Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2021-144

Anonymous Referee #1

Referee comment on "Prognostics-based adaptive control strategy for lifetime control of wind turbines" by Edwin Kipchirchir et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-144-RC1, 2022

This manuscript describes a combination of control to mitigate the loads with the objective of managing the lifetime of the wind turbine.

The authors have presented the methods and applied and demonstrated that for a mean wind speed of 18 m/s. However, 18 m/s is not the wind speed that would cause the most fatigue damage and the occurrence probability is relatively low. Therefore the authors should add/replace results from mean wind speeds that are more representative to demonstrate the capability of the controllers. It would be necessary to show the behavior of the wind turbine under rated wind speed. Here it can be seen how the controllers will perform in this transition region when the wind speed can be below rated and above rated. This can be used also to demonstrate and validate the switching behavior that the authors mentioned in the manuscript.

The switching behavior and implmentation in the controllers as mentioned in the manuscript should be described with more details. Another question that needs to be clarified is whether the constant switching of the controller will cause additional dynamics to the response of the wind turbine. Especially when the wind turbine is operating in the transition region.

The performance of the controller for the given turbine shown in Figure 8 of the manuscript seems to indicate that the rotor speed can deviate as much as 20% from the rated rotor speed (20 rpm) and the power can deviate more than 30% from the rated power (1500 kw). This is usually not possible as the overspeed protection will kick in as soon as the rotor speed is more than 110% of the rated rotor speed. The same would be applicable to the power, since the generator protection wlll kick in to protect the overheating of the generator. Therefore, the controller should be retuned to meet the standard performance requirements regarding overspeed and power deviation.

In Table 2 and in the text, the authors use the steady wind speed and prevailing wind speed in order to decide the switching of the controller that were tuned for different wind speeds. How are these wind speeds defined and how are they calculated in a continuous operation of the wind turbine, especially if one takes into account that the stationarity assumption of the wind does not really apply in reality.

The authors have considered the flapwise bending moment for the blade, while the edgewise bending moment play also an important role in the fatigue damage of the blade. One should consider the total bending moment of the blade for the estimation of the fatigue damage. The same should apply also to the tower fore-aft and side to side bending moment.

The wind field used for the validation of the method is not described sufficiently. It is not clear whether the stochastic wind field is coherent over the rotor plane and the quetstion remains whether one single realization of the stochastic wind field is representative enough to demonstrate the robustness of the controller.

Some additional remarks can be found on the attached pdf.

Please also note the supplement to this comment:
https://wes.copernicus.org/preprints/wes-2021-144/wes-2021-144-RC1-supplement.pdf