# Rotating Machinery, Tachometer Processing, and Order Analysis Tools

## NI LabVIEW Order Analysis Toolkit

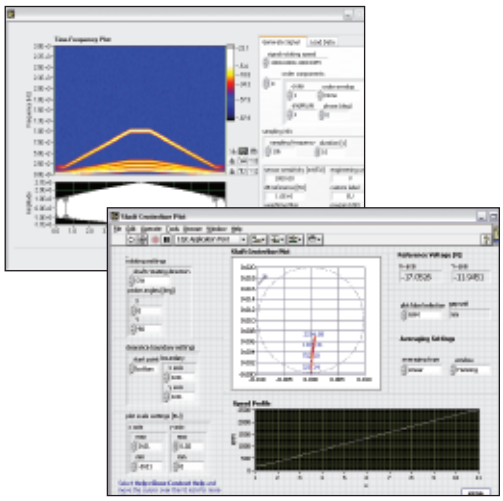
### Patented Order-Tracking Algorithm
- State-of-the-art Gabor Order Tracking algorithm analyzes sound, vibration, and other dynamic signals from mechanical systems with rotating components
- Order extraction tools separate order-specific signal components
- Automatic order selection tools find and extract the most significant orders
- Tachometer and tachometerless signal processing

### Online Order Analysis
- Resampling order tracking method
- LabVIEW Real-Time compatibility

### Flexible Spectral Map Selection
- Frequency versus time
- Frequency versus rpm
- Order versus rpm
- rpm versus order

### Enhanced Data Presentation and Calibration
- Waterfall displays
- Orbit and polar plots
- Bode plot
- System (end-to-end) calibration

### Operating Systems
- Windows 2000/NT/XP



## Overview

With the National Instruments LabVIEW Order Analysis Toolkit, you can build custom measurement and automation applications based on LabVIEW with order analysis capabilities such as order tracking, order extraction, and tachometer signal processing. The toolkit employs Gabor Order Tracking, a patented algorithm based on the concept of joint time-frequency analysis (JTFA), as well as conventional resampling for online processing capability.

Order analysis is a tool for examining dynamic signals generated by mechanical systems that include rotating or reciprocating components. As with frequency-domain analysis, you can think of order analysis as a signal "scalpel" that can dissect sound, vibration, and other dynamic signals into components that relate to physical elements of mechanical systems. Unlike the power spectrum and other frequency-domain analysis standards, order analysis works even when the signal source undergoes rotational speed variations.

The main component of the NI LabVIEW Order Analysis Toolkit is a set of VIs that you can drag and drop to build custom LabVIEW applications so you can perform the following analysis operations:

- Calculate and examine rotational speed
- Measure power distribution in the frequency or order domain as a function of either time or rotational speed
- Extract order components from noise or vibration signals
- Measure magnitude and phase of any order component as a function of rotational speed
- Present data in a waterfall, orbit, bode, or polar plot

The examples included illustrate how to perform common order analysis tasks.

## Machine Condition Monitoring (MCM) and Machine Health

The LabVIEW Order Analysis Toolkit is ideal for machine monitoring, machine health, and machine efficiency applications. You can use the toolkit to perform the most common analyses required by MCM applications, including order tracking, slow-roll compensation, and vibration integration. With this toolkit, you can develop your application faster by using built-in examples for order spectra, tachometer processing, and waterfall plots. If you are performing measurements in a production test environment, you can easily apply limit testing on almost any measurement result from this toolkit, such as time-domain data, order spectra, scalar measurements, and many more.

## Applications and Signal Sources

You can apply order analysis to dynamic signals generated by mechanical systems that include rotating or reciprocating components, such as turbines, compressors, pumps, and engines. It is common to use order analysis in applications such as machine condition monitoring and noise, vibration, and harshness (NVH) testing. With the added capability for online processing, you can easily create flexible applications for condition-based monitoring and predictive maintenance.

The National Instruments 44xx dynamic signal acquisition devices are ideal for acquiring sound and vibration signals to analyze with this toolkit. Use any NI data acquisition (DAQ) hardware with LabVIEW and the order analysis toolkit to create a robust machinery monitoring application quickly and easily.

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## Hardware

The examples work with NI dynamic signal acquisition (DSA) and multifunction DAQ devices. For optimal frequency-domain measurements, NI recommends robust alias protection using a DSA measurement device or a DAQ device with appropriate signal conditioning. You can use these examples with both Traditional NI-DAQ (Legacy) and NI-DAQmx driver software.

## Order Analysis Toolkit Function List

**Methods**

- Gabor transform (off-line analysis)
- Resampling (online analysis)

**Preliminary Processing**

- Scaling and calibration
- Analog and digital tachometer signal processing
- Vibration filtering and integration
- Slow-roll compensation

**Functions**

- Order power spectrum
- Spectrum averaging (rms, vector, peak hold, weighting mode)
- Order waveform, magnitude, and phase
- Level measurements (rms, peak, crest factor)
- Limit testing

**Displays**

- Spectral map
- Color map
- Waterfall plot
- Cascade plot
- Bode plot
- Polar plot
- Orbit plot
- Timebase plot
- Shaft centerline plot

## Order Analysis VI Description

**Scaling and Calibration**

Use the Scaling and Calibration VIs to scale an input signal measured in volts to the appropriate engineering units and calibrate microphones, accelerometers, or other sensors.

**Preprocessing**

Use the Preprocessing VIs to filter vibration waveforms, convert acceleration signals to velocity or displacement signals, or extract reference signals.

**Level Measurement and Limit Testing**

Use the Level Measurement and Limit Testing VIs to perform level measurements and limit testing on waveforms, spectra, XY data, identified peaks, or scalar measurements.

**Tachometer Signal Processing**

Use the Tachometer Signal Processing VIs to process analog and digital tachometer signals.

**Order Analysis**

Use the Order Analysis VIs to calculate order-related results such as order map, order magnitude and phase, order spectrum, and order waveform.

**Data Presentation**

Use the Data Presentation VIs to display results as polar plots, orbit plots, timebase plots, or waterfall displays.

**Utility**

Use the Utility VIs to manipulate calculated data to obtain specific data formats or set triggers on input signals.

## Ordering Information

NI LabVIEW Order Analysis Toolkit[1] .....778392-03
Run-Time License .....778395-01

[1]Requires LabVIEW Professional or Full Development System 6.x or later.

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*For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S. only) or go to* **ni.com/products** *and enter* **lvorderanalysis**.

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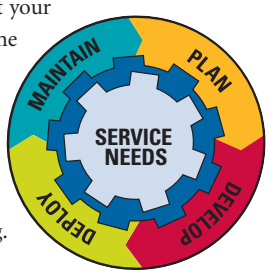


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