Brüel & Kjær Vibro

Success Story

NACELLE MONITORING COMPLIMENTS DRIVETRAIN MONITORING

Nacelle monitoring in a wind turbine, using accelerometers mounted on the nacelle frame, is an essential part of a holistic condition monitoring approach for wind turbines.
Sensors on the drive train detect faults associated with the main bearing, gearbox and generator but not the blades, tower and yaw bearing system. Nacelle monitoring, however, is very effective for detecting these type of faults.

MACHINE/INDUSTRY/PROCESS

Machine	Wind turbine blades, yaw bearing system and drive train
Company/Process	Several wind turbine operators
Monitoring System	Brüel & Kjær Vibro Wind Turbine Monitoring System: MEMS accelerometer mounted on nacelle frame, triggered to the speed/phase reference system.
Monitoring Strategy	Detection: Main rotor speed, blade passing frequency and broadband measurements (DC-2000 Hz). Diagnosis: Time signal

OBSERVATION/DIAGNOSIS

The following faults have been detected and diagnosed using the nacelle monitoring strategy:

Blade misalignment – When there is a difference in pitch between the three blades, this changes the rotor aerodynamic loading and consequently results in running speed and blade passing frequency vibration in the downwind direction (see Figure 1).

Yaw bearing defect – If the springs supporting the yaw bearing assembly are loose or damaged, the downwind and lateral vibrations increase (see Figure 2).

Cross reference of drivetrain faults – If a drivetrain component fault, such as the intermediate shaft speed gear, develops to an advanced stage, this creates high amplitude impacts that propagate to the nacelle structure. The nacelle sensors detect these, giving an indication of the high severity of the fault.

BENEFITS

The nacelle sensors are well suited for detecting faults such as blade misalignment, pitch malfunction, ice accretion, damaged blade tips and yaw system defects. Blade faults, for example, can consequently stress the nacelle structure and drive train components. By detecting these faults early, corrective action can be taken to avoid premature consequential damage and catastrophic failures and also enables the operating efficiency of the wind turbine to be restored.

Figure 1. Vibration trend at rotor speed in the downwind direction under increasing pitch misalignment.

Figure 2. – Low frequency bandpass vibration trend in the downwind direction indicating loose springs in the yaw bearing assembly.

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