Gating in SKF @ptitude Observer

Introduction

In some applications, it is important to collect vibration data only at a specific operating condition of the machine. This way of collecting vibration measurements is called "Gating" and is used to control when to take the vibration measurements on variable speed machines like paper machines, rolling mills, shovels, haul trucks and draglines.

This technique makes sure that the data is collected as close as possible at a "fixed" running speed of the machine. **Fig. 1** shows the rotational speed profile of the cardan shaft for a mining haul truck. To decide when to take the measurement, it is important to know the speed profile of the machine. In **fig. 1**, the rotational speed varies from 100 to 1 100 rpm of the cardan shaft. The ideal situation to collect data is at a constant speed of the machine. In this case, the speed range for "gating" of the cardan shaft was set to 800 to 1 100 rpm.

If the load of the machine is also varying, it is strongly recommended to measure the motor load on the machine. A varying load on the machine can affect the vibration levels a lot; for example, the vibration level at the gear mesh frequency is strongly affected by the load on the machine.
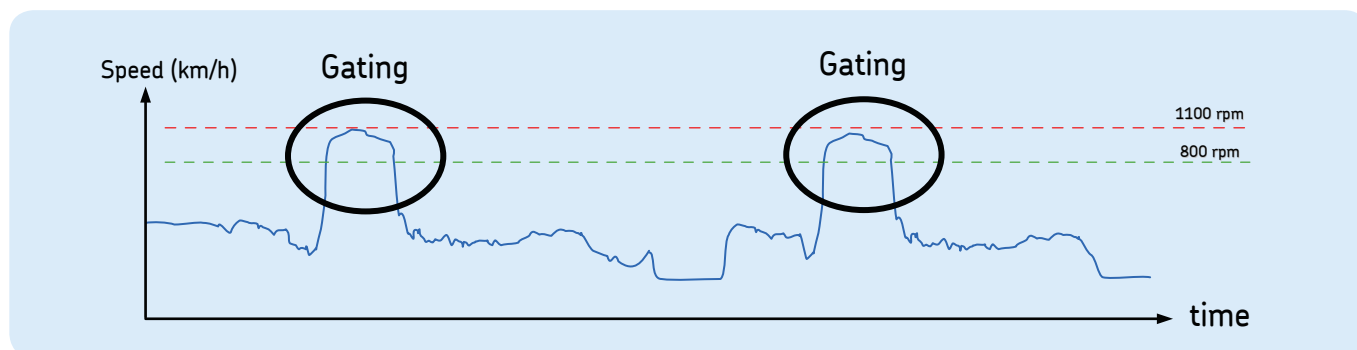

Fig. 1. A typical variation of the speed of the cardan shaft on a haul truck.

On variable speed machinery, an allowed variation of the rotational speed has to be set in SKF @ptitude Observer, when collecting data, to avoid collecting data during acceleration and deceleration of the machine.

Too much variation of the rotational speed will cause a "smear out phenomena" in the frequency amplitude reading. What happens is that the energy from the center peak leaks to the adjacent frequencies, i.e., the frequency peaks in the spectra will be smeared out. In theory, the FFT transform assumes that the actual vibration should be repetitive and infinite in time.

It is recommended to initially try out different gating combinations to find an acceptable data acquisition range. Experience has shown that a variation of the rotational speed with 5% generates an acceptable measurement error (i.e., the vibration peaks in the frequency spectra will not smear out). In **fig. 1**, the allowed variation of the rotational speed on the haul trucks was set to 30 rpm.

Procedure

1 Right-click on a machine in the hierarchy tree and select **Properties** (→ **fig. 2**).
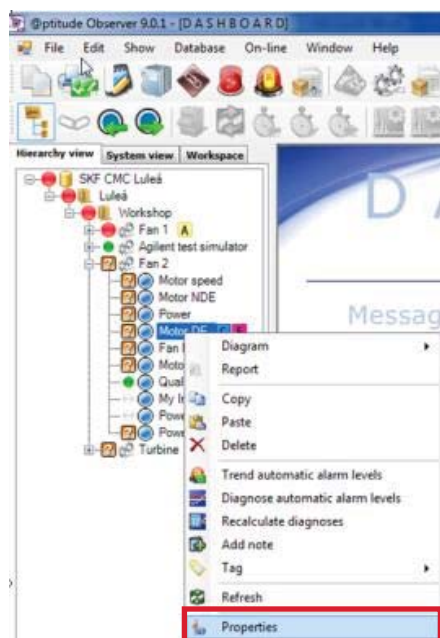

Fig. 2. Select "Properties".

