

Master's thesis opportunity: Development of a surrogate model for wind turbine loads

The Wind Energy Systems group is offering a master's thesis in the field of wind turbine load modelling.

Background

In modern wind farms, turbine and farm control can be used to balance energy production with structural load mitigation to extend turbine lifetime and reduce maintenance costs. Accurately predicting these loads under wake effects and turbulent inflow typically requires high-fidelity aeroelastic simulations, which are computationally expensive. Surrogate models offer a powerful alternative by providing fast, approximate predictions of turbine loads based on input variables such as wind speed, turbulence intensity, and turbine control settings. These models are particularly useful in real-time optimisation, control, and design processes, where thousands of evaluations are needed within seconds. This thesis focuses on developing and validating a surrogate model for integration with an in-house dynamic flow model.

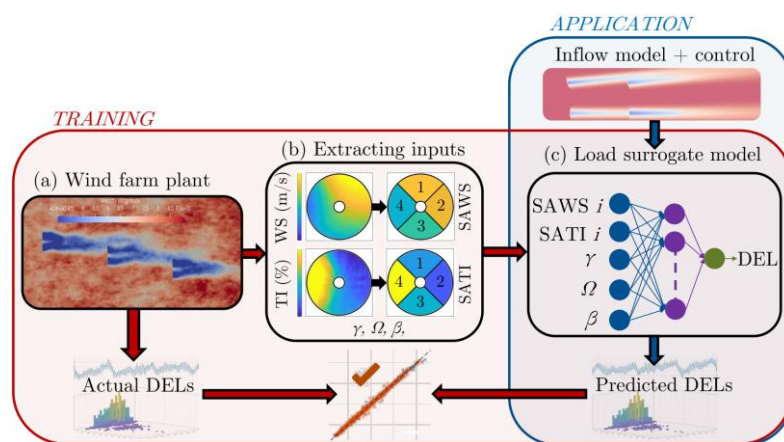


Figure by Guilloiré *et al.* (2024). J. Phys.: Conf. Ser., **2767**, 032019. doi.org/10.1088/1742-6596/2767/3/032019

Thesis tasks

- Conduct a literature review on the current state-of-the-art of turbine load surrogate models.
- Identify a suitable surrogate model that integrates with an in-house dynamic flow model.
- Implement the selected model in Python. First under simplified, idealised inflow conditions. Then as a modular component of the existing in-house dynamic flow model.
- Validate the implementation using reference data from aeroelastic simulations.
- Document and present the work.

Requirements

- Master's student in physics, engineering, mathematics, meteorology, or computer science
- Strong background in mathematics
- Strong interest in wind energy and basic understanding of relevant physics
- Basic programming experience in Python or MATLAB, and high motivation to deepen Python skills and engage in model development

Student assistant position

In general, there are opportunities to work as student assistant in the Wind Energy Systems group, supporting scientific or administrative tasks, which are independent of the master's thesis topic.

Place	University of Oldenburg, Institute of Physics / ForWind, Wind Energy Systems
Duration	6 months (can be extended by a preceding internship) from September 2025 or later
Supervision	Jan Bohrer and Prof. Dr. Martin Kühn. Contact: jan.bohrer@uol.de