Order Tracking with SKF @ptitude Analyst

Background to order tracking

If you are going to collect vibration measurements on a variable speed machine that has no stable speed, you will probably end up with spectra that are not sufficient. If a normal FFT is taken during a speed variation, the peaks in the spectrum will smear out; they will either be smaller and wider or completely disappear (→ **fig. 2**). This is because the number of samples per time unit will always be the same independently of the speed. For example, it will be difficult to find peaks from bearing frequencies in the normal spectrum collected during a speed variation.

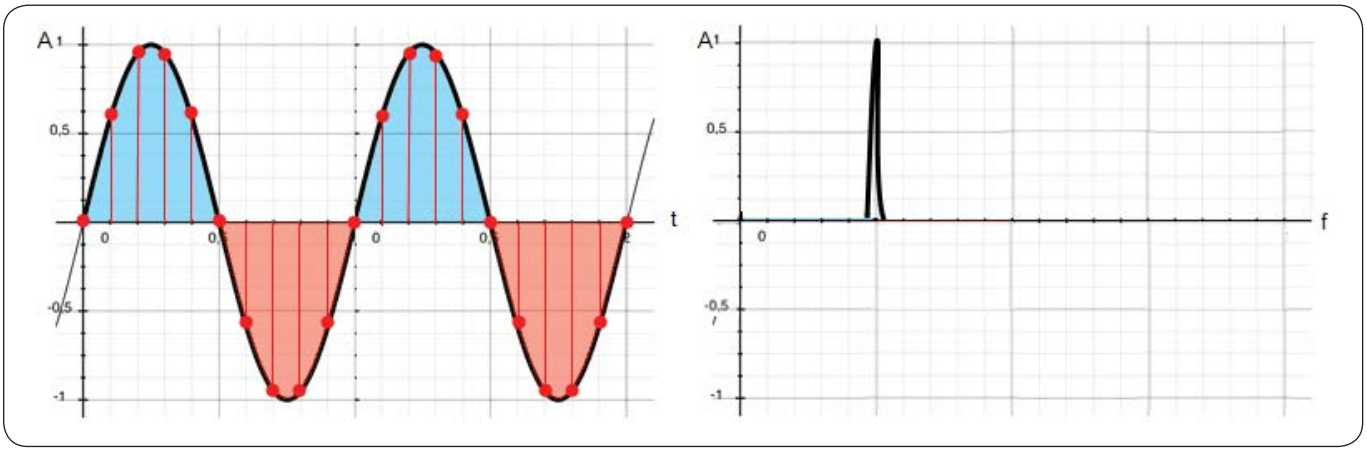


Fig. 1. Sampling and FFT during constant speed.

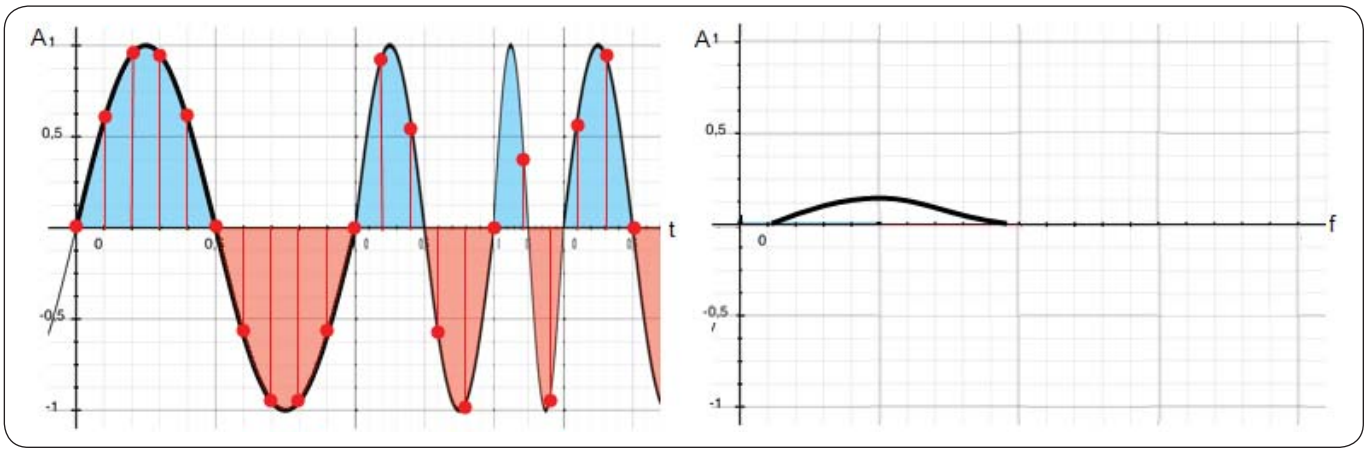


Fig. 2. Sampling and FFT during variable speed (consider that in real life, speed variation is gradual and it does not jump between revolutions).

