PRODUCT DATA

ME'scopeVES™ Modal and Structural Analysis — Type 7754
Including PULSE Bridge to ME'scope — Type 7755 A

ME'scopeVES Modal and Structural Analysis

ME'scopeVES™ post-test analysis tools allow you to observe, analyse and document the dynamic behaviour of machines and mechanical structures. ME'scopeVES includes options for performing operating deflection shape analysis, modal analysis, multiple input/output analysis and structural modifications. By animating the measured responses of a structure in slow motion, you can see what cannot be seen any other way.

PULSE Bridge to ME'scope

PULSE™ Bridge to ME'scope is software developed expressly for the purpose of transferring measurement data from PULSE to the ME'scopeVES family of post-processing analysis tools. PULSE Bridge to ME'scope combines PULSE and ME'scopeVES into an easy to use, integrated, test and analysis solution.

7754, 7755 A

Brüel & Kjær

USES

- ❍ Post-test analysis, animation and documentation of operational deflection shapes and mode shapes using PULSE and ME'scopeVES post-processing tools:
  - ME'scopeVES Visual ODS
  - ME'scopeVES Visual ODS Pro
  - ME'scopeVES Visual Modal
  - ME'scopeVES Visual Modal Pro
  - ME'scopeVES Visual SDM
- ❍ Multichannel measurement and transfer of experimental data from PULSE to ME'scopeVES

FEATURES

- ❍ Time and frequency domain animations
- ❍ Operational Deflection Shapes (ODS)
- ❍ Modal analysis
- ❍ Structural modifications

PULSE Bridge to ME'scope

PULSE Bridge to ME'scope software is an easy to use program for transferring experimental data from PULSE to the ME'scopeVES post-test analysis tools. PULSE Bridge to ME'scope software uses OLE automation to control both PULSE and ME'scopeVES.

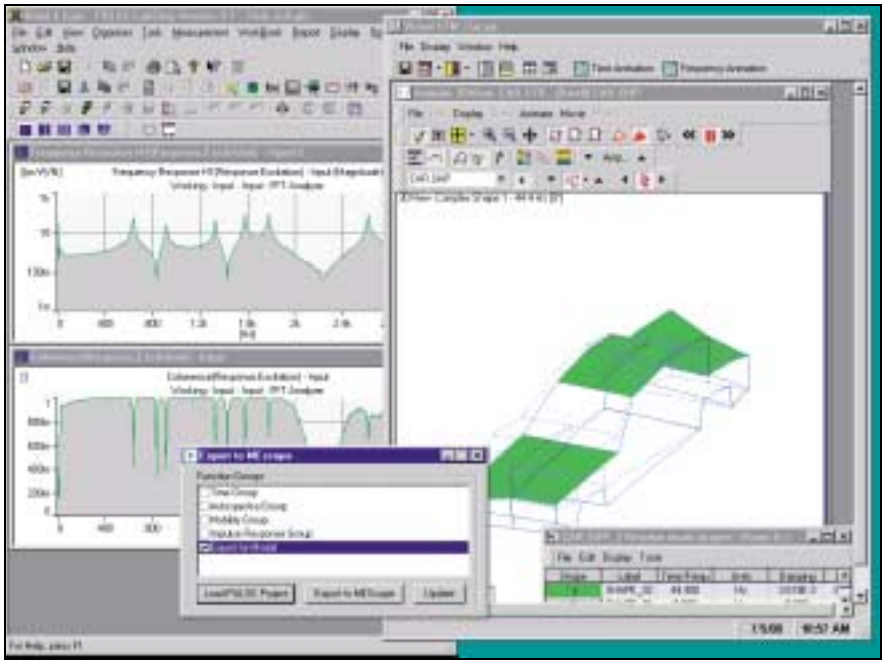

Fig. 1
Bridge to ME'scope window with both PULSE and ME'scopeVES open

To use PULSE Bridge to ME'scope, you activate the program directly from Windows® via its icon. A window then appears and both ME'scopeVES and PULSE are started automatically (see Fig. 1). Clicking on the **Load PULSE Project** button takes you to the PULSE **Open** dialog box. Here you can select the project with the required measurement data. On selecting a project, the contents of its Function Organiser appear showing the Function Groups in the PULSE Bridge to ME'scope program window. You simply check the box next to the data you wish to transfer to ME'scopeVES, and click on the **Export to ME'scope** button (see Fig. 2). The data files are then automatically imported into ME'scopeVES with the correct data format.

It is also possible to attach the PULSE Bridge to ME'scope icon to a WorkNote within a project so that on starting the PULSE Bridge to ME'scope program, it will automatically take information from the Function Organiser of the project it was started in.

