ME'scope VES™

Visual Engineering Series

Vibrant TECHNOLOGY

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What is ME'scopeVES?

The ME'scopeVES ***Visual Engineering Series*** of software packages and options makes it easier for you to observe and analyze noise & vibration problems in machinery and structures using either experimental or analytical data.

With ME'scope, you can import or directly acquire multi-channel time or frequency data from a machine or structure, and post-process it. Using its industry-leading 3D animated shape display, you can observe order-related operating deflection shapes from running machinery, resonant vibration and mode shapes from real structures, acoustic shapes, and engineering shapes directly from acquired data.

In addition to its photo-realistic interactive animated display, ME'scopeVES contains ***state of the art tools*** for performing:

- FRF-Based Modal Analysis
- Operational Modal Analysis
- Vibro-Acoustic Analysis
- Dynamics Modeling & Simulation
- Structural Dynamics Modification
- Experimental FEA

ODS Animation

An Operating Deflection Shape (ODS) is the simplest way to see how a machine or structure moves during its operation, either at a specific frequency or moment in time. An ODS contains the overall dynamic response of a structure due to forced and resonant vibration.

Time-based ODS animation sweeps a cursor through a set of time histories describing motions at multiple points and directions on a test article. You can stop the animation, back it up, and play it forward to observe in slow-motion phenomena that may have taken place very quickly in real time.

With frequency-based ODS animation, you simply move the cursor to a frequency of interest in your data, and the ODS for that frequency is displayed. With this animation, you can observe resonant vibration as well as order-related and other types of forced vibration.

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FRF-Based Modal Analysis

Modal analysis is used to characterize resonant vibration in mechanical structures. Each resonance has a specific “natural” or modal frequency, a modal damping or decay value, and a mode shape. FRF-Based parameter estimation (or curve fitting) is used to estimate the modal parameters of a structure from a set of FRFs.

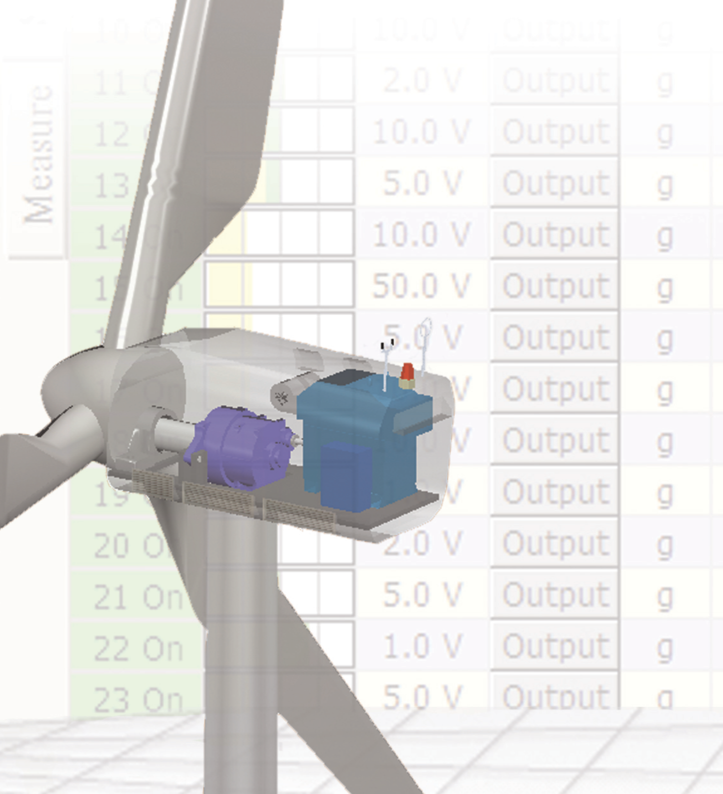
At the heart of the Basic Modal Analysis option is the ME’scope Polynomial method, an easy to use MDOF curve fitter. This curve fitter can be used to simultaneously extract parameters for multiple modes, especially in cases of high modal density. It can also extract local modes where the resonant vibration is confined to a local region of the structure.

The Multi-Reference Modal Analysis option contains all of the features of the Basic Modal Analysis option, plus additional methods for curve fitting a multiple reference set of FRFs. Multi-Reference curve fitting is used to extract closely coupled modes and repeated roots (two or more modes at the same frequency). This option contains a Stability diagram for locating stable pole estimates, and three additional curve fitting methods: Complex Exponential, Z-Polynomial, and the patented AF Polynomial method.

Operational Modal Analysis

When the excitation forces causing a structure to vibrate are not measured, then FRFs cannot be calculated, and modal parameters can only be extracted for output-only or operational measurements. Nevertheless, a key advantage of OMA is that data can be acquired under real-world operating conditions.

This option contains special tools for curve fitting measurements obtained from output-only or operating data. Common OMA measurements are a Cross spectrum or ODS FRF, which are calculated between a roving accelerometer and a reference (fixed) accelerometer. After a set of these has been specially windowed, they can be curve fit using FRF-based curve fitting methods to obtain operating mode shapes.



