Xi ENGINEERING CONSULTANTS

LASER VIBROMETRY

Point & Shoot Condition Monitoring

Long Range: >300m

Wide Band Width up to 25 kHz

Safe No Restrictions Class 2 Laser

Works on nearly every surface

Performing measurements on wind turbine can be challenging. Certain areas and elements such as the blades, and the tower wall where it cannot be reached from the ladder can require costly rope access work to reach, in addition to the lost revenue through down time during the measurements. Laser vibrometery provides a solution to measuring hard to reach surfaces. As measurements take place on the ground there may not be a need to even stop the wind turbine minimising lost revenue from unnecessary shutdowns. The measurement itself is fast, in some instances a tower survey can take place in a half a day, offering significant savings versus traditional measurement methods

LASER ADVANTAGE

Fast No lengthy and complex set-ups of sensors or ascent of the turbine required

Safe Measurements from ground level, no need to ascend tower or to be near live or moving plant

Cheaper Minimised turbine down time and no rope access required

Simple Lasers provide a simple method to measure parts that would otherwise be impossible to access and fit traditional sensors.

LASER VIBROMETRY

WORKING EXAMPLES FOR WIND TURBINES

BLADE MEASUREMENT

An unwanted and unexpected tonal emission from a wind turbine is proving problematic for acoustic assessments. There is concern that a forced frequency from the drive train is exciting a high order vibration in the blades. As a result it has been decided to perform a vibration assessment of the blades. Typically access to the blades requires complex operations with rope access technicians or operating within the confined spaces of the blade cavity - both requiring the turbine to be shutdown for the whole process. Leading to compounded costs from specialist personnel and lost revenue resulting from the turbine being turned off.

TOWER MEASUREMENT

It has been established that the surface of a wind turbine tower is the source of a tonal noise. A skin resonance of the tower is being excited and has the effect of "ringing the tower like a bell". A computer simulation has been developed to simulate this resonance. This will be used to target damping solutions on the areas of greatest skin mode activity. To ensure model accuracy, verification and calibration is required through measurement. Spot measurements of the tower have been suggested but as the tower is a hybrid construction the wide taper at the base makes access from the internal ladder difficult and the concrete substrate is challenging to affix sensors.

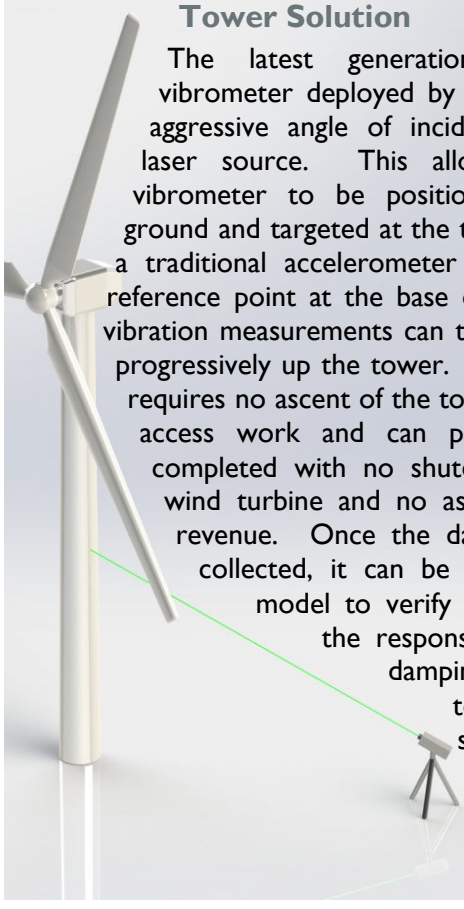
Blade Solution

With an operational range of up to 300m a laser vibrometer can be deployed on the ground below the turbine pointing upwards to target the blade. Assessment can therefore be carried out with no requirement to ascend the tower, removing the need for specialist rope access or working at height teams, minimising the turbine down time, and decreasing costs significantly.

The measurements themselves require the blade to be stationary, parked parallel to the ground. By exciting the blades by briefly pitching the blade or yawing the nacelle, the vibration response can be measured. This process is then repeated for different points along the blade building an overall picture of the dynamic behaviour.

Tower Solution

The latest generation of laser vibrometer deployed by Xi allows an aggressive angle of incidence to the laser source. This allows a laser vibrometer to be positioned on the ground and targeted at the tower. Using a traditional accelerometer to act as a reference point at the base of the tower vibration measurements can then be made progressively up the tower. This method requires no ascent of the tower, no rope access work and can potentially be completed with no shutdown of the wind turbine and no associated lost revenue. Once the data has been collected, it can be fed into the model to verify and calibrate the response allowing a damping solution to be specified that directly targets the tone.



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