GE
Measurement & Control

Wind Turbine Health Indicators

Sideband Energy Ratio (SER)

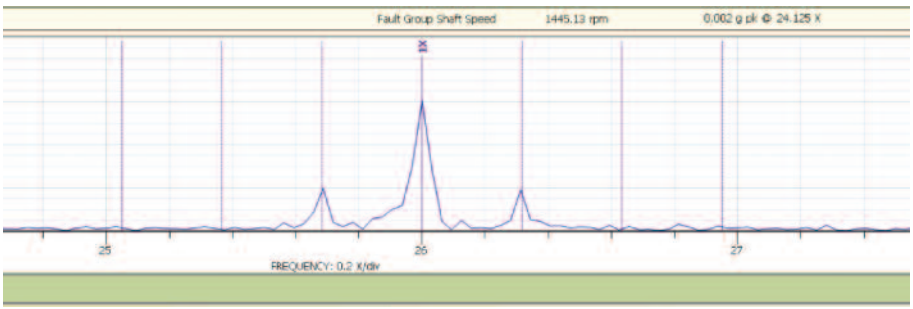
The Sideband Energy Ratio (SER) is a new, patented algorithm designed to detect gear mesh failures, such as a cracked tooth. This technique is so powerful that on a standard parallel gearmesh, it not only tells you there is a problem, but can pinpoint if it is on the gear or pinion. Likewise, on a planetary mesh, it will tell you if the problem is on the ring, sun, or planet gear.

The concept is simple in design. Under normal conditions, gearmesh frequencies and their harmonics exist in the vibration spectrum. They are expected. As faults develop, the changes in their amplitude are not always detectable. That is, the mesh frequency itself can be largely unaffected by the development of a fault.

However, there is a phenomenon that occurs as faults develop in a gearmesh. The vibration becomes modulated by the defect. For example, if a tooth is damaged on a pinion, then every time the damaged tooth engages the accompanying gear, a delta in amplitude is detected. This causes a 1X modulation of the mesh frequency at the pinion shaft speed. This modulation manifests in the frequency domain as 1X pinion shaft sidebands around the mesh frequency. Typically, the more damage that occurs, the more energy there is in the sidebands.

The concept of SER is to sum the energy of these sidebands and divide it by energy of the mesh frequency to create a ratio. Multiple harmonics of the sidebands, both above and below are summed. The figure below demonstrates a single SER measurement, where the sidebands (as indicated by the magenta vertical lines) are summed and divided by the 1X gearmesh (labeled as 1X).

There are up to nine SER measurements that are created for a gearmesh. For a parallel mesh, six measurements are created. For a planetary mesh, there are nine. For all meshes, an SER is created for the fundamental mesh frequency (1X), the first harmonic (2X), and the second harmonic (3X). For parallel meshes, an SER is created for those three mesh frequencies using both gear sidebands and pinion sidebands, resulting in six measurements. For planetary meshes, an SER is created for the three mesh frequencies using ring fault, sun fault, and planet fault sidebands, resulting in nine measurements.



Bently Nevada Asset Condition Monitoring
1631 Bently Parkway South
Minden, Nevada 89423 USA
+1 775.782.3611
energy.bnsales@ge.com
www.ge-mcs.com/wind

GEA19501A (11/2012)