

Wind Farm Analytics Newsletter - Spring 2023

Floating Offshore (Axial Flow) Turbines are Floating "Onshore" (Axial Flow) Turbines

Wind Farm Analytics' pitch control adjustment for increasing the power output of turbines in hilly terrain can be directly applied to floating turbines. Floating turbines may tilt backward due to thrust forces from the wind. The tilt angle may also oscillate due to wave and wind variability. Tilt angles can be 5° or even more, depending on conditions and design. But the floating turbines may have a rotor plane tilt angle with respect to the tower of a further 5° (a design feature to reduce risk of blades flexing so much they hit the tower) resulting in an overall angular misalignment of 10° or more. This is directly analogous to a wind turbine operating on a hillside of 5° slope. This will cause losses of around 4.5% on the rise of the power curve which is worth millions of pounds per turbine for large turbines. Wind Farm Analytics has patented solutions to eliminate these losses via active blade pitch adjustment. If you work with wind turbines in hilly terrain, or with floating turbines, then please get in touch to discuss further.

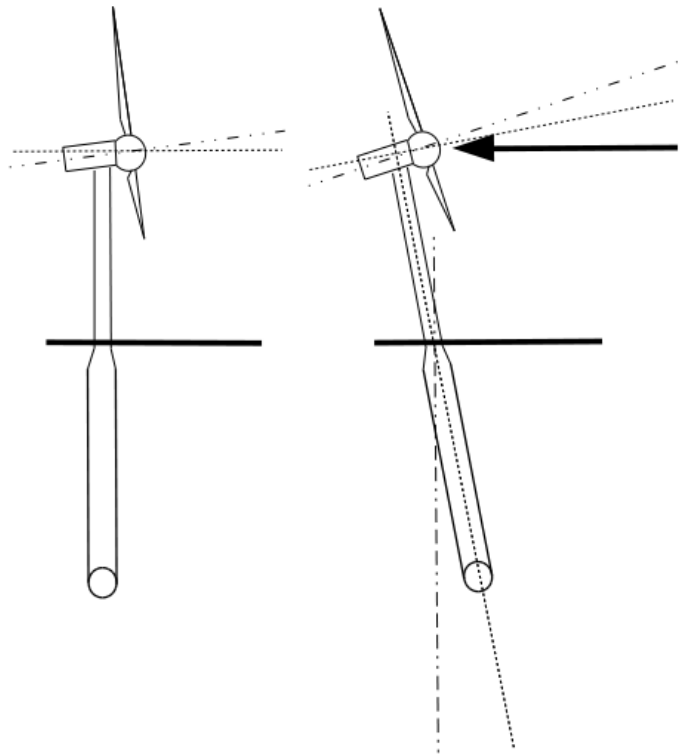


Figure 1: Thrust force of wind causes floating turbine rotor axis to be further significantly misaligned with wind flow

Latest Developments at WFA

- 10-11 May 2023 All-Energy conference - Dr Theodore Holtom of Wind Farm Analytics will speak on "*New pitch control method for aerodynamic improvement in case of flow misalignment*" (14:30 on Thursday 11th May at the Marine Energy & Floating Offshore Wind Show Floor Theatre, Main Exhibition Hall). Get in touch if you'd like to meet, or you might find us at the All-Energy Research Hub exhibition pod of our academic collaborator Dr Anthony Brooms of Birkbeck, University of London. Look out for our poster at the Academic Poster Site in the Main Exhibition Hall. Poster and Presentation Slides will appear on our website news page after the event.
- 10 Mar 2023 Wind Farm Analytics has made a [Presentation on Improving Wind Harvest](#) to the CEPEC investor Conference in the City of London, emphasising additional controller opportunities to complement converging beam LIDAR.
- 11 Oct 2022 Brazilian National Institute of Industrial Property (INPI) awarded Wind Farm Analytics [our first Brazilian patent](#), our thirteenth patent grant globally,
- 4 Sep 2022 Wind Farm Analytics Ltd has fed into a Scottish government request for ideas on Energy Strategy and a Just Transition, suggesting "[Pumped hydro energy storage to eliminate fuel poverty](#)" - if you agree with us on this important topic then please get in touch about any possibility to work together on pumped hydro projects - WFA has experience studying optimisation of physical and financial parameters for pumped hydro energy storage, whether stand-alone or combined with wind energy.

