Interactive comment on "A control-oriented dynamic wind farm model: WFSim" *by* Sjoerd Boersma et al.

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Dear Referee #1,

Thanks for reviewing our work and the comments/questions. Below I provide answers.

» The author's don't mention powerincreasing wind farm control. Is that deliberate, in that is model is being designed specifically for electrical grid service provision?

Answer:

The presented wind farm model can be used in/for controllers providing grid facilities, but also controllers providing power maximization. In fact, in both:

Vali, M., van Wingerden, J. W., Boersma, S., Petrovic, V., and Kühn, M.: A predic-

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tive control framework for optimal energy extraction of wind farms, Journal of Physics: Conference Series, 2016.

Vali, M., Petrovic, V., Boersma, S., van Wingerden, J. W., and Kühn, M.: Adjoint-based model predictive control of wind farms: Beyond the quasi steady-state power maximization, International Federation of Automatic Control, 2017.

the objective is to maximize the power production of the farm.

» Do I understand correctly that for the PALM and SOWFA comparisons, identical Ct time series are played through the turbine models, effectively open loop?

Answer:

The signals are not equivalent for the PALM and SOWFA case. The signals are constructed such that they contain power in multiple frequency regions ensuring that the wind farm will be excited in multiple regions. In this way, we can show that for a broad frequency range, the presented model can estimate LES data. But, the CT' series applied to PALM and WFSim are exactly equivalent. The CT' series applied to WFSim are not exactly equivalent as applied in SOWFA since the latter does not allow for such a control input. We used equation 24 to estimate CT' (this is applied in WFSim) from SOWFA data.

» Is there no online estimation being applied?

Answer:

There is no online estimation applied in this work.

» Is the assumption that if such estimation, made possible by the model structure, remove any remaining error?

Answer:

In the following work:

Doekemeijer, B. M., van Wingerden, J. W., Boersma, S., and Pao, L. Y.: Enhanced Kalman filtering for a 2D CFD NS wind farm flow model, 20 Wind turbine wake estimation and control using floridyn, a control-oriented dynamic wind plant model., 2016.

Doekemeijer, B. M., Boersma, S., van Wingerden, J. W., and Pao, L. Y.: Ensemble Kalman filtering for wind field estimation in wind farms, American Control Conference, 2017.

we illustrate that the model can be used for online estimation and we illustrate that the estimation of wind farm dynamics will improve using an estimator (Ensemble Kalman filter in this case).

However, I don't think that any remaining error can be removed using an estimator, but also think that this is not the objective. The question according to me is: can the wind farm model (including online estimator) sufficiently capture the wind farm dynamics such that it can be employed for controller design/application providing pre-specified performance? And we are trying to answer this question by using the presented wind farm model as a building block for the proposed closed-loop control framework (Figure.1 in the paper).

I hope that your questions are sufficiently answered. Follow up questions are more than welcome.

Best regards, Sjoerd Boersma