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Title: “Field test of an active flap system on a full scale wind turbine”
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General comments:

An innovative Active Flap control System (AFS) is evaluated on field tests of a multi-MW wind turbine in an open-loop configuration. The tests were performed during long cycles (30 min) and for several months. The given objective of the authors is to control loads. The authority is evaluated during this period from root flapwise moments using strain -gauges installed at the blade root. A blade to blade method is used, consisting on comparing the loads between blades with only one equipped with the AFS. Results demonstrate the control efficiency with a global root load gain from 5% to 10%. Also, from control step functions and a specific post-processing method, the control dynamics is evaluated. It can be approximated to a first order system with a time response of the order of few seconds. Finally, aero-elastic simulations were performed and were able to reproduced the load gain of the Active Flap control System.

As pointed out by the authors, academic and industrial contributions on active flow control on full scale wind turbines are scarce. In that sense, this work is remarkable.

However, important descriptions are missing and should be tackled before the publication of this paper. They are listed below:

Point 1- The control objective is not clear as the time response of the control system do not allow a load control in closed-loop.
Point 2- Details on the inflow characterization are missing to evaluate the representation of the samples used relatively to the atmosphere conditions on the given terrain.
Point 3- Details on the actuator set-up are also missing. We don’t know how the system is working.
Point 4- Some descriptions on the evaluation of the actuation impact are not clear

Point 1: Control objective ?

The blade to blade analysis method is very interesting and certainly the best method to easily evaluate the authority of a new control system. However, the needed control authority dependents on the objective of the control. Such authority is certainly not necessary for alleviating loads, while this is certainly unavoidable to control the output power of the turbine (similarly as the pitch control). Also, for alleviating loads fluctuations, due to the blade passages in front of the wind turbine mast for instance (the famous tower shadow effect), the control system must be faster than the 3p frequency which can be as fast as to 0.5s. From the transient analysis of the present study, the system developed is too slow to alleviate the load fluctuation from tower shadow effect for instance.

Question 1: It is therefore important to have a literature review on the different control objectives in the field of wind energy (power control , load and fatigue …) and the associated time scales (from large atmospheric boundary layer scales to small shear layer vortices or 3P ...). Authors should specify the objective study within this literature review. Also, in this review, it is certainly worth mentioning the only AFC using fluidic actuator (plasma actuator) work on a multi-MW

turbine (Matsuda et al 2017), able to perform a very fast actuation (10kHz).

H. Matsuda, M. Tanaka2, T. Osako2, K. Yamazaki1, N. Shimura, M. Asayama and Y. Oryu “Plasma actuation effect on a MW class wind turbine” International Journal of Gas Turbine, Propulsion and Power Systems, Feburary 2017, Volume 9, Number 1

Point 2: Details on the inflow characterization:

In order to evaluate if the samples used include sufficient atmosphere conditions, on must know the atmosphere conditions of the terrain and the terrain topology. More details are therefore needed for this:

Question 2:
p3L75: instead of giving the wind speed and turbulent intensity range(2m/s → 15 m/s Ti = 3% → 30%), please give the wind roses for the the wind speed and the Turbulent intensity used in the study.

Question 3:
P3L73: “ the cycles were performed during several month ...”
Please be more specific, how many month, which month ?

Question 4: what is the type of Sensor and their acquisition frequency ?
Can you evaluate the atmosphere stability with these sensors for instance ?

Question 5:
Where are the 10 heights measurements (including the topology of the terrain) ?

Point 3: Details on the actuator set-up

The description of the actuator system is never explicitly given. We don’t know actually how the actuator is working unless we go the the publication from Gonzales et al (2028).

A Gomez Gonzalez, P B Enevoldsen, B Akay, T K Barlas, A Fischer, H Aa Madsen Experimental and numerical validation of active flap for wind turbine blades. Journal of Physics: Conf. Series 1037 (2018) 1234567890 ‘’“” 022039

This is particularly annoying to evaluate if the targeted objective (load control) is reachable. The needed time response of the system for load control (due to shadow effect) seems to be not reachable from the present system. Delays come from the whole control system arrangement itself, one order of magnitude slower. Indeed, this can’t be the time response of aerodynamic loads which is faster, of the order of 0.2s (for 1.25m blade chord and a relative velocity of 60m/s). Moreover, this delay does not include the whole system:
P10L172: “The pressure response measurement of the transient analysis must be used with care due to the physical distance between the location of the actual measurement, and the location of the AFS. The pressure is measured directly at the exit supply valve.”

Question 6: A more detail description of the actuation system with the tubing arrangement (including the valve type, dynamic characteristics) should be included to at least evaluate what objective can be reached by this control system.

Question 7: It seems that the control system is mostly interesting for power control. In that case, it

is important to evaluate the net benefit.
Can you provide more details on at least the power supply needed to compress the air ?
At maximum the impact of the additional weight and the impact on the rotor imbalance should be provided.

Point 4: Evaluation of the actuator impact:

p6L95: “A standard method for this consist on the calibration of strain measurements in the root area of the blade, where strain gauges are placed on the intersection points between the contour of the blade and the principal axes of the section. With independent strain measurements of two different blades (and the corresponding transfer function to obtain bending moments), the integral load impact of an active device on a blade can be readily measured.”

Question 8: The location of the strain gauges are not clear: which section is used ? Principal axis are not given. What transfer function are you using ? Are the bending moments known from another source ? What is the calibration procedure used in the present study ?

Question 9: Also, the calibration of strain gauges on operating wind turbines is generally a long/heavy/costly and not accurate procedure. Is the evaluation of the bending moment necessary in the present blade to blade analysis ? Can’t we use the strain gauge measure directly ?

P6L104: “Furthermore, the uncertainty related to point-wise wind speed measurements is removed.”

Yes, but this is valid only if the statistical converge is reached. Regarding the atmosphere changes, there is diurnal changes, seasonal changes, dependence on the terrain etc …

Question 10: You should moderate this sentence, the uncertainty related to point-wise wind speed measurements is only smoothed and valid for a limited range in the atmosphere/terrain conditions (which are not given in the paper).

Question 11: There is certainly limitations that are linked to the statistical convergence of data, which is certainly dependent on the coherence of the turbulent wind field contrary to what is said in the text. In other terms, why 30 min and not 1hour, 2hours, 1 day … for your statistics ?
Have you looked on how the statistics converge towards the final value ?

Minor correction:
p13 237: Skjoldan, P.F. while Fisker in p11L181