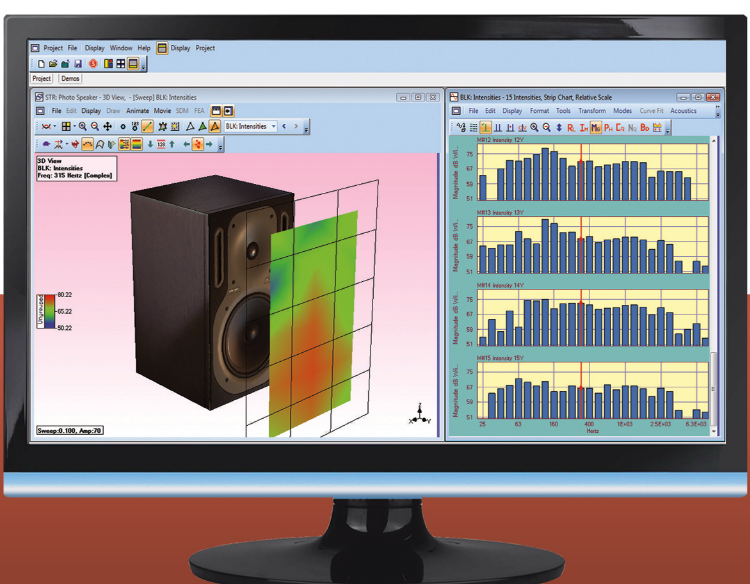
Vibro-Acoustic Analysis

This option post-processes and displays Acoustic Intensity, Sound Pressure Level (SPL), and Sound Power. It allows you to analyze vibro-acoustic problems by displaying both vibration and acoustic data together in the same animated picture.

Acoustic Intensity is measured with a two to four channel acquisition probe and a multi-channel acquisition system. Each Intensity measurement is made either normal to an acoustic grid or surface, or in three directions (tri-axially) at each grid point.

Sound Power flow through an acoustic surface is calculated from Intensity data. Sound power is displayed on the acoustic surface using a color map.

Interactive Source Ranking allows you to graphically document the breakdown of acoustic energy measured from various components of a test article. Acoustic sources can be ranked according to their percentage of the total power, in dB units or watts.



Dynamics Modeling & Simulation

This option uses a Multiple Input Multiple Output (MIMO) dynamics model to calculate Inputs, Outputs, and Transfer functions. Each part of the model can be calculated from the other two.

Transfer functions can be calculated from multiple Input and Output time waveforms. Time domain windowing (Rectangular, Hanning, or Flat Top), linear or peak hold spectrum averaging, triggering, and overlap processing can be applied during Transfer function calculations. Ordinary Coherences are also calculated for single Inputs, and Multiple & Partial Coherences are calculated for multiple Inputs.

Multiple Output time waveforms or frequency spectra can be calculated from Transfer functions and multiple Input time waveforms or frequency spectra, and animated ODS's can be displayed directly from the Outputs. Transfer functions can be derived from experiment or from mode shapes. Inputs can be derived from experiment or synthesized.

Similarly, multiple Input time waveforms or frequency spectra can be calculated from Transfer functions and multiple Output time waveforms or frequency spectra. The Outputs can be derived from experiment or synthesized. This capability can be used for Force Path Analysis.

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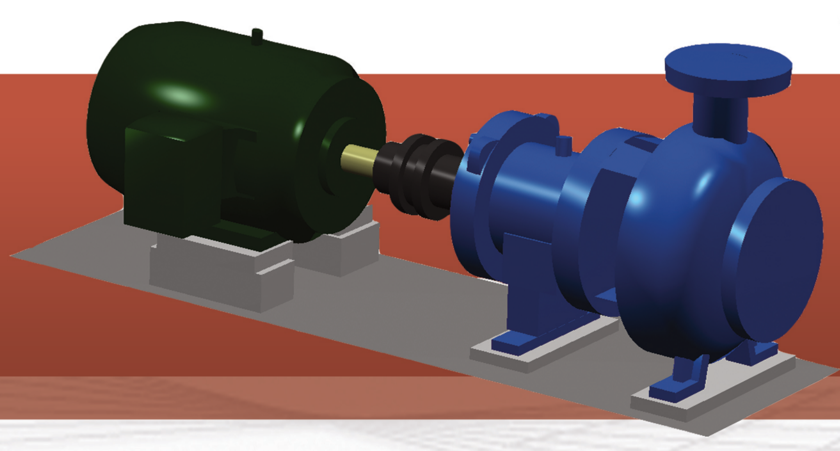
Structural Dynamics Modification

If a noise or vibration problem is due to the excitation of a resonance, the structure must either be isolated from its excitation sources or physically modified to reduce its vibration response levels. With this option, you can quickly investigate the effects of structural modifications on the modes of a structure. The new modes can then be used in MIMO calculations to determine the effect of structural modifications on overall vibration levels.

