PitchMe

Robotics internship in wind turbine control

Our mission: we provide smart blade pitch-control solutions to enhance vertical-axis wind turbine performance and lifetime.

Our project

Vertical-axis wind turbines are great alternatives to produce ultra-low carbon electricity, but they often suffer from low efficiency and premature failure in unsteady winds.

The industry has developed rudimentary control solutions to mitigate these short comings. These solutions improve turbine performance on average but fail to ensure safe turbine operation in the broad range of wind conditions encountered by a wind turbine during its lifetime.

We've pioneered an innovative active blade pitch control strategy for vertical-axis wind turbines, optimising the blade's orientation in real-time using a physics-informed, data-driven algorithm. On our small-scale lab prototype, we've demonstrated a 3-fold power coefficient enhancement and a projected 5-fold extension of turbine lifespan.

Internship title: Implementation of a sensor-based solution for feedback control on a vertical axis wind turbine.

Description

The intern will participate in the experimental demonstration of our core technology: a data-driven control framework for wind turbine performance enhancement using blade-pitching. Agile Wind Power, our industrial partner, provided us a small-scale model of their Vertical Sky turbine. Our experimental campaign involves three main steps: instrumenting the wind turbine prototype with sensors, developing motion and data acquisition code to operate the prototype, and performing experiments to extend our existing control framework. We aim to demonstrate our lab results on Agile's prototype for a wide range of wind conditions.

Intern role: implement a pressure-based sensor solution and integrate its output into our control framework.

Tasks

- Collaborate with the mechanical workshop and Sébastien Le Fouest (CEO) to design a mounting solution for a PCB in the turbine wing.
- Connect pressure taps from the sensors to the blade surface, wire the PCB to a Raspberry Pi and develop the digital data acquisition code.
- Implement the data acquisition strategy into our closed-loop control framework.
- Participate in wind tunnel experimental campaigns.
- pro-actively participate in the improvement of our cluster-based closed-loop control strategy, bringing expertise to improve its stability, performance, and robustness.

Deliverables:

- sensor implementation & data-acquisition code.
- sensor validation tests.
- robust closed-loop control strategy post wind tunnel experiments in preparation for field experiments (shared deliverable).

Benefits

The intern will be working alongside our CEO Sébastien Le Fouest and CTO Daniel Fernex, who will mentor them and share experience based on our previous experimental campaign. This project involves the unique opportunity of performing a hands-on experimental study on an industrial-grade wind turbine prototype and developing our cutting-edge control framework for highly unsteady aerodynamics. This control method has strong potential for wind turbine, aviation, drone, and aerospace industries.

Additional information:

- Applicant's status: either a working permit or a European citizenship.
- Job type: full time internship.
- Start period: January or February 2024.
- Duration: 6 months.
- Location: EPFL, Lausanne Campus.
- Sought profile: master student with a robotics or mechanical engineering background.
- Required skills: python, control systems, sensor integration, and data acquisition and processing.
- Nice to have skills: machine learning, aerodynamic, power production.
- Gross salary: 2500.-/month
- Please send your CV and cover letter in a single pdf file to sebastien.lefouest@epfl.ch