Paper machine: Bearing failure

- High speed paper machine
- System Reporter 200 with software version 5

This case study demonstrates a bearing failure in the second of eight dryers in a modern high-speed paper machine.

The error is indicated in red in the System Reporter tree (Figure 1) and the problem can be addressed to the section 2nd dryer. The section overview Figure 2) points out that the accelerometer mounted on the front side (FS; opposite the drive side, DS, where the engine is connected) on roll LV115 triggered the alarm.

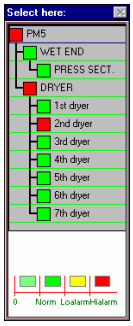


Figure 1. Tree.

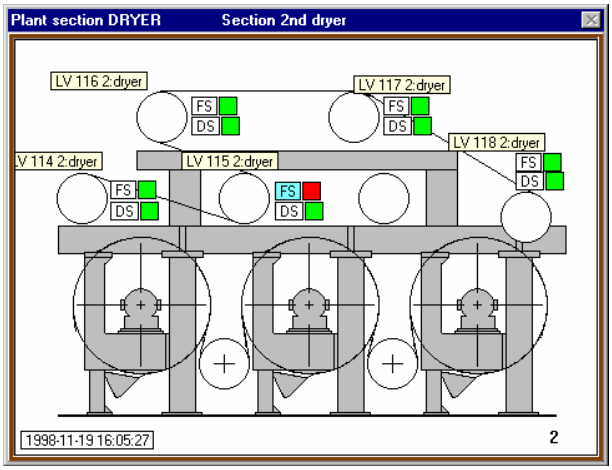


Figure 2. Dryer section.

A waterfall spectra displays an overview of frequency bands from hourly measurements clearly demonstrate that something is wrong (Figure 3).

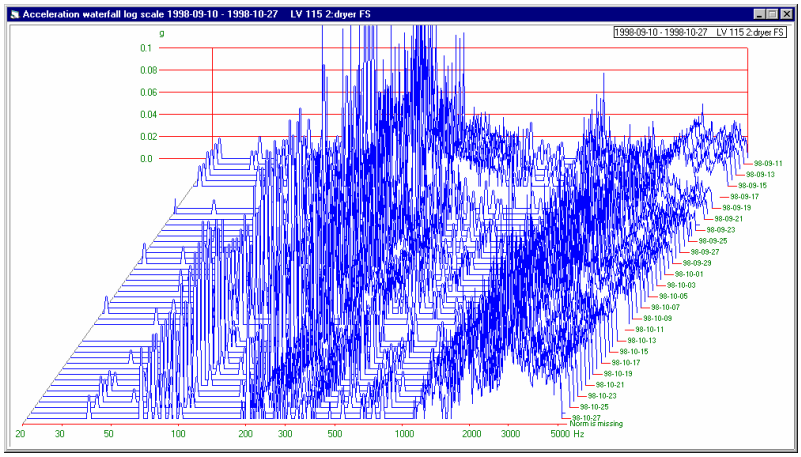


Figure 3. Waterfall spectrum.

Figure 4 shows the RMS trend for the frequency range 2 to 10 kHz. The trend ranges from September 18 to November 5, 1998. During this period of time the output signal from the accelerometer increases from 0.3 g to 0.8 g (the low levels at the end of the time period demonstrates the signal after the problem was solved). As the low alarm level was set to approximately 0.5 g (yellow line) and the high alarm level to 0.75 g (red line), the alarms were triggered in early and late October respectively.

By studying the single spectrum for the alarming roll it was possible to determine whether certain amplitudes in the spectrum was caused by frequencies or harmonics originating from a specific bearing or from another machine part. System Reporter can perform the frequency analysis needed to identify the source of the error both manually and automatically.

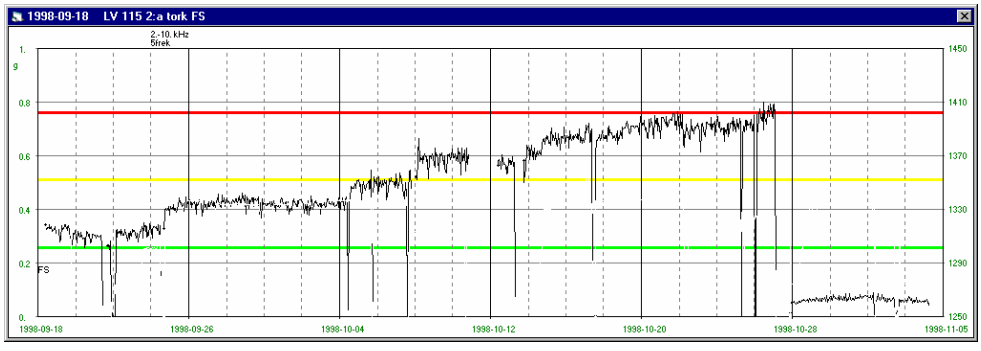


Figure 4. RMS trend for 2 – 10 kHz.

