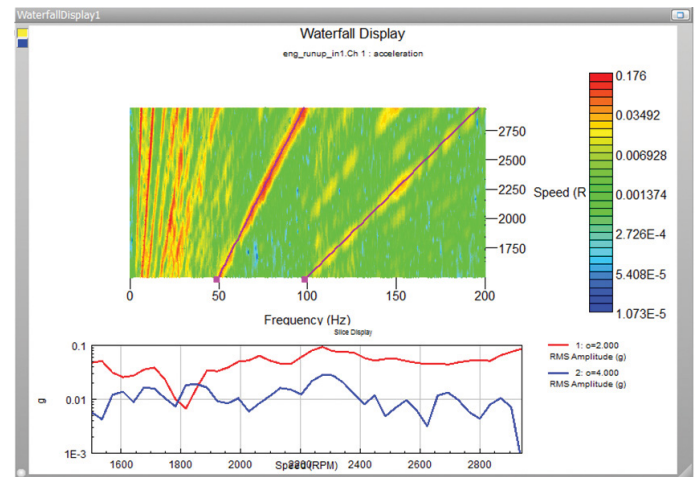


# VibeSys

## Powerful Data Processing System for Acoustics and Vibration Analysis

nCode VibeSys is a powerful data processing system for acoustics and vibration test data analysis. In addition to general signal processing, VibeSys provides sophisticated analysis capabilities for early fault detection in rotating machinery, rating human reactions to sounds and vibrations, and for characterizing the dynamics of a structure. VibeSys is easy-to-use software that enables Acoustics and Vibration engineers to design a reliable product that satisfies customers' expectations in terms of sound, comfort, and regulatory requirements.



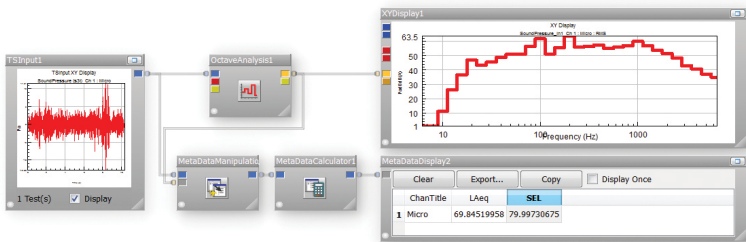
### Product benefits:

- **Comprehensive** analysis capabilities for experts but simple to use for occasional users, raising team effectiveness
- **Save time and cost** with faster, more meaningful fault detection and diagnostics for rotating machinery
- **Improve consistency and quality** with standardized analysis processes
- **'One-click' generation of results and reports** go straight from raw data to finished document for improved productivity
- **Easily process** huge amounts of data in a wide range of data formats

### Product features:

- **Proven analysis methods** for rotating machinery, understanding human perception of vibration and sound, and structural dynamics
- **Basic signal processing** tools to visualize data, perform general signal processing, and run reports
- **Pre-defined processes** for performing time, frequency, and statistical analysis
- **User-defined processes easily created** with MATLAB® or Python programming language
- **Intuitive, graphical interface** for easy process development with media playback capabilities
- **Interactive displays** for characterizing modal properties to validate or enhance structural FE modelling

# Core functionality for performing acoustics and vibration analysis



Designed for Acoustics and Vibration applications, nCode VibeSys provides a graphical, process-oriented environment. Within this environment, users can simply create an analysis workflow by 'dragging and dropping' pre-defined processes called 'glyphs' on to a workspace.

## nCode Fundamentals

nCode Fundamentals provides visualization and basic manipulation of data, frequency spectrum analysis, filtering capabilities, and reporting. It is included in the base package of VibeSys and is a prerequisite for all other product options.

