OROS DATASHEET

Spectral Diagnostic Toolset

FFTDiag, an NVGate® plug-in for OROS Teamwork Analyzers

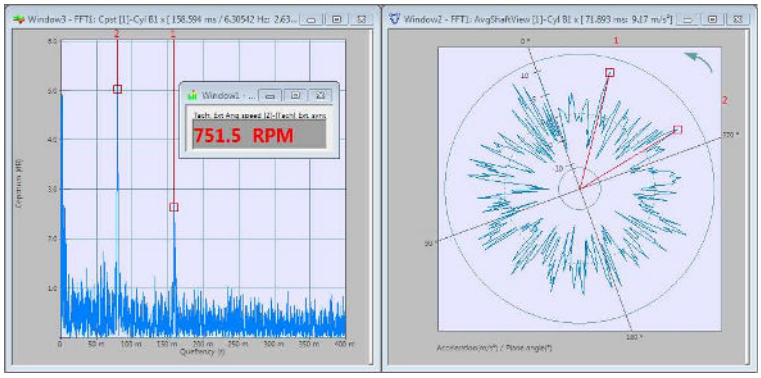


Fig1: Cepstrum and ShaftView from a diesel engine head of cylinder

Introduction

Narrow band spectral analysis (FFT) provides essential tools for noise and vibration measurement. Such functions remain the base of any structural, rotating or even acoustic evaluation.

When the goal is to diagnose machine behavior, for prototyping, overhaul test, predictive maintenance or even part integration effect, additional tools are needed. Specific techniques are then necessary to extract the buried signals for a clear identification of the problem.

OROS ORNV-FFTDiag software module enriches your NVGate FFT plug-in with powerful computations, graphs, markers and signal extractions.

Industries

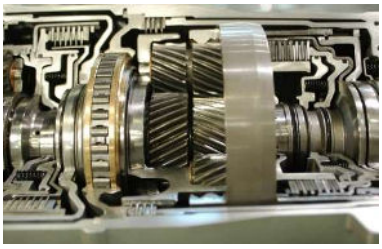
- Energy and Process
- Automotive
- Marine
- Precision Machining and Processes
- Aeronautics

Machines

- Engines
- Transmissions/ Gearboxes
- Generators
- Pumps/Compressors
- Turbines/Jet engines
- Motors/Alternators/Starters
- Conveyors
- Fans/Blowers

Applications

- Predictive maintenance
- Acceptance test (FAT/SAT)
- Prototype validation
- Parts integration
- Overhaul tests
- Transient monitoring
- Source identification
- Life duration evaluation



Time domain

The first information that reflects the machine behavior and health is not frequency related but time & amplitude based. Such data provides information regarding the vibration energy (overall), shocks and its locations.

Levels

In order to extract and follow such levels, the FFTDiag software module provides a set of relevant computations:

- **DC**: the offset level
- **RMS**: the vibration/motion power
- **Min** and **Max**: the motion range
- **Peak** and **peak-to-peak**: the maximum excursion
- **Crest factor** (or **peak to average ratio**): the impulsiveness

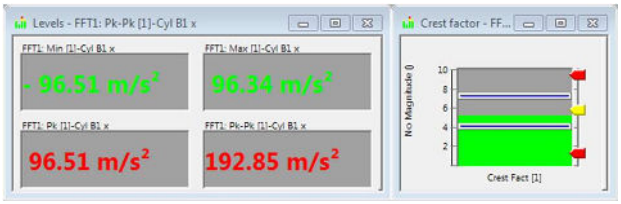


Fig2: View-meter display of FFTDiag levels

Every level is extracted from the time domain signal (i.e. the FFT trigger block) providing a true and real-time value.

All parameters are fully adjustable by the operator:

- **Scan time base** (2.5 ms to 2 hours) and duration (sec to days)
- **Synchronization with machine cycles** (top rev) or other events
- **Time resolution** down to 10µs per sample
- **Integration** (velocity), **double integration** (displacement) and **differentiation** (acceleration) filters, independent on any channels.

The FFTDiag provides **true RMS**, **and peak based levels** avoiding shadowed portions of the signal.

Synchronous time averaging (STA) is available for reducing uncorrelated noise and providing clear and stable level figures on rotating machines.

Profiles

For evolution control, the Waterfall/Profile NVGate plug-in (comes as a standard) collects and plots these levels in:

- **Profiles** vs. time, RPM, parametric (DC) inputs or any other level
- **3D plots reference** (Z axis)

Signal graphs

In the same way the raw signals are made available in specialized graphs. It is useful to locate and qualify the shock and synchronized vibration:

Fig3: Trigger block signal with periodic marker

- The FFT trigger block **sample vs. time** with **dual cursors** and period evaluation marker.
- The **ShaftView** which plots the time domain signal (acceleration, pressure, velocity, etc…) along the shaft rotation. Any tachometer measured with the analyzer can be used for this representation:
  - **Radial cursors** for signal angle identification. Angular gap.
  - Synchronous time averaging & jitter free triggering for **stable** and **clear** graph.

