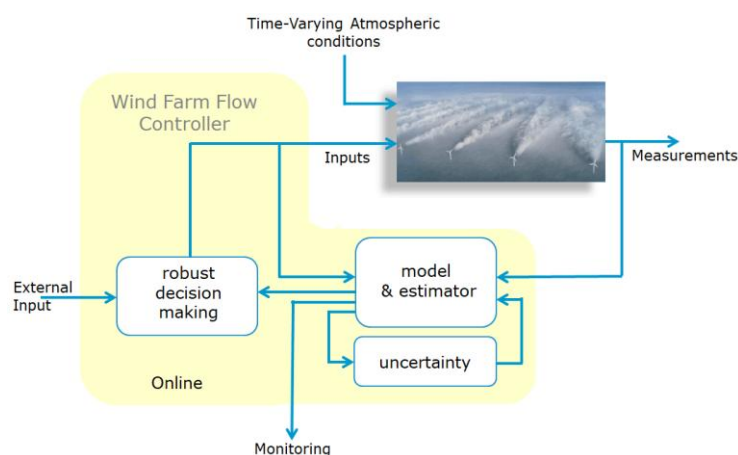


Master's thesis opportunity: Model predictive wind farm control with yaw steering

The Wind Energy Systems group is offering a master's thesis in the field of wind farm flow control.

Background

Wind turbine wakes describe regions of reduced wind speed and increased turbulence induced by turbine rotors. They play a critical role in the performance, efficiency, and structural loading within wind farms. As wind turbines influence each other through these wakes, coordinated control strategies are needed to optimise total power output and reduce mechanical fatigue. One promising approach is model predictive control (MPC), a control strategy that uses a model to predict the flow and optimise turbine settings over a given time horizon. In wind farms, MPC can be used to intentionally misalign turbines relative to the incoming wind to redirect wakes away from downstream turbines. This technique, known as yaw steering, has shown potential to significantly improve overall wind farm performance.



Figures by Meyers *et al.* (2022). doi.org/10.5194/wes-7-2271-2022. Photo by Vattenfall, Christian Steiness.

Thesis tasks

- Conduct a literature review on the current state-of-the-art in model predictive yaw control.
- Identify a suitable MPC algorithm that integrates with an in-house dynamic flow model.
- Implement the selected control algorithm in Python. First under simplified, idealised inflow conditions. Then as a modular component of the existing in-house dynamic flow model.
- Evaluate and validate control performance using simulation results.
- 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 and control
- 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 a 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