### nCode Fundamentals features:

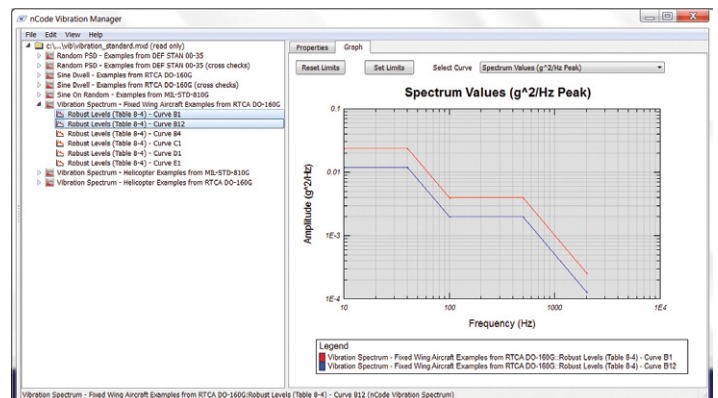
- Input/output support of multiple data formats
- Visualization and reporting
- Frequency Spectrum (Amplitude, Power, Energy)
- Filtering (IIR and FIR)
- Extraction and concatenation
- Statistics and running statistics, including higher order standardized moments such as kurtosis
- Resampling
- Unit conversion
- Time at level analysis
- Probability density functions
- Graphical editor
- Channel calculator
- Batch and interactive interfaces
- Super glyph to encapsulate multiple analysis functions as a single glyph that can be saved and reused

## Vibration Manager

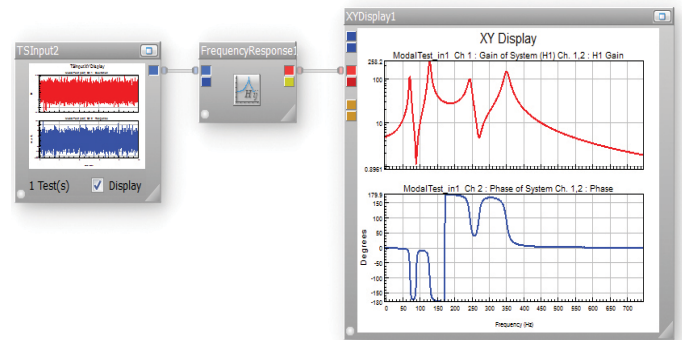
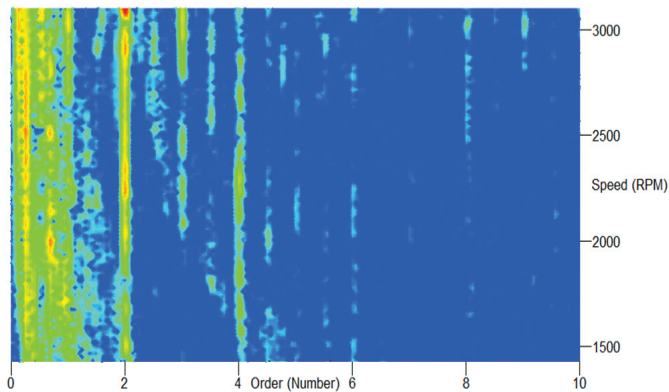
The Vibration Manager module provides the ability to enter, edit, and view vibration specification data.

### Vibration Manager features:

- A database that contains over 100 vibration entries. This includes UK DEF STAN 00-35 Part 3 Issue 4 Chapter 2-01 Annex A, USA MIL-STD-810G Method 514.6 Vibration Annex C, Civil Aircraft Standard RTCA DO-160G, the Electric Vehicle Battery Test Procedures Manual, Revision 2, Published January 1996, and ISO 16750-3:2012 describing the mechanical loads for electrical and electronic equipment in road vehicles.
- Up to 16 vibration curves can be overlaid for graphical comparison
- Data import/export capabilities via XML files
- Filters to find curves of interest within database



# Dedicated analysis for acoustics and vibration



## Rotating Machinery

Rotating Machinery features a set of pre-defined processes for detecting early symptoms of noise or vibration problems in rotating machinery and identifying their root cause.