- Adjustable **transducers angular position** and **clock/counter-clock wise** rotation. Ideal to **overlay measured signal with the reality** or axial pictures of the unit under test.

Both graphs can be moved left and right using the pre/post triggering. Overlay with saved results and other channels are easily available (just Drag & Drop) for comparison.

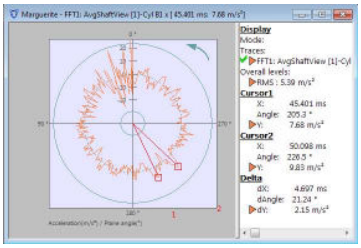
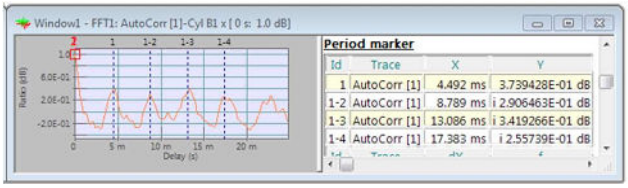


Fig4: Shaftview of diesel cylinder head vibration

Correlations

The correlation functions extract the repetitive or similar patterns in the signal. The X-correlation is used for **identifying the root source of vibration** when they are transmitted solidly among the structures.

The auto correlation is a great help **isolating the cyclic signatures** generated by moving parts. The X axis time scale **gives the periodicity of phenomenon**. It is then easy to locate parts or areas causing the vibrations.



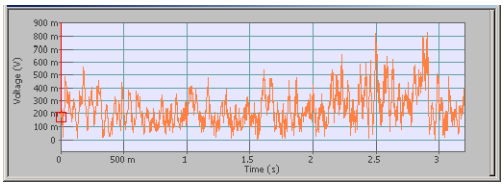


Fig6: demodulated time series

Envelope demodulation

Shocks are one of main sources of failure in rotating machines. Their signature is modulated by the rotating speed and then hidden if the highest frequencies. The envelope demodulation allows getting the **time series of roller bearing shocks** in a few clicks. In order to make the investigation easier and clearer, **spectra, zoomed** spectra, **trigger blocks** and **demodulated signals** are all available simultaneously on each channel.

Narrow band/spectral results

The spectral distributions are also precious indicators of the **stationary content** of the acquired signals (i.e: vibration). In addition to the FFT plug-in tools (time/spectral average, FRFs, zoom, Lissajou), the FFTDiag software module offers the ***Cesptrum*** representation.

The *Cepstrum* is a powerful signal process that **extracts and makes clear the harmonics sets** in the stationary signal. The harmonics are typical signatures of non-sinusoidal repetitive signals; typically the **shocks generated by rotating parts**.

Kinematic marker

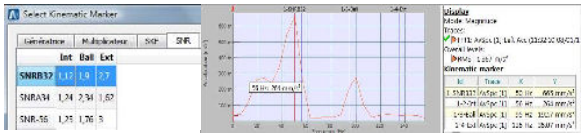


Fig7: Kinematic marker

From **roller bearings** to **gearboxes**, each machine and part has its own kinematic signature, related to the main rotating speed.

The FFTDiag software module includes an easy to use kinematic marker. It applies to any frequency narrow band graphic. The **frequency relationship** and the parts names are entered in text or **Excel™** file and can be modified live.

Ordering Information

ORNV-FFTDiag	Real-time & post-processing diagnostic toolset add-on for FFT plug-in
ORNV-TDA	Real-time time domain analysis plug-in analyzer
ORNV-FFT	Real-time & post-processing FFT plug-in
ORNV-ORD	Real-time & post-processing synchronous order analysis plug-in
ORNV-ORDiag	Real-time & post-processing diagnostic tool set add-on for ORD plug-in

OROS, Leadership through Innovation

About Us

OROS has been designing and manufacturing noise and vibration testing systems (instruments and software) for more than 35 years, meeting the requirements and expectations of automotive, aerospace, marine energy & process, manufacturing and automation industries.

Our Philosophy

Reliability and efficiency are our constant ambition. We know you have the same requirements for your measurement instruments: comprehensive solutions providing guaranteed performance, designed to meet the challenges of your demanding environments.

Our Emphasis

Constantly in tune with your needs, OROS collaborates with a network of proven scientific affiliates to offer the latest in technology in this field, always based on innovation.

Global Presence

OROS products are marketed in more than 35 countries, through our authorized network of representatives, offices and accredited maintenance centers.

Want to know more?

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