Fig. 2
Bridge to ME'scope program window

Once the information has been transferred to ME'scopeVES, the next stage is to enter the structure geometry directly into ME'scopeVES. ME'scopeVES contains a variety of drawing tools for building 3D models for animation. After the model/geometry is complete, the measurement information is assigned to the appropriate points/nodes along with constraints, directions and DOFs (degrees-of-freedom) on the model. Then, operational deflection shapes of the model can be animated directly from the PULSE measurement data, and the mode shapes can be estimated.

ME'scopeVES Features and Functions

ME'scopeVES Measurements Imported

To display operational deflection shapes and mode shapes, ME'scope uses multichannel time or frequency domain data, acquired during the operation of a machine or excitation of a structure.

Operational Deflection Shapes

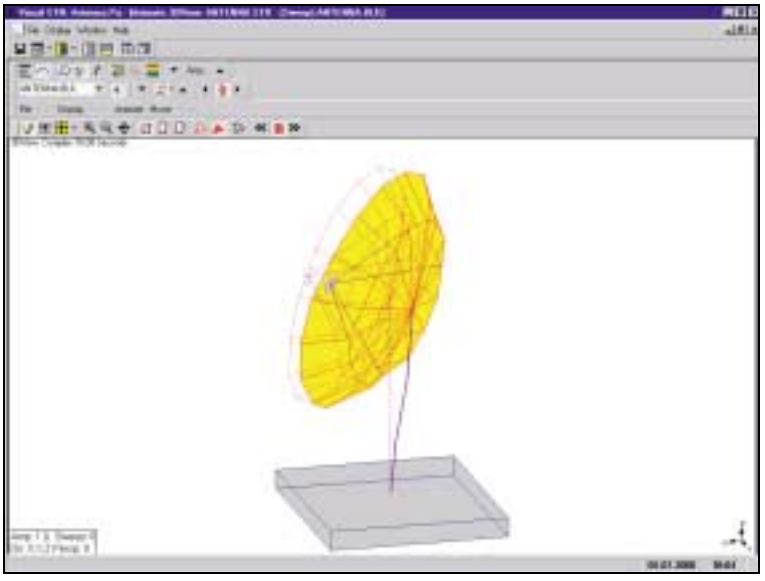

Fig. 3
Animated model showing an Operational Deflection Shape

An operational deflection shape is the easiest way to see how a machine or structure moves during its operation, either at a specific frequency or at a moment in time. Traditionally, ODS have been used to characterise the steady-state operation of a machine at a specific frequency. But ODS can also be obtained from time domain measurements and used to characterise the motion of a machine or structure at a moment in time.

All types of time and frequency domain measurements can be used in ME'scope to display operational deflection shapes in animation. Furthermore, since the FFT in ME'scope transforms all measurements at once, you can conveniently observe deflection shapes from either a set of time histories or from their equivalent frequency spectra.

Mode Shapes

Mode shapes are the dominant motion of a structure at each of its natural or resonant frequencies. Modes are an inherent property of a structure and do not depend on the forces acting on it. On the other hand, operational deflection shapes do show the effects of forces or loads, and may contain contributions due to several modes of vibration.

To obtain valid modal data, measurements have to be made while maintaining linear, stationary motion on the test article. Mode shapes can be obtained from sinusoidal time responses, Impulse Response Functions (IRFs) or Frequency Response Functions (FRFs).

Modal Parameter Estimation

Using the ME'scopeVES Visual Modal option, experimental modal data (frequency, damping and mode shape) is obtained by curve fitting a set of FRF measurements. ME'scope contains three built-in curve fitting methods: Quadrature Fit, Peak Fit, and MDOF Polynomial Fit. The MDOF polynomial fit method can be used to curve fit single reference or multiple reference FRF data sets.

Time Domain Animation

With ME'scope, you can animate the deflection of a structure by sweeping through a set of acquired time histories. Time domain animation allows you to view a structure's overall motion at any moment in time. You can stop the animation, back it up, and play it forward to observe in slow motion vibration phenomena that may have taken place very quickly. For example, you can observe the run up, coast down, or other transient behaviour of a machine. During this transition period, the machine may pass through a variety of vibrational states, due to resonances, imbalances, varying loads, fluid flow, etc.

Frequency Domain Animation

Frequency domain animation allows you to see how a structure behaves at a single frequency. While dwelling at a particular frequency, ME'scope animates the deflection shape of the structure using sinusoidal modulation. At or near one of its resonant frequencies, the deformation of a structure is usually dominated by a mode of vibration. With ME'scope, you can examine the difference between a resonance condition (a mode shape), and simple forced vibration (an ODS).