SDM models structural modifications using industry-standard FEA elements. The FEA element library includes the same elements used by the Experimental FEA option.

All modification elements are displayed on the 3D structure model. Each element type has its own spreadsheet, where its properties can be viewed and edited.

SDM works with either analytical (FEA) modes or experimental (EMA) modes of the unmodified structure. Because the new modes of the structure are calculated so quickly, SDM can be used for Modal Sensitivity studies, where thousands of solutions are calculated and ranked for comparison. SDM also includes a special command for adding tuned vibration absorbers to a structure.



Experimental FEA

This option allows you to construct an FEA model of your test structure and solve for its analytical mode shapes. The FEA model is constructed by adding industry standard FEA elements to the same 3D model that is used for displaying experimental shape data. The FEA element library includes springs, masses, dampers, rods (with axial stiffness), bars (with axial, shear, and bending stiffness), triangular and quadrilateral plate elements, and solid elements such as tetrahedra, prisms and bricks. These same elements are used by the SDM option. This option includes both a normal mode solver for FEA models without damping, and a complex mode solver for FEA models with damping.

By constructing an FEA model and solving for its modes prior to a modal test, this option helps you determine proper transducer and exciter locations for the test. Following the test, you can compare the experimental and FEA mode shapes (both graphically and numerically) to validate your results.

The FEA model can also be used to expand experimental data to include all unmeasured DOFs where the FEA model is defined.

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Vibrant Portable Hardware

Vibrant Portable Hardware is shipped with ME'scope software pre-installed, and it is ready for field use. A VPH box can be used for troubleshooting noise and vibration problems in operating machinery using ODS Analysis. It can also be used for experimental Modal Analysis using either impact testing or shaker testing. With 4 to 32 simultaneous acquisition channels, ME'scope can be macro-programmed to acquire as many channels of data as necessary to display operating deflection shapes or mode shapes in animation.

With a large archival database installed either in the box or in the cloud, a VPH box can also be used for short-term or long-term machinery health monitoring and structural health monitoring. Red-light green-light graphics on a machine or structure model in our separate network-based operator Console software makes it easy to monitor vibration and other engineering parameters, and quickly spot problem areas. Trend plots and spectrum alarm bands also help identify order-related or resonance-related problems. ME'scope software options can be added to your VPH box as you need them.

Portable Hardware Options

Each Vibrant Portable Hardware option is contained within a ruggedized Pelican® carrying case and includes a SSD computer, power surge protection, wireless or cell phone modem, multi-channel simultaneous acquisition, external BNC connectors, and external USB & Ethernet connectors for surveillance camera or network connection options.

VPH-804 4-Channel Portable Acquisition
VPH-808 8-Channel Portable Acquisition
VPH-816 16-Channel Portable Acquisition
VPH-824 24-Channel Portable Acquisition
VPH-832 32-Channel Portable Acquisition

Technical Specifications

Physical

Dimensions	Pelican 1500 case 18.50" x 14.06" x 6.93" (47 x 35.71 x 17.60cm)
Weight	18.8 lbs
Mounting	Ruggedized Pelican Case with Handle
Power	110V (50 or 60 Hz) - *up to 1 hour battery backup*

Inputs

Number of Dynamic Channels	4, 8, 16, 24, 32
Dynamic Range	102 dB (24-bit ADCs)
Voltage Range	-10 to +10 volts
IEPE Sensor Power	4 mA
Frequency Span	min (0 - 97 Hz) max (0 - 105,400 Hz)
Samples per Channel	4 to 250,000
Speed Range	1 to 100,000 RPM
Tachometer	Any Channel
Trigger	Any Channel
AC/DC Coupling	Yes
DC Removal	Yes

Data Archiving

Storage Capacity	Microsoft SQL Database 10 Gbyte (larger capacity available)
Machine / Structure Based	Monitored & Animation Shapes Time Waveforms Narrow Band & Octave Spectra
Baseline Snapshot	Yes
Short-Term FIFO Storage	Operator Controlled Snapshots (real time, per second, minute, hour, day, month)
Long-Term FIFO Storage	Operator Controlled Snapshots (real time, per hour, day, month)
Pre and Post-Event FIFO	Snapshots (number before, number after)
Security	Administrator Controlled Database Access

Networking

Communications	Wireless, Cellular, Ethernet, Internet
LAN / WAN Support	10/100 MB Ethernet Port
Remote Access	Integrated Wireless Hub
Remote Operation	Windows Remote Desktop





Founded in 1991, Vibrant Technology is a leader in developing tools for post-processing vibration and acoustic test data. Vibrant Technology's software is used by structural testing and machinery maintenance professionals in a wide variety of industries, including:

- Automotive
- Aerospace
- Construction Sites & Equipment
- Power Generation
- Paper Mills
- Chemical Plants
- Steel Mills
- Semiconductor Manufacturing
- Sporting Goods Manufacturing
- Qualification Testing

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