Overwhelmingly Positive Industry Engagement, New Wind Industry Opportunities

In the last year Wind Farm Analytics has been engaging with colleagues across the wind industry on the subject of pitch control solution for improving wind turbine output in the case where wind flow is not perfectly parallel to the wind turbine rotor axis. Please see below some overwhelmingly positive feedback (anonymised) confirming both technical and commercial opportunities for new business and increasing wind energy productivity:

- 1) Director, Medium UK Wind Farm Owner/Developer: "[WFA is] speaking common sense, wind farm owners would be ready to do profit sharing deals with wind turbine manufacturers";
- 2) Development Engineer, Medium/Large UK Wind Owner/Developer: "very interested to quantify added value of this option at project development stage";
- 3) Operations Manager, Medium UK/USA Wind Owner/Developer: "idea makes sense, especially interested if turbine manufacturers offer this upgrade";
- 4) World Leading Control Specialist, Wind Certification Provider: "[WFA is] quite right - pitch control can be used to compensate for change in aerodynamic angle of attack";
- 5) Senior Expert in Loads and Optimisation, Major EU Wind Turbine Manufacturer: "[WFA] idea is quite interesting";
- 6) Control Engineer, EU Control Specialist: "we like the idea, see potential, have successfully checked it with computer simulations and are now working on implementation at a multi-MW turbine";
- 7) Loads & Measurement Engineer, EU Wind Turbine Manufacturer: "Maths and physics is clear - we see the potential";
- 8) Loads & Certification Engineer, EU Wind Turbine Manufacturer: "Technically its a great idea - why wouldn't you harvest more energy? Even rotor tilt alone can be significant for large rotors in flat terrain";
- 9) CTO, EU/Chinese Wind Technology Co: "The [WFA] method can work and has potential for handling combinations of shear, yaw, upflow, etc";
- 10) Aerodynamic Engineer, EU Blade Specialist: "totally convinced, it totally makes sense";
- 11) Wind Turbine Lead Expert, UK/International Wind Owner/Operator: "likes the idea, ready to work with [WFA] if UK Operations wish to proceed";
- 12) UK Operations Manager, UK/International Wind Owner/Operator: "makes perfect sense, ready to work in partnership with [WFA] and Turbine Manufacturers - if OEMs offer this upgrade it is more straightforward and attractive";
- 13) Head of Asset Management, UK Wind Owner/Asset Manager: "keen if upgrade is approved by turbine OEMs";
- 14) Senior Control Engineer, Chinese Wind Turbine Manufacturer: "interested subject to approval of Chinese colleagues";

15) CEO & Engineer, UK Blade Specialist: "I liked the idea so much I bought shares in WFA"

16) Senior Research Scientist, LIDAR manufacturer: "an interesting idea";

17) Head of Engineering, Major EU-based Wind Maintenance Provider, "[WFA] is right, flow inclination is not properly taken care of"

18) Lead Engineer, Major European Utility and Wind Farm Owner: "There is a compelling case aerodynamically";

The pitch control solutions can be applied without LIDAR but can be even better tuned with LIDAR so our pitch control work is perfectly aligned with direct measurement of three-dimensional wind velocity using converging beam LIDAR.

Apart from exciting opportunities for wind farms in hilly terrain, there is also value for large rotors accounting for rotor tilt both onshore and offshore, and for floating offshore turbines (see Fig 1 above) there is a huge opportunity in relation to tilting motion. Since *wind thrust causes tower tilt which is always present* (irrespective of horizontal wind direction) and increasing with wind speed then the situation can be even worse than the hilly onshore case where usually there are some horizontal wind directions where the flow inclination axial misalignment is reduced. There are automation opportunities in identifying lead candidates.