When measuring vibrations on a variable speed machine, there is a need to constantly follow the speed and adjust the number of samples to the speed. This is done with order tracking in the SKF Multilog On-line System IMx and SKF @ptitude Analyst on-line systems.

The functions behind the order tracking in SKF Multilog IMx

To be able to perform a good FFT, there is a need to have the same number of samples for each revolution independently of the speed. The Order Tracking function in the SKF Multilog IMx uses the speed measured on each revolution to adjust the number of samples for that revolution afterwards. Finally, the FFT is calculated based on a time waveform that appears to be in stable speed (→ **fig. 3**); the FFT will not have problems to perform a good spectrum. In this case, the FFT is calculated during a specific number of revolutions and not during a specific time.

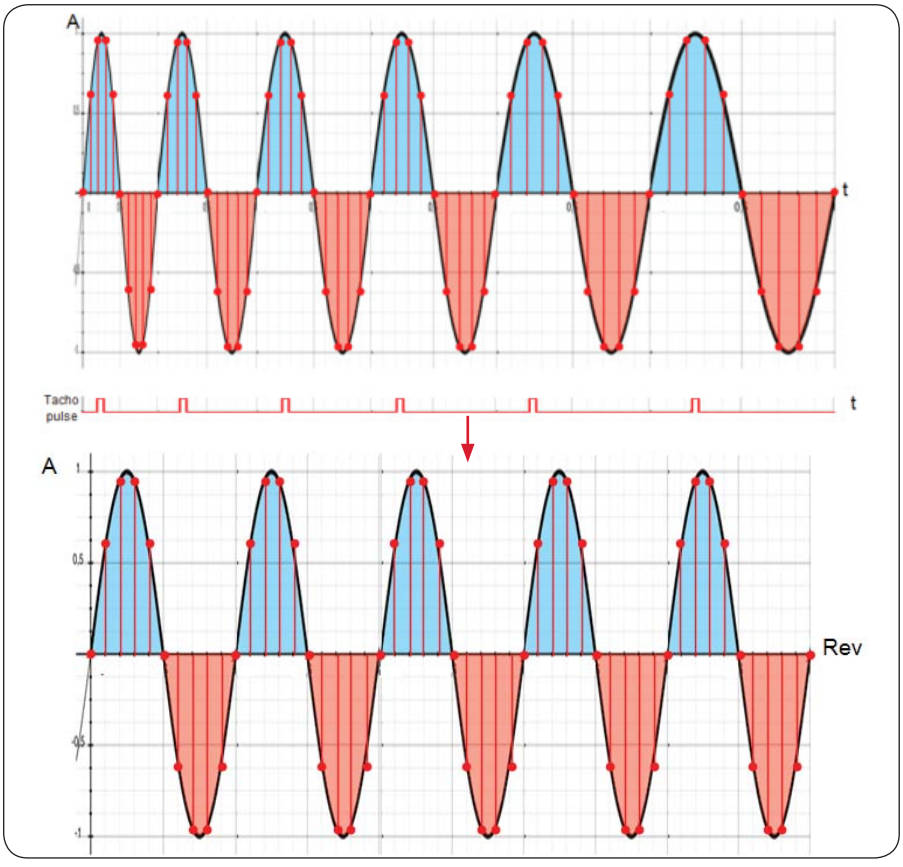


Fig. 3. Sample rate normalized for every revolution.

In order to get appropriate values with order tracking measurements, the speed variation should not be more than 100% when increasing the speed and 50% when decreasing the speed during the measurement (i.e., the number of revolutions in the setup). Refer to *Order tracking revolutions setup.xls* to get an estimate of the number of revolutions you will need in your setup according to your specific case.

