Uncertainties identification of the blade-mounted lidar-based inflow wind speed measurements for robust feedback-feedforward control synthesis

Róbert Ungurán, Vlaho Petrović, Lucy Y. Pao, Martin Kühn

We thank the referee for the attention and enormous energy to read our work and write a detailed review which has helped us to improve the content of the paper. This document includes our response to reviewer comments. Furthermore, an additional document is attached, highlighting the changes that have been made.

Q 1: *On page 5, line 5 it is stated that "the rotational effect of the blade was not accounted for ..." I am just wondering if you can add a brief explanation as to why it isn't accounted for. Also, what about yaw of the wind turbine? I assume this was all done without considering what would happen if the turbine yaws to a new wind direction. This is probably something that can be ignored, but it was something that got me thinking as an interesting problem to try to tackle although outside the scope of this paper.*

Reply: This is a very interesting question. Yawing the wind turbine would be seen in the blade segment velocities, so in the wind speed correction, it is accounted for. However, we assumed that we have an instantaneous single point measurement, because its effect is considered neglegible, e.g. ZephIR lidar can have a sampling rate up to 400 Hz, so the accumulation time is smaller than 2.5 milliseconds.

Q 2: *On page 8, line 5 it says in this sentence that blade root flapwise and edgewise mo- ments are widely available wind turbine sensors, however in my experience these sensors are found on most research turbines, but not on utility wind turbines in the industry.*

Reply: To our best knowledge, some wind turbine manufacture includes such a sensor in the series production, while others offer them on demand. We replaced the wording in this sentence as follows:

To account for this effect in the lidar-based inflow wind speed measurement, we construct a second-order polynomial function (f), whose inputs are chosen as rotor speed (ω_r), blade pitch angle (β_i), and blade root flapwise and edgewise moments ($M_{fw,i}$, $M_{ew,i}$). Rotor speed and blade pitch angles are easily measured, and we assumed that the blade root flapwise and edgewise moment sensors are also available for implementing this method.