Title of the Master thesis:

Behavior of a Wind Turbine Situated in a Seismic Area and Subjected to Environmental Loads

Master Thesis subject:

Wind turbines are increasingly being installed in seismic regions. Wind turbines are thin, poorly damped structures, and are highly sensitive to vibrations induced by the simultaneous actions of wind and earthquake.

The recent construction of wind turbines in seismic regions requires an assessment of the impact of the combined action of wind and earthquake on these structures. This study may be divided into two parts:

The first part involves the establishment of a 3D numerical model of a wind turbine in seismic areas. The aim of this model is to investigate the effect of the seismic loading on the structural responses of the wind turbine.

The second part involves the implementation of a passive vibration reduction device to attenuate excessive wind and earthquake vibrations. Currently, standard vibration absorbers, like tuned mass dampers (TMDs), are used to mitigate OWT tower motion by attaching an oscillatory secondary mass in the turbine nacelle with stiffness and damping properties tuned to counteract the tower vibrations, thus dissipating the wind-induced kinetic energy. Nevertheless, ordinary TMDs require large secondary mass and excessive free volume to accommodate the secondary mass displacement (stroke) inside the nacelle/tower for the effective reduction of strains and stresses under environmental dynamic loads. On the other hand, Inerter-Based Dynamic Vibration Absorbers (IDVAs) were shown to significantly reduce requirements for secondary mass and stroke. In this regard, the second objective of this project is to assess, numerically using the 3D model, the performance of IDVA-equipped wind turbines. To this aim, time-domain simulations will be performed to quantify performance improvements and efficiencies compared to uncontrolled (without IDVAs) wind turbines and to wind turbines controlled by conventional TMDs.

Candidate profile:

The candidate should have a background in Civil or Mechanical engineering (Final year of an engineering diploma or second year of a Master program). She/He should possess a good understanding of structural dynamics with a deep mathematical background. Ideally, the successful candidate should have skills in coding in MATLAB/Python, in structural modelling and dynamic analysis using standard finite-element software (e.g. ABAQUS, OpenSees or similar), in simulating the dynamic response of structural systems.

Supervisors:

- Abdul-Hamid Soubra, Nantes Université, Abed.Soubra@univ-nantes.fr ;
- Mourad.Aït-Ahmed, Nantes Université, Mourad.Ait-Ahmed@univ-nantes.fr

Location:

The candidate will be located in Nantes University (GeM Laboratory) at the Saint-Nazaire city.

Starting date:

The Master internship will start on February 12th, 2024 for a period of 5 months.

Salary per month:

550 € net

To apply to the internship:

Interested candidates are invited to send their CV, a motivation letter and their transcript during their study at the university *via* email to the two supervisors mentioned above by January 12th, 2024 at the latest.