General tab

2 Before proceeding to Step 3, it is necessary to make sure that a **"Rotational speed point"** and/or a **"Process point"** has been selected in the "Simultaneous measurements" section in the **General** tab in **fig. 3**. Without these settings, the gating will not work. For "gating", it is not necessary to have the "Trigg." activated. But if you have one reference point on the shaft, it can be used to collect phase data.
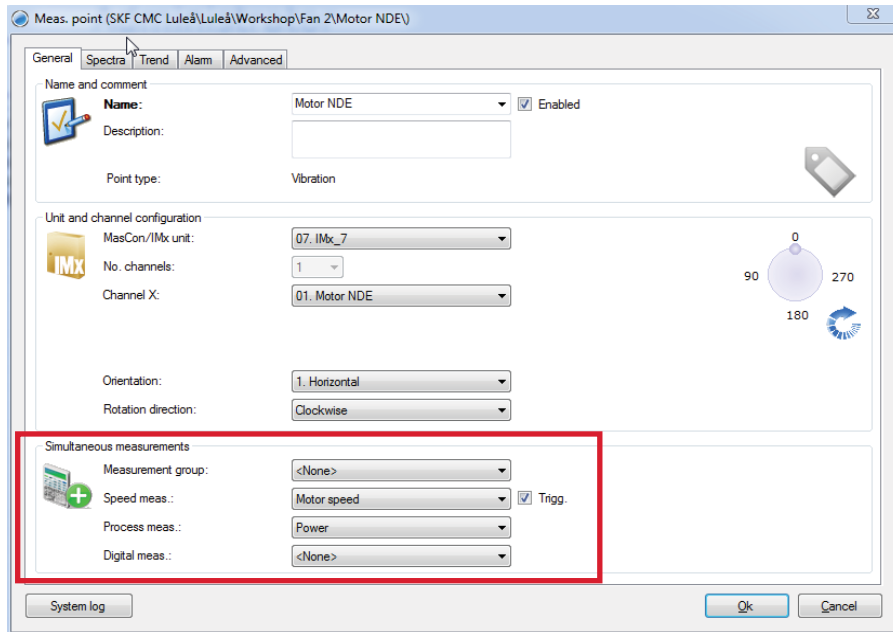

Fig. 3. Necessary settings in the General tab.

Spectra tab

3 The "Active range" for the gating is set to 800 to 900 rpm, and with a maximum variation of the rotational speed (with 10 rpm) during the measurement (→ **fig. 4**). The "Max allowed delta" controls how much the rotational speed is allowed to vary during the measurement. A too high value will cause a "smearing effect" in the frequency spectra. For example, a variation of 10 rpm of a shaft that runs at 1 000 rpm will generate a good vibration spectrum. The best practise is to adjust the "Max allowed delta" during the start up of the of the system.

NOTE: The "Active range" for when a spectrum shall be taken in **fig. 4**, has to be inside the "speed range" of the **Trend** tab in **fig. 5**.
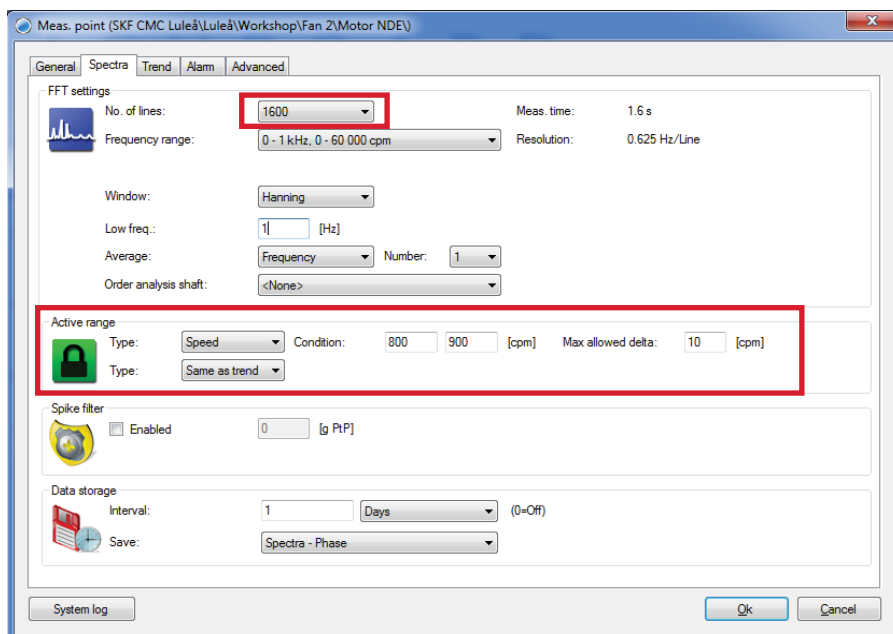

