PhD Studentship: Predictive scour monitoring for Offshore Wind Turbine foundations by Inverse Physics-Informed-Neural-Network technology

Application Deadline: 1st December 2023
Anticipated Starting Date: September 2024
Application and Funding Details: See https://research.ncl.ac.uk/marinezero/applicants/

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Offshore wind is central to realizing the net zero emission targets for many countries and offshore wind farms are developing quickly. However, the scour on the foundations of fixed-bottom offshore wind turbines (OWTs) threats the safety of offshore wind turbines, therefore the development of scour on OWT foundations must be monitored and assessed. However, current scour monitoring mostly relies on hiring offshore service boat and employing underwater scan facilities, which is a heavy financial burden on OWT farm operators. How to reduce the cost on scour monitoring for OWTs effectively has always been concerned by offshore wind industry. The emergency of Artificial Intelligence technology provides a promising solution to solve this issue via using the existing monitoring data from sensors commonly installed on the wind turbine blades. Physics Informed Neural Network (PINN) method has been employed to improve the accuracy of numerical modelling tools for the dynamic responses analysis of OWTs, which furtherly makes it possible to bring digital twins in scour monitoring for offshore wind farms. Nevertheless, there are still many challenges in realizing the digital monitoring of scour development on OWT foundations by PINN technology.

This PhD project aims to establish an Inverse Physics-Informed-Neural-Network digital twin system with predictive maintenance system for scour monitoring of offshore wind turbines foundations.
The candidate is expected to master the knowledge of theories in multi-disciplines used in dynamic performances analysis for offshore wind turbines and scour development. With mastering these theories and related skills, the candidate will propose novel method and do programming work to update and develop an in-house aero-hydro-servo-structure-scour programme *DARwind* into *DARwind+*, which will be an Inverse PINN-based programme for OWT foundations and scour development predictive monitoring. In addition, candidate is also expected to conduct scour test in wind-wave-current flume in Hydrodynamics Lab at Newcastle University and link the testing data with the Inverse PINN digital twin system. Furthermore, the candidate will also participate in some collaborative research with offshore wind industry.

The applicant is expected to have a 2.1 or 1st class honors MSc degree in an appropriate engineering or science discipline. It would be desirable for the applicant to have a background of understanding offshore engineering, wind energy, basin experiment, and related computing science knowledge.
This award is available to UK/EU and international candidates.

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