Internship or BSc/MSc thesis: Development of a System Identification Tool for Low-order Wind Turbine Model Identification.

Many of Germany's wind turbines approach the end of their lifetime, but often they are still able of withstanding loads for several years and therefore provide a cheap and low CO2-footprint source of energy. Moreover, lidar-assisted control can help to reduce loads and extend the turbine's lifetime beyond the design. However, many of these already erected wind turbines do not have any aero-elastic model of themselves. This latter is a requirement for performing load and control design studies, in particular lidar-assisted control. Consequently, a grey-box parameter identification tool is of significant relevance for identifying the aero-elastic model, based on measured data, and then enabling wind turbines life-time extension by means of lidar-assisted control.

sowento is a successful spin-off of the University of Stuttgart with deep expertise in lidar-assisted control and offshore floating wind turbines. Our aim is realizing commercial construction of floating wind projects in the future through advanced technology: We use advanced modeling and control in order to save material, approaching minimum safety factors for a most efficient use of steel and concrete. Our vision is to advance Floating Offshore Wind Turbine (FOWT) technology for sustainability and cost-efficiency through an optimization of the dynamic characteristics. (Read more: Lidar-Assisted Control / Floating Wind)

Research challenge

The objective of this work is to develop a system identification tool, which can identify the grey-box parameters (i.e., the physical description of the problem is known, but not the equation's parameters) of an onshore wind turbine based on real measurements. On the other hand, the wind turbine is a complex system, since its dynamics consist of aero-servo-elastic coupled dynamics. Hence, the scope of this project is to identify the grey-box parameters assuming a reduced order model of the turbine, which will consider only three degrees of freedom (DOF), the rotor speed, the tower motion (longitudinal direction) and the blade pitching actuator. For all of them the equations (nonlinear) are given.

The main research questions are the following:

- With which grade of uncertainty can an onshore wind turbine be identified using measured signals?
- Which uncertainty is particularly induced by using wind speed lidar measurements as input?
- Which is the impact of the unmodeled modes on the system identification?

In the present work, you will participate and contribute to develop a tool with direct application in a research project involving several partners of the wind energy industry. You will gain knowledge in system identification, industry-standard wind turbine control, and software development. You will be part of a very motivated team, working in a creative and enthusiastic environment.

Candidate Profile

For a successful completion of the internship/thesis project, applicants should have an understanding of system identification, control engineering and programming. Knowledge in MATLAB or Python is required.

Contact

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