Relation between tones and lines

- Description of the relation between tones and lines in a spectrum

Vibrations in e.g. revolving machinery are often measured using accelerometers, which delivers an output current which is proportional to the acceleration that the object to be measured is subjected to.

This document tries to briefly describe how the output signal from the accelerometer is converted into a spectrum where the amplitude in mm/s or g (1 g = 9.81 m/s^2) is plotted against the frequency in Hz.

The upper left graph in Figure 1 shows two tones, one with frequency 5 Hz and amplitude 8 mm/s and one with frequency 25 Hz and amplitude 4 mm/s., as they theoretically would appear is sampled individually from the transducer. The x-axis of the graph is the sampling time, which typically is measured in the range of milliseconds.

The lower left image in Figure 1 shows how these two tones would appear as output from the transducer when overlaid, i.e. appearing simultaneously and sampled with an accelerometer.

For real data the output becomes considerably more complex, as shown in Fig.1. In order to be able to interpret the data from an accelerometer, the data is processed using Fast Fourier Transform (FFT). The result is a spectrum where we still have the amplitude on the y-axis and with

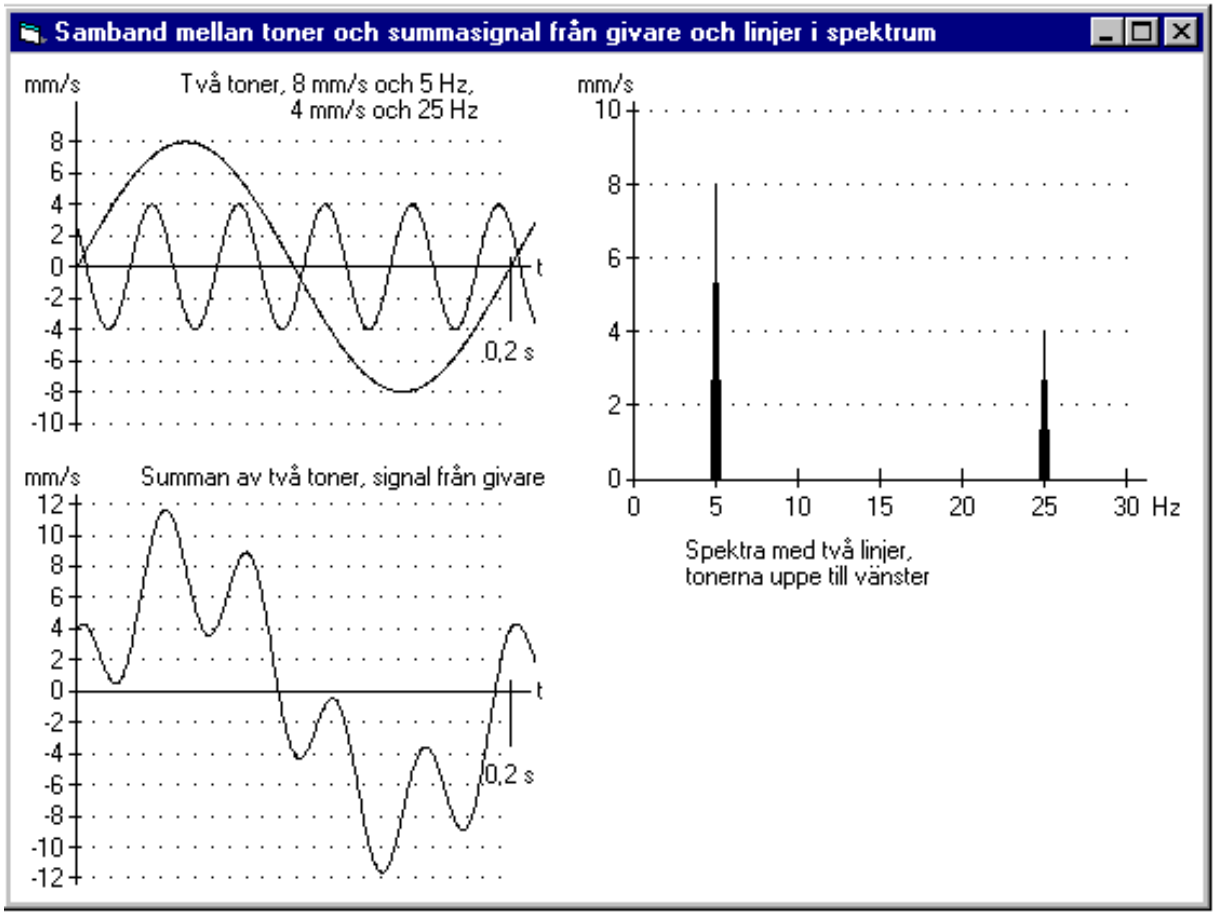

Figure 1. Relation between tones and the lines in a spectrum. The upper left graph shows two tones, one at 5 Hz with amplitude 8 mm/s and one at 25 Hz with amplitude 4 mm/s. The lower left graph shows the sum of these two tones. The right graph shows how these tones are displayed in a spectrum.

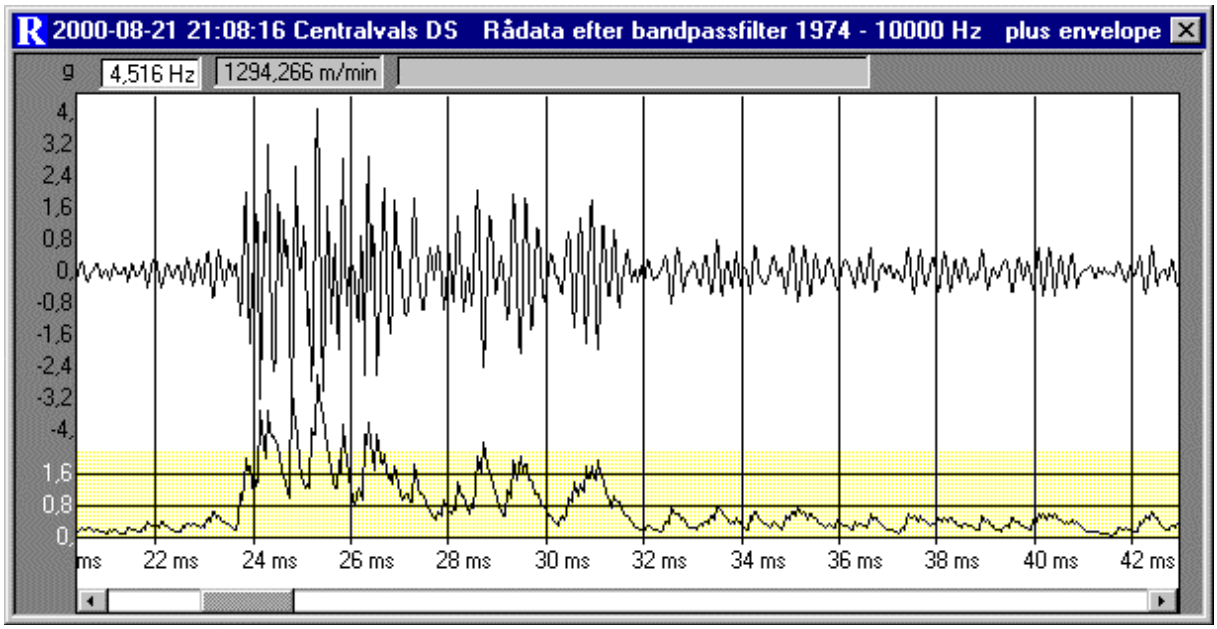

Figure 2. Unprocessed data (also called Time domain data) from an accelerometer taken from a field application.

the frequency in Hz on the x-axis. The FFT basically resolves the tones into a frequency spectrum that is more easy to interpret than the raw output from the accelerometer.

The upper left graph in Figure 1 show how a spectrum would look like after taking the data in the lower left graph through FFT. Note that the amplitudes in the spectrum corresponds to the amplitudes for the two curves in the upper left graph.

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