Procedure

- Start SKF @ptitude Analyst and check that the SKF @ptitude IMx service is running.
- Create SKF Multilog IMx units, channels and hierarchy according to the manual.
- Right-click on a machine and choose **Insert Item** (→ **fig. 4**).
- Select "IMx" as the **DAD type** and "Vibration" as the **Application** (→ **fig. 5**).
- In the **Point Properties' Setup** tab (→ **fig. 6**):
  - Select the **Device** and the desired **Channel name**.
  - In **Freq type**, select "Order track".
  - The differences for an order tracking point compared with a standard vibration point are the FFT settings.
  - The most important settings for an order tracking point are **End order** and number of **Lines**, where **End order** is equivalent to Fmax in a standard point.
  - The maximum frequency will change according to the speed.
  - The **Low freq cutoff** is set in orders (X).

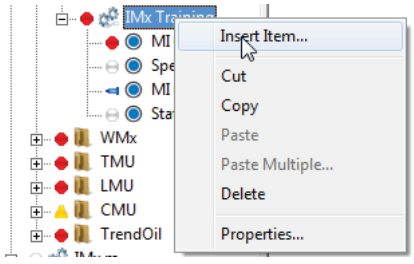


Fig. 4. Select Insert Item from a machine.

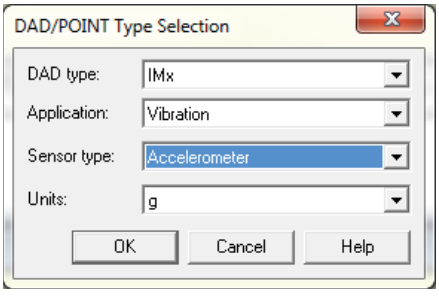


Fig. 5. Select the DAD type and application.

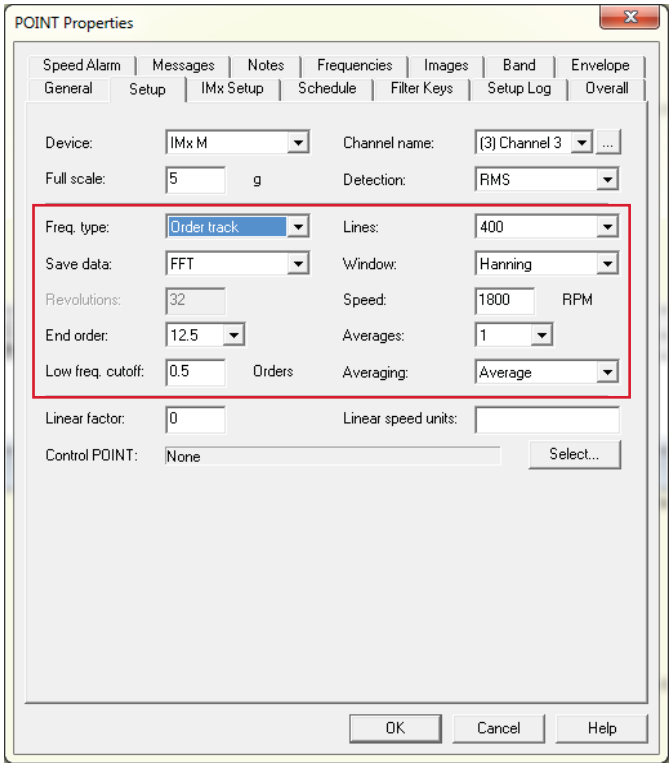
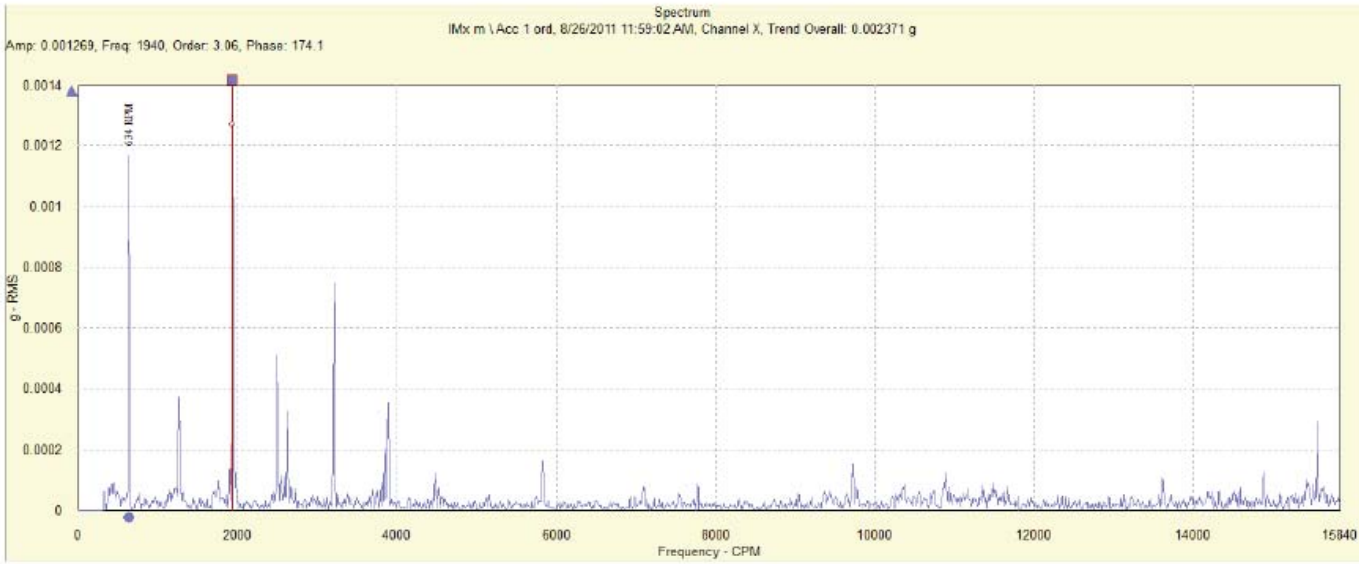


