Wind Energ. Sci. Discuss.,
https://doi.org/10.5194/wes-2018-29-RC1, 2018

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Interactive comment on "Control-oriented Linear Dynamic Wind Farm Flow and Operation Model" *by* Jonas Kazda and Nicolaos Antonio Cutululis

Anonymous Referee #1

Received and published: 1 June 2018

This paper addresses an important topic in wind farm control: the need for an accurate and linear model of the turbine and flow dynamics inside a wind farm. However, there are a number of important short-comings in this work.

- The need for a wind farm model has not been motivated sufficiently in the introduction. Claims are made about the need for a dynamic wind farm model, while good results have been shown with steady-state wind farm models in the literature. Furthermore, there are publications in the literature that address the APC problem while neglecting the wake interactions between turbines, showing positive results. The literature overview given in the introduction is very sparse, and does not suffice for a journal publication. The scientific gap has not been presented convincingly.

- A linear model is claimed to be presented. However, actually, a nonlinear model is

presented which is linearized periodically, if the conditions change sufficiently. However, how often the model needs to be updated has not been investigated under the relevant conditions, such as changing wind directions, wind speeds, and turbine operational settings. Furthermore, the actual expressions of the model are not presented, which makes the general model formulation abstract and hard to follow.

- It is mentioned several times that the computational cost of this model is significantly lower than comparable models from the literature. However, the computational cost is never quantified inside this paper. Even more so, the upper limit on the computational cost that can be afforded has not been addressed, leaving the reader completely in the open about the computational costs involved.

- Many decisions are taken without proper argumentation, and the underlying assumptions are often ignored. For example, the choice of the wake superposition model, the sampling time of the model, the choice of model states and outputs, and the use of a Kalman filter, which uses a periodically linearized model. However, the choice for the (Extended) Kalman filter has not been discussed, nor have the underlying assumptions been presented. It is not clear whether the underlying assumptions of the KF are valid for the problem at hand. Furthermore, it is not discussed how the covariance matrices in the KF are chosen.

- The SimWindFarm simulation model has been used to "validate" the control-oriented model. However, the control-oriented model has been chosen such that the wake models are identical in the two models, introducing bias into the validation process. Furthermore, the validity of SimWindFarm is unclear, and it is uncertain why the authors did not choose to use a high-fidelity dataset from a validated LES model. Irrelevant of the results presented in this paper, it is uncertain whether the proposed algorithms work in a realistic scenario, since the fidelity of the simulation model is very limited. Furthermore, the results section is very difficult to understand, and it is unclear what the measurements are that are fed in to the Kalman filter Furthermore, several variables such as the power available have not been introduced mathematically. It is unclear how

to reproduce the results presented in this work.

- The paper is not very easy to read. Specifically, the results section is confusing, and several figures do not add information compared to the text. The reader should consider removing these figures, and replacing them with more informative graphics, such as flow field plots or tables with simulation settings. The graphics are often pixelated, and the captions and axes labels often have different fonts than the rest of the text. The symbol notation is confusing at parts, too.

See the attached pdf for more detailed comments. Due to the number and the severity of the remarks, I suggest this paper is declined.

Please also note the supplement to this comment:
https://www.wind-energ-sci-discuss.net/wes-2018-29/wes-2018-29-RC1-supplement.pdf

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