### Rotating Machinery features:

- Pulse to speed conversion with error checks and smoothing
- Waterfall analysis from run up/down, constant or non-monotonic speed profiles
- Orders extraction in both time and frequency domain
- Order tracking filter for sensitivity analysis and sound quality
- Signal playback
- Revolution domain resampling, order spectra and waterfalls
- Waterfall display and Campbell plots, with order slicing
- Resonance or custom cursors
- Cepstrum analysis
- Global and running kurtosis
- Envelope analysis using Hilbert transform for demodulation analysis

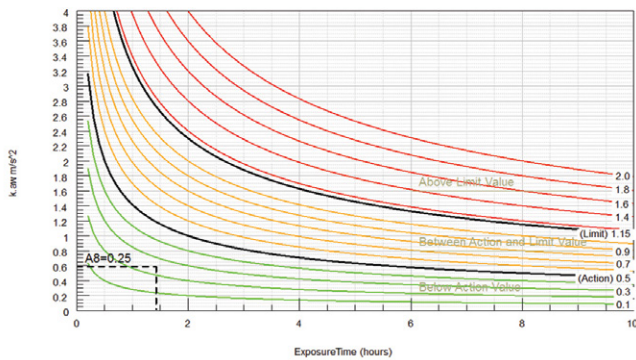
## Structural Dynamics

Structural Dynamics contains functions designed to characterize the dynamics of a machine or structure in terms of its mode of vibration.

### Structural Dynamics features:

- Frequency Response Function (FRF) with Gain (H1, H2) phase, coherence, auto and cross spectra
- Waterfalls of FRF to check for linearity
- Custom Fast Fourier transform (FFT) filter to apply a transfer function defined as gain and phase spectra
- Convolution to filter from an impulse response function
- Auto/cross correlation
- Hilbert transform to calculate the decay rate of an impulse response function from its envelope
- Horizontal and vertical cursors on spectra to identify resonances and damping ratio

Whole Body Vibration: A(8) Daily Exposure Graph (Weighted RMS acceleration in m/s<sup>2</sup>) Z Direction



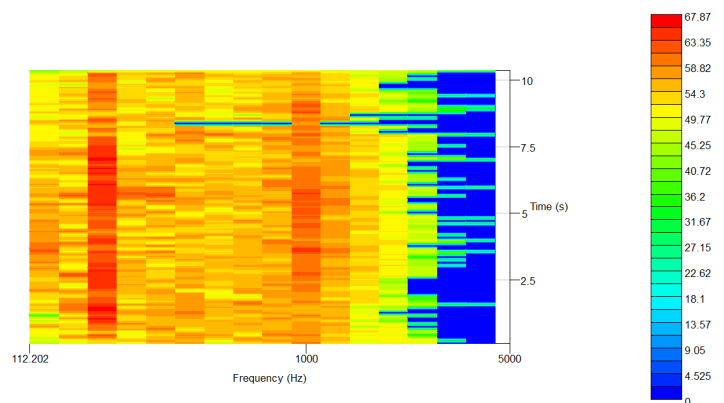
The whole body vibration analysis results from VibeSys help engineers understand the perceived quality of a product and assess the health effects related to extended exposure to high levels of vibration.

## Human Perception

Human Perception includes standard processes for assessing whole body comfort and health. Specific functionality includes vehicle ride quality analysis and hand-arm vibration assessment.

### Human Perception features:

- Readily available processes for finding the frequency weighted RMS acceleration to obtain crest factor and Vibration Dose Values (VDV) - eight hours combined vibration total value, eight hours VDV, etc.
- Sound level indicators such as LAeq, eight hours LAeq, SEL, LAE, etc.
- Octave-band or fractional-octave spectra analysis capabilities from data in the time domain, PSD, or waterfalls - in linear or dB scales
- Psycho-acoustics including A, B, C noise filters
- Order tracking filters with analysis playback capabilities
- Weighting filters for human body vibration in accordance with ISO 2631 and ISO 5349
- Calculation of sound quality metrics e.g. loudness, sharpness and articulation index



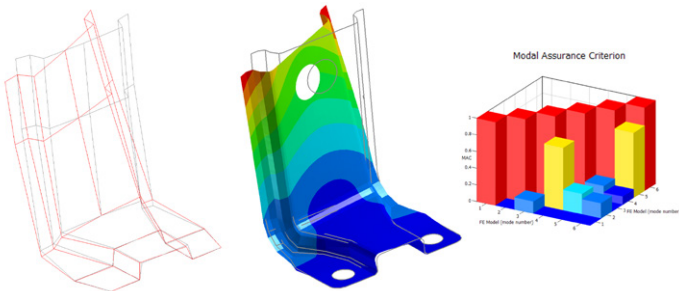
# VibeSys options

## Modal Analysis

Modal Analysis is a specialized product option that identifies vibration modes and extracts modal parameters. It can also animate mode shapes or display Operating Deflection Shapes (ODS) with color-filled contours during animation.

