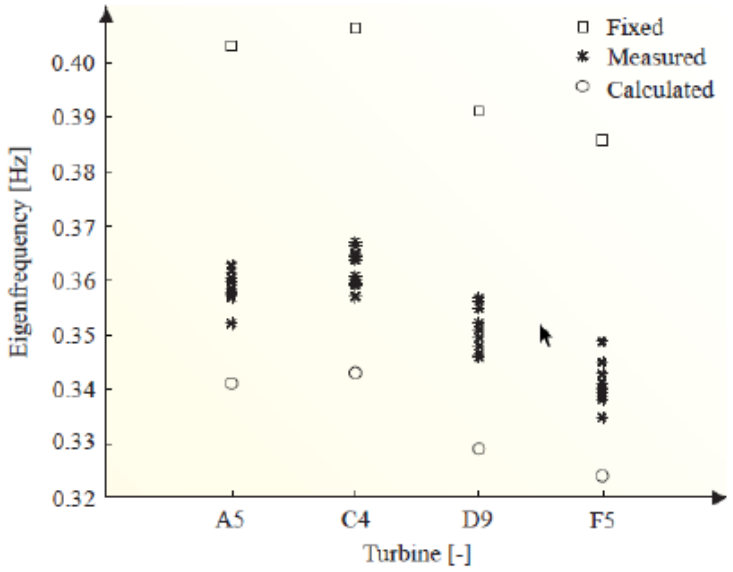
Student Project Proposal

Background

The dynamic response of offshore wind turbines occurs in frequency range close to excitation frequencies related to environmental and structural harmonic loads. Sufficient geometrical and material damping in the structure and subsoil are required to counteract large amplitudes of vibration. Especially for wind turbine sites characterised by a large degree of wind-wave misalignment, a proper estimate of the eigenfrequency and inherent damping is needed due to low aerodynamic forces in the rotor plane. Consequently, aeroelastic wind turbine simulations should reflect these modal properties in a reasonable manner in order to obtain reliable and safe designs.

Scope

The thesis aims to improve the knowledge of the dynamic behaviour of offshore wind turbines. Based on full-scale modal testing of different offshore wind turbines, the experimental structural eigenfrequencies and damping ratios are derived and compared against (non)linear numerical models capturing the most important soil-structure interaction effects with few additional degrees of freedom added to the wind turbine model. The experimental analysis allows the student to improve the numerical model, which can be used to evaluate to what extent the soil-structure interaction affects the dynamic structural response and associated fatigue loading of offshore wind turbines.



Keywords: Modal analysis; soil dynamics; soil-structure interaction; wind turbine