

Feedforward-Feedback wake redirection for wind farm control

The manuscript presents a combined feedforward-feedback wake redirection framework for wind farm control. They used FLORIS to calculate optimal yaw angles for a given wind farm layout and atmospheric condition. They estimated the wake center from lidar measurements 3D downwind of the wind turbines. They also used SOWFA to prove the concept of the work.

In general, the topic is relevant for the wind energy community and the analysis is interesting. However, there are also very significant flaws with the manuscript that both reduce its potential impact and preclude its suitability for publication in WES. Also, the manuscript needs a careful review of the English language. A global re-writing is recommended. There are several places where sentences are not understandable.

Major.

- 1) Please elaborate on time sensitivity (time resolution).
- 2) What kind of optimization applied in this study? Is it l-1 or l-2 optimization what is the feasible region for optimization manifolds. What are the constraints of this optimization problem?
- 3) Equation 6. What is the parameter that minimize the optimization problem?
- 4) The author applied the proposed control strategy on only one case study (speed 7.7 m/s and $T_i = 6\%$). To provide better statistics of performance, the authors need to run many simulations with different parameters.
- 5) Please provide more details about the simulation. Please comment on the spacing impact on the proposed approach.
- 6) It is not obvious what the authors implied by the surrogate model.
- 7) What do you mean by phase free filter? Please add some citations.
- 8) On page 7, the authors mentioned that “only rejects disturbances and uncertainties”, In the current case what the disturbances are?
- 9) Figure 4, Only one snapshot at $t=2198.5$ sec is shown, Please show the performance at a different time step.
- 10) Figure 4 needs axis titles.
- 11) Please add a range of small frequencies at which control can take action. Please connect them with the Bode diagram.
- 12) What is the cost function that is used to meet the design specification for a feedforward-feedback wake redirection control approach?
- 13) This is a mixed sensitivity control approach, Please elaborate on the impact of the time delay on the effective control bandwidth and the attainable lower-band for peaks of S and T.
- 14) Please identify the number of poles and zeros of the system.
- 15) What is the limit to push down the peak of S without causing other peaks to occur suddenly and unexpectedly?
- 16) How the current approach can attenuate the sensor noise for real cases to obtain low gain at high frequencies?

- 17) Assuming 10D downstream is neglected is little bit rough assumption. Please add a comparison between $N=2$ and $N=3$ for verification. You need to consider a large number of wake interactions.
- 18) Figure 10, the difference in total wind farm power output between FF and FF+FB approaches is only shown at small time window (2100-2800) sec. Before and after this period, the trend is approximately similar. Please discuss this point.

Minor:

There are a large number of grammatical errors and many sentences that are confusing and hard to understand. Please check the manuscript and fix.