MECHANICAL ENGINEERING

MUR DM 118 - Development of an AI based optimization tool for offshore wind farm layout optimization and informed decision making

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Dipartimento DIMEAS

Supervisor	BRACCO GIOVANNI - giovanni.bracco@polito.it

Contact	

Context of the research activity	Floating wind systems are one of the pillars for the Italian and European decarbonization of the electric energy. The mooring are a key component in the system dynamics and an important part of the system cost. Thus advanced metodologies are needed to detect innovative layouts, able to adress the novel challenges in the field. Progetto finanziato nell'ambito del PNRR - DM 118/2023 - CUP E14D23001800006

Objectives	Offshore wind farms represent a key asset in the energy transition path. However, the optimization of a wind farm layout is a complex task, encompassing a large number of requirements to be met, as well as challenging and interconnected optimization goals. The optimization process should therefore effectively combine technical, environmental, economical, and social needs. A fully integrated optimization tool would therefore be a crucial step to explore innovative design solutions that embrace the complexity of the topic. At the same time, it would represent a valuable instrument for Public Administration, investors and policymakers to take informed decisions both at the planning and design stage. The objective of this PhD is to develop an advanced AI-based optimization tool to effectively address the challenges faced in the optimization of a wind farm layout. The primary focus will be the creation and training of a model meeting multiple optimization criteria. The tool should be able to offer a solution to reach common optimization targets, such as the maximization of the energy output and the cost minimization. At the same time, it should implement new criteria, such as relevant economic indicators and the minimization of the inter-turbine wake effects, and it should investigate environmental impacts, in order to adhere to environmental regulations and

minimize potential threats. The research should also explore the vast potential of AI-based models as an effective strategy to deal with complexity, training the algorithm with multi-fidelity model results and possibly with real-world data, building a comprehensive and significant database.

The Italian PNRR identifies the need to improve the quality and effectiveness of the Public Administration actions by investing in qualified actors in the STEM field, as explained in its Mission 4 Component 1 "Istruzione e ricerca". This PhD program aims at developing an advanced tool that would be at the lead of innovation in the offshore wind energy field and that would represent a great opportunity to provide Public Administration with a powerful instrument for informed decision-making and planning

Skills and competencies for the development of the activity	Simulation capability in Matlab/Simulink Basic knowledge of floating wind systems