wes-2021-144- Responses to Referee Comments and changes in revised manuscript

	Reviewers' comments	Reply to the editor	Changes in the revised manuscript (marked-up)
1 Reviewer 2	a) The revision has considered some of the comments by the reviewer. Regarding the overspeed as shown in Figure 10a, where speed excursion of more than 10% of the rated rotational speed can be observed. The authors responded that the HSS brake will be deployed to prevent overspeed. In fact, the HSS brake is not able to prevent overspeed or will be deployed in such case. The HSS brake is only used to bring the wind turbine to a complete stop once the aerodynamic brake (blade pitch) has reduced the torque to a such extent that the remaining torque can be handled by HSS brake	We agree that the HSS brake is only useful for bringing the wind turbine to a complete stop after engaging the aerodynamic brake has reduced the torque to a manageable level. Unfortunately, this did not come out clearly in our previous response.	N/A

	b) The speed controller should limit the rotor speed to prevent overspeed event. When an overspeed event occurs, the emergency brake using the rotor pitch system is triggered, causing large transient loads. Therefore, a robust controller should be able to limit the rotor speed without triggering frequently emergency stops.	We realized that binary hub-height wind profiles instead of full-field stochastic wind fields were erroneously used in the original simulations. This resulted in the rotor overspeed and high power fluctuation. In the revised manuscript, results obtained using more realistic full-field stochastic wind profiles are presented. Neither overspeed nor high power fluctuation events are noted. Hence the proposed controller is shown to be robust.	Speed/power regulation performance: L290-295 (Figure 9) L307-310 (Figure 12)
	c) For wind turbine control, robustness is much important than better performance, in load reduction for example. In this case, a more reasonable comparison would be to compute and include the fatigue damages that are caused by emergency stops if the speed controller is not able to prevent overspeed.	We agree that robustness to changing wind conditions is more important than improved load mitigation performance. In the revised manuscript, we have shown that the proposed controller improves load mitigation without trading off robustness in speed/power regulation. Therefore, evaluation of fatigue damages caused by emergency stops due to overspeed events is not necessary.	N/A
2	The conclusion regarding the load reduction and effectiveness of the of the aIPC controller and RDAC	We agree that only two wind fields were not sufficient to conclude on the effectiveness of the proposed control scheme.	Additional wind fields: L275-278, (Figure 7)

	is based on one single wind field of 18 m/s and 14m/s. Since the wind fields are stochastic, 6 seeds should be used to understand the impact of the variability of the wind field on the response of the turbine, i.e., power fluctuation, speed regulation, blade loads, and tower loads as well as pitch activity.	Six seeds were used to evaluate its performance. The additional results are included in the revised manuscript.	L297-300, (Figure 10)
	The additional seeds of wind field would also show if the overspeed events are likely to occurs for different wind fields	No notable overspeed events can be seen from the simulation results generated using the new wind fields	Figures 9 and 12
1 Reviewer 3	The results are still reported for a single load realization at one wind speed, and then supplemented by a second realization at a slightly lower wind speed. This is insufficient to evaluate the potential benefits of the suggested procedure and to demonstrate its robustness. I would	We agree that only two wind fields were not sufficient to conclude on the effectiveness of the proposed control scheme. As suggested, six seeds were used to evaluate its performance. The additional results and corresponding discussions are included in the revised manuscript.	Additional wind fields: L275-278, (Figure 7) L297-300, (Figure 10) New results: Figures 7-12 (referenced discussion)

	rather carry out multiple evaluations with at least 6 turbulence realizations at wind speeds from rated to cut-out at 1-2 m/s bins. Then the aggregated effect of applying a certain strategy on the accumulated fatigue damage, probability-weighted over the different wind speed bins could be shown.		
2	I do not agree with the statement that 18m/s is very important for blade loads. For a typical site, the wind speeds above rated occur only about 15% of the time. Also, due to the reduction of the rotor thrust above rated wind speed, blade flapwise loads are also getting smaller (or at least not increasing) for wind speeds above rated. So for example if you choose to reduce the total accumulated fatigue damage for the region above 14m/s by 50%, the total effect on the turbine	We agree that wind turbines spend a small fraction of their lifetime in region 3. It is for this reason that a near-rated stochastic wind field of 14m/s was included. Although in practice these two wind fields are not representative of average conditions in a most wind farms, the proposed control concept is demonstrated to region three operation but can be extended in future work to below-rated operation. IPC control inherently curtails rotor thrust hence reducing blade loads in above-rated operation. However, the claim of this work is on proactive trade-off between load mitigation and speed regulation based on state-of-health (lifetime estimate), and not only on overall load reduction in the blades. In the revised manuscript, overall fatigue loads (DELs) for various load channels under varied wind fields are additionally evaluated.	DEL Analysis: L284-289 (Figure 8c) L304-306 (Figure 11c)

	lifetime will likely be less than 10%. In order to find the total range of impact on lifetime-equivalent loads that the control strategy is capable of, one would need to establish the relationship between wind speed and fatigue loads for the entire wind speed range.		
3	Does the proposed control strategy increase the duty cycles on other components (e.g. pitch hydraulics or bearings)? The effect on pitch duty cycles should be reported.	Pitch actuator usage is evaluated using total blade pitch travel obtained from simulations. There is generally a marginal increase of < 1%. Although, no direct evaluation of pitch components is carried out, it can be inferred from the actuator usage that the proposed control scheme has a marginal effect on the duty cycle these components.	Pitch usage: L295-296 (Figure 9c) L310-312 (Figure 12c)
4	The authors say that the new control strategy reduces the standard deviation of the power output. However, any changes in the mean power output should also be reported.	The mean power outputs have been reported in the revised manuscript.	L294-295, L309-310
5	The authors have shown estimations of fatigue damage accumulation,	Damage equivalent loads evaluation is carried out using the open-source post-processing software (MLife) developed by NREL, in which the fatigue load cycles are calculated over	MLife: L286

	which is a more relevant metric than the standard deviations reported earlier. However, it is not described sufficiently how the fatigue damage is calculated (S-N curve slopes are missing). Also, calling a 10-minute period as a "lifetime" is misleading, I would simply call it "short-term damage".	wide spectrum of stress ratios based on a recursive RFC algorithm. The software documentation is duly cited in the manuscript. It is true that a 10-minute simulation doesn't qualify as a lifetime. It is only treated as such in this work for illustrative purposes in a simulated scenario. This is made clear in the manuscript.	Lifetime: L242-243
6	I still do not agree with having "prognostics" in the title of the paper. This is active closed-loop control and not damage prognostics.	In our opinion we believe that a lifetime estimate (calculated from the accumulated damage, based on Equation 10) which is used as a measure to implement active control to achieve the desired damage, qualifies this work as prognosis. However, we will be willing to adopt a more suitable title as guided	N/A