Project 5: LIDAR Simulation for Wind Turbine Control

Student Project Proposal

APPLY

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Background

Doppler LIDAR technology for measuring wind speed has been under development some years. One of the often talked about applications is LIDAR Assisted Control (LA which has the potential to add prediction of gusts to the control loop thus enabling wind turbine controller to react before the gust hits the rotor.

One of the barriers for implementing LAC is the ability to model the advection of wi both for the purpose of reconstructing the wind field and for simulating LIDAR measurements.

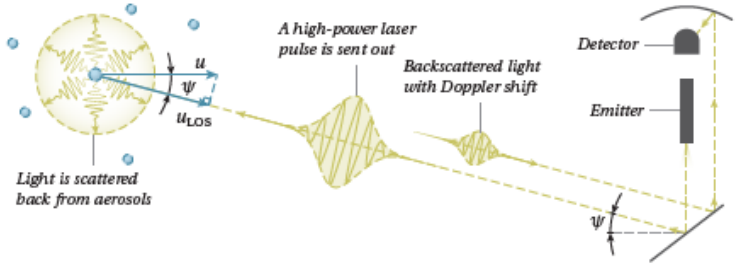

Figure 4.19: Working principle of a pulsed lidar system.

Scope

This project is focused on implementing a LIDAR model in Vestas Turbine Simulator (VTS), which is an aeroelastic tool used for design load calculation of wind turbines.

The goal is to provide realistic simulations of LIDAR measurements to the turbine controller based on the wind field which the turbine is subjected to in the simulation. See the referenced Ph.D. thesis for a theoretical basis.

Initial feasibility studies are suggested to be performed without integration into the aeroelastic tool. They should show the realistic transformation of a simulated wind field into LIDAR measurements. Successful completion of the feasibility studies would lead to a proof of concept implementation in VTS.

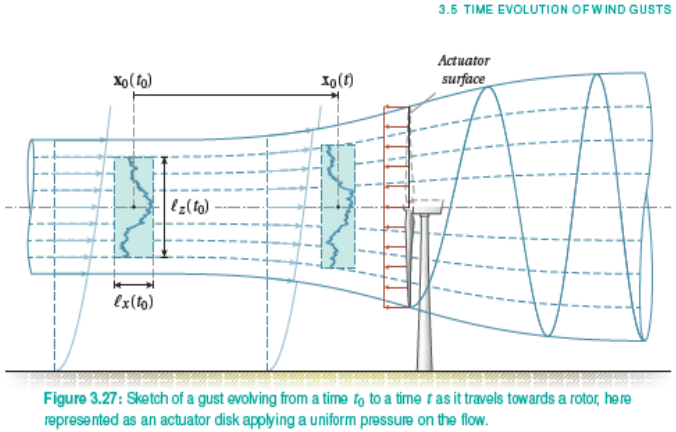

Figure 3.27: Sketch of a gust evolving from a time t_0 to a time t as it travels towards a rotor, here represented as an actuator disk applying a uniform pressure on the flow.

Images: Bos. R (2017), Extreme gusts and their role in wind turbine design

Keywords

Wind turbines, LIDAR, Aeroelastic Simulation, Wind Field Modelling