The results from the automatic frequency analysis are shown in Figure 5. System Reporter has identified that the error has frequencies similar to harmonics originating from BPFO (ball pass frequency, outer) errors, i.e. that the error originates from a defect outer ring in a bearing.

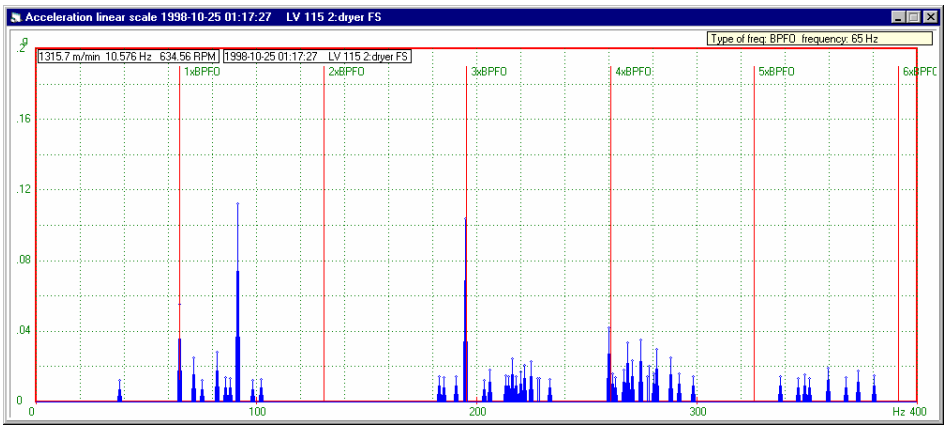


Figure 5. Single spectrum after automatic frequency analysis.

The analysis can also be performed manually. by using the toolbox (see Figure 6). In Figure 7, the harmonics for BPFO has been selected in the toolbox. At approximately 65 Hz, 195 Hz and 260 Hz, frequencies that coincide with the known harmonics of an error caused by a defect outer ring in a bearing are found.

Figure 6. The toolbox.

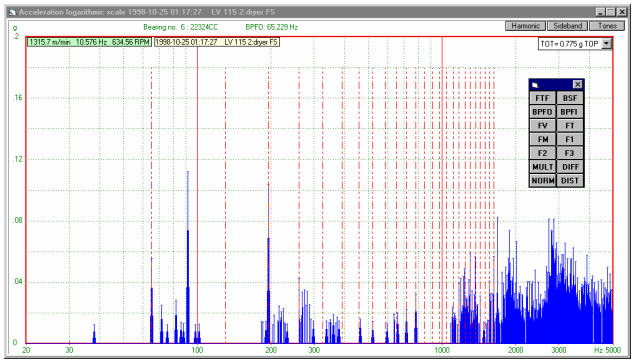
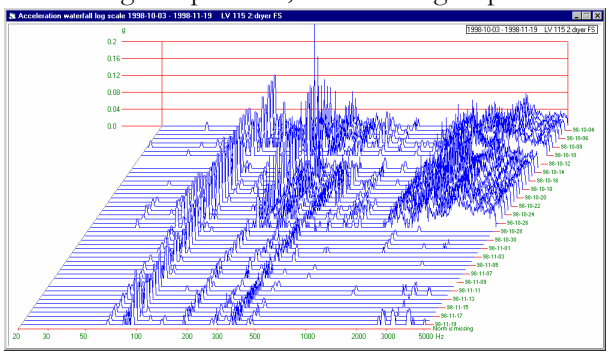


Figure 7. Single spectrum with BPFO harmonics.

The last picture (Figure 8) shows spectra from the unit after the problem as solved, i.e. the bearing was replaced by a new one. The waterfall spectrum shows the output signal (the accelerometer) before and after addressing the problem, and the single spectrum shows that the cluster of peaks above 1 kHz has disappeared.



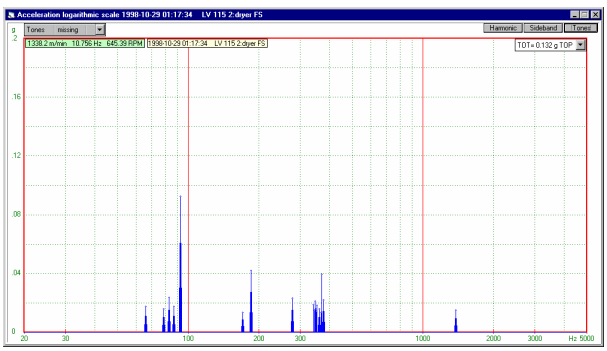


Figure 8. Waterfall spectra before and after replacing the bearing (left) and single spectrum after replacing the bearing (right).

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