Fig. 4. Example of how to configure the Spectra tab.

Trend tab

NOTE: The "Number of lines" for the "Trend alternative" settings (→ **fig. 5**) has to be equal to or lower than the setting on the **Spectra** tab (→ **fig. 4**). The idea is that the user can configure a low resolution trend measurement with a low number of lines (for example, 100 lines). This will make the trend measurements very fast. In some applications, this can be convenient to do, for example, if you would like to catch a transient that occurs now and then in your machine.
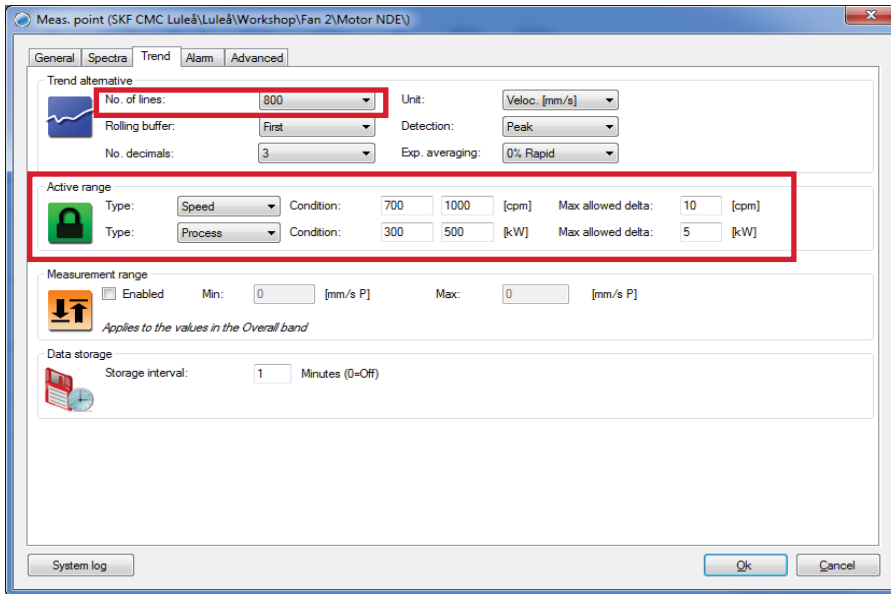

Fig. 5. Example of how to configure the Trend tab.

Description of the available "Types" and "Conditions" for the Active range in **figs. 4** and **5**:

- **Type** is the type of gating that can be set to one of the following values:
  - **All:** The active range check is disabled. In other words, the active range that the measurement point is using is all values.
  - **Speed:** The active range check is determined by the rotational speed measurement point readings selected under "Simultaneous measurements" in the **General** tab.
  - **Process:** The active range check is determined by the process measurement point readings selected in "Simultaneous measurements" in the **General** tab.
  - **Digital:** The active range check is determined by the digital measurement point readings selected in "Simultaneous measurements" in the **General** tab.
  - **Same as trend:** Configures the active range to be the same as the active range for the trend. This setting is only available for the "Active range" setting on the **Spectra** tab.
- **Condition:** The minimum and maximum values for the "active range", when the SKF Multilog On-line System IMx shall collect data.
- **Max allowed delta:** The maximum accepted change of the gating parameter during the measurement. This setting is used to force the system to take data when the operating mode of the machine is "almost" stable (which may be the only way to capture accurate and trustworthy data).

Examples of process and speed measurements are, for example, motor load and rotational speed of the shaft.

In combination with gating, adaptive alarming would give a more accurate alarming depending on the speed at a specific process value. For detailed information, refer to application note **CM3206 EN**, *Adaptive Alarming in SKF @ptitude Observer*.

Please contact: