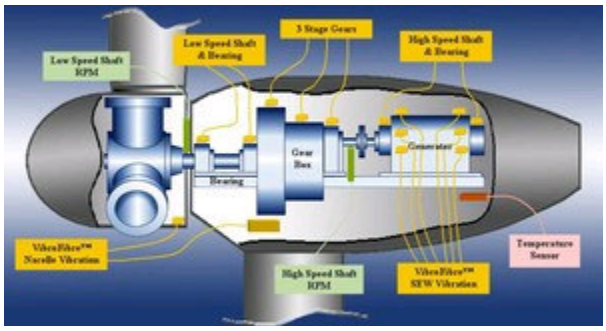
QPS Photronics – Monitorig solutions for Smart Wind Turbines



Earlier troubles found in wind turbines were associated with the gear box. Most people are ready to jump into conclusion that it was due to poor quality workmanship and maintenance. In real life, rapid wind speed and direction changes can cause severe stresses on gear teeth. Strong wind can change the centre of mass of the Nacelle; the force distribution as a result is totally unpredictable. It is equivalent to a fan running out of balance all the time.

It might be a mistake to consider the wind turbine a simple rotating machine: wind speed can change all the time, affecting the vibration signature; there could be just too many variations to be included in a library of diagnostics. How would you generate such a library in the first place? You might need a giant wind tunnel and subject the wind turbine to the various conditions.

Wind turbine design has advanced: yaw control and pitch control are mechanisms that might address these critical issues. However we fail to have a closed loop structure where the pitch and Yaw control can react in real time to such changes in wind speed and direction.

The problem of the wind turbines can be considered a combination of structural health monitoring and condition monitoring: there are many problems to be solved:

- The distortion of the rotating blades
- Long term damage due to mishandling during transport and integration
- Impact such as bird and bat strikes, lightning can weaken the blade's ability to resist strong wind
- Magnetic forces that cause vibrations that are enhanced by looseness inside the generator structure
- Looseness occurs as a result of daily temperature cycle, stronger seasonable temperature changes

We need a method to detect such looseness in situ; we need to develop a method to re-wedge the structure without removing the generator set from the top of the tower.

Off shore wind farms will deliver added challenges: corrosion of the tower and rusting of mounting bolts to its foundation can produce gradually occurring hazards like time bombs. The key to solving all these problems is to make the Wind Turbine smart.

Image a patient who is signalling all the time his own state of health, becomes aware that he needs help and provide diagnostic information so that maintenance technician can come with the right remedy and spare parts. The only way to make a smart wind turbine is to work out these details during its manufacturing. Such would be a triple win solution: wind turbine owners, manufacturing companies and service companies.