We now emphasise to investors that the LIDAR investment proposition is geared up via multiple pitch control opportunities. Industry colleagues and others who recognise the value of this are very welcome to get involved, either by company/personal investment (big or small), or by project collaboration - just get in touch by email theodore.holtom@wind-farm-analytics.co.uk or phone **+44 7720 767545**.

A Word on "The Science" and Green-Washing

WFA encourages scientific debate and free speech. We are against censorship and find it obvious that bad decision-making results from incomplete study of the evidence. Sadly corporate green-washing and attempts to close down debate on climate change is causing a lot of people to be mistrustful of governments, corporations and international organisations including the IPCC. WFA reckons that if the arguments for Net Zero are strong enough then they should be communicated to the public without unscientific claims that science is settled. There are always new pieces of evidence and understanding which result in the evolution of science. The wind industry now needs to deal with increasing hostility as a direct result of green-washing. WFA focuses on a simple argument why wind turbines are beneficial even if one does not fear anthropogenic carbon dioxide emissions. The simple reason is that wind energy is abundant and will never run out and is very cheap thanks to having *zero fuel cost!!*

Defeating Controlled Narrative - Decentralised Networking, Federation & the Fediverse

Wind Farm Analytics sympathises with mainstream narrative sceptics because censorship of opposing views in mainstream media is obvious, unjustified and dangerous to humanity. WFA does not comply with authoritarianism and we encourage industry colleagues to resist counter-productive censorship in favour of true advancement of science and humanity.

Our solution to centralised authoritarian control is to adopt decentralisation. For example instead of Twitter one may use Mastodon. Instead of Youtube one may use Peertube video sharing. Mastodon and Peertube are examples of decentralised information sharing with

"Federation". You can be a subscriber to one independent decentralised server but that server may be federated in a network with other decentralised servers so that when you post information on your server it becomes visible to others across that network or "Fediverse".

If you want to learn more a starting point could be to watch these short explainer videos:

What is Peertube? (1m53s) - <http://tube.spdns.org/w/kkGMgK9ZtnKfYAgNEtQxbv>

What is the Fediverse? (1m37s) - <http://tube.spdns.org/w/9dRfC6Ya11NCVeYKn8ZhiD>

What is Mastodon? (2m16s) - <http://tube.spdns.org/w/cwkbSrtr6CGBna2WeT6QVx>

Free Software and Wind Turbines - Right to Repair

Mastodon & Peertube are examples of free software (protecting your freedoms, as defined by the Free Software Foundation) without hidden algorithms manipulating users, or introducing security vulnerabilities. This is unlike proprietary software with hidden code exploiting users without true consent or understanding. WFA finds it illogical that corporations spend effort on risk reduction and yet willingly use proprietary code whose functionality is hidden. Isn't it negligent of corporations to use proprietary software for video conferencing which allows meetings to be recorded and spied upon by uninvited third parties?

Wouldn't it be better to use free software without hidden code, such as Jitsi instead of Zoom or MS Teams? WFA prefers Jitsi. Jitsi does not require any software installation although you can set up your own server which would require installation; if you just want to set up a web meeting room you can type your own room name such as DaddyCool by typing into your browser <https://meet.jit.si/DaddyCool> . If you don't already know it then why not try it out?

One legal and ethical argument for using free software is to do with the notion that the owner of an item should have the right to repair. This is a reason why software code should be openly available. Visibility of code also allows improvements to be made more readily. WFA has been thinking about this with regard to wind turbines. We frequently encounter wind turbine "owners" who don't have access to controller software or parameters. Isn't it time wind farm owners /managers asserted a legal right to repair their wind turbine assets?

In the UK right to repair laws were introduced for consumer electronics but this could be extended to wind turbines ensuring spares for 25 years. A right to repair wind turbines, including access to control software, can enable wind turbines to be maintained better for longer, avoiding waste, extending asset lifetimes and lowering further the cost of energy.



 **Join us on our journey**

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