### Modal Analysis features:

- More accurate damping ratios through enhanced FE modelling
- Modal Assurance Criterion (MAC) analysis to determine the similarity of mode shapes by comparing the response motion captured using virtual sensors with the measured displacements
- Rapid comparison of different designs in terms of their dynamic properties
- Validate FE modelling using MAC analysis
- "AutoMAC" matrix to help position virtual sensors and optimize physical instrumentation to capture the modes of interest
- Noise and Vibration related troubleshooting
- Structural Health Monitoring by tracking changes in modal parameters due to damage



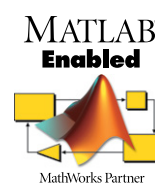
## Accelerated Testing

Accelerated Testing provides the ability to create a representative PSD or swept sine shaker vibration test based on measured data for assessing the impact on shock and fatigue damage. It uses the fatigue damage spectrum (FDS) approach as described in NATO STANAG 4370 (AECTP-240)/ UK DefStan 00-35/Mil-Std-810G, allowing users to tailor vibration tests to a target vibration environment. Users can also compare existing test evidence against the requirements of a known test specification. It enables assessment of

whether components in service will likely survive to the target service life. This known safety margin may help extend the life of parts in service or conversely avoid unexpected failures.

## GlyphBuilder

The GlyphBuilder option enables users to add their own unique or proprietary methods and file formats by combining the capabilities of the Scripting and Open glyphs.



In the Scripting glyph, users can define their own processes by using either MATLAB or Python programming language. Both Python 2 and Python 3 are supported.

The Open glyph gives direct access to external applications from within a VibeSys process. A given command line operation is executed from within this glyph so that external code or scripts such as Visual Basic®, Java™, nCL, C++, etc., can all be called using data from the process.

## Media Display

Media Display glyph enables video and audio signals to be played using Windows Media® Player embedded in the glyph. It also enables cursor synchronization with other data displays to gain insight on what was occurring in other signals. The Gauge Display glyph enables synchronized values to be displayed during playback in a variety of styles such as angular gauges or digital read-outs.

## Data Cleaning

The Data Cleaning option provides advance data cleaning techniques beyond what is possible with classical filtering techniques alone. This option includes the Wavelet Denoising glyph that enables noise to be separated out from signals by decomposing data into the combination of "wavelet levels". It also includes the Kalman Filter glyph which accounts for noise in measured data using a physics model that predicts, given the current point, where the next point will be.



## About HBM Prencia

HBM Prencia is a global leader in providing technology and engineering software products and services for reliability, durability, and performance. We offer a broad range of engineering solutions that deliver compelling value to our customers for the design and development of reliable, robust systems, and reduce life cycle costs for mechanical and electronic hardware and software (mechatronics). By offering a range of industry leading software (nCode and ReliaSoft), training, and services (Prencia Solutions and Omnicon), we enable companies to enhance returns on investment and operational success through design and certification, optimized processes, data management and processing, and CAE simulation. For more information, please visit [www.hbmprencia.com](http://www.hbmprencia.com)

© 2019 HBM United Kingdom Limited (an affiliate of HBM Prencia Inc.), at Technology Centre, Advanced Manufacturing Park, Brunel Way, Catcliffe, Rotherham S60 5WG, UK. All Rights Reserved. nCode® and VibeSys™ are all trademarks of HBM United Kingdom Limited. All other product names, logos, trademarks, and service marks are the property of their respective owners.

NC2019-VS-PD\_0119/EN



**nCode**

[www.hbmprencia.com](http://www.hbmprencia.com)