Fig. 6. Point Properties' Setup tab.

Order tracking in a real machine

Fig. 7a is a point with order tracking configuration and **fig. 7b** is without. Both spectra are taken at the same time during a speed variation from 200 to 1 200 r/min. The speed variation took nine seconds.



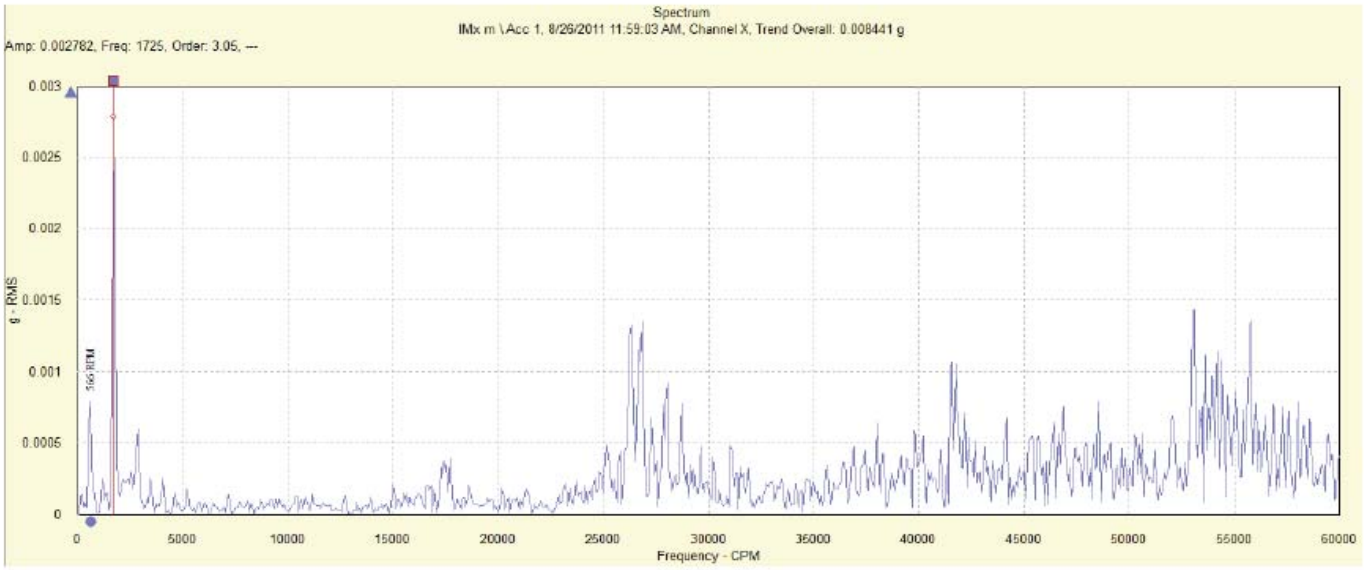


Fig. 7. a) FFT with order tracking (top graph) and b) FFT without order tracking (bottom graph).

Please contact:

SKF Condition Monitoring Center – Luleå
Aurorum 30 · SE-977 75 Luleå · Sweden
Tel: +46 (0)31 337 1000 · Fax: +46 (0)920 134 40

Web: www.skf.com

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