Sources of Shape Data

ODS or mode shapes can also be stored in a Shape table. Analytical mode shapes from a finite element model can be imported into a Shape table and compared with experimental results. Shapes can be compared analytically using the Modal Assurance Criterion (MAC) or by displaying them together in animation.

Digital Movies™

Digital Movies is a standard part of every ME'scope option. With this unique capability, you can document all ME'scope animation results with Windows AVI files and distribute them to your clients. Anyone with a PC running Windows, an Apple® Macintosh®, or a UNIX® system can play back the Digital Movie files and view the animations.

Shape Contours

Because ME'scope allows you to define surfaces on the structure model, contour lines (lines of equal deformation) or contour colour maps can be displayed during animation. Nodal lines (lines of no motion) are also displayed (see Fig. 4).

Interpolation Between Measured Points

Because of time and cost, usually only a small number of responses are measured on the surface of a structure. By interpolating between measured points, ME'scope provides more realistic animated pictures of a structure's deformations from relatively few measurements. With interpolation turned on, motions for all unmeasured points on the model are interpolated from motions at neighbouring measured points.

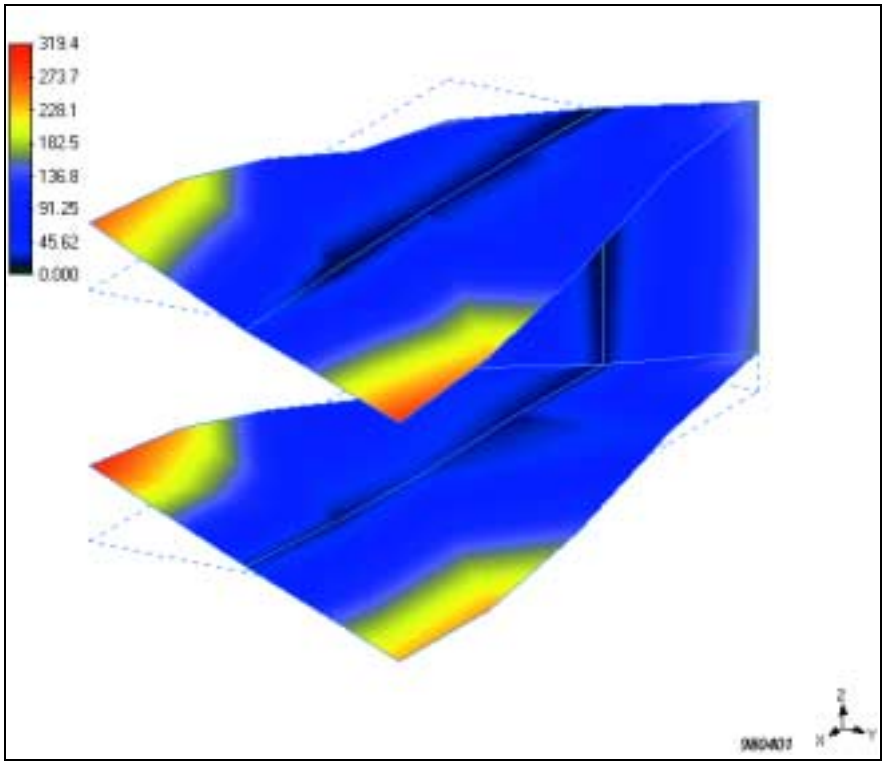

Fig. 4
Deflection shape contour map

ME'scopeVES Options

ME'scopeVES are MS® Windows-based applications that run in Windows 95/98, Windows 2000® or Windows NT®. ME'scopeVES can be purchased in several options. All options contain the same 3D model-building, display, and interactive animation features and come with Digital Movies, a unique ME'scopeVES feature for making and playing back movies of the animation. Each option has its own characteristcs:

Visual ODS: Import and display operating deflection shapes, mode shapes and engineering data shapes. Strong animation capability without any signal processing

Visual ODS Pro: All the features of Visual ODS, plus additional signal-processing features. FFT/IFFT, APS, PSD and ODS-FRF calculations, waveform integration/differentiation, Notch/Band windowing.

Visual Modal: All the features of Visual ODS Pro, plus modal-parameter estimation (SDOF and MDOF curve fitting) and FRF synthesis.

Visual Modal Pro: All the features of Visual Modal, plus Multiple Reference Curve Fitting and MIMO analysis.

Visual SDM: All the features of Visual Modal Pro, plus Structural Dynamics Modifications and Modal Sensitivity Analysis.

Multi-user Versions

All of the ME'scopeVES options can be purchased in multi-user versions. A multi-user version can be run on as many different computers as desired, without a security key.

Data File Translators

As a standard feature, ME'scopeVES can import from and export to PC disk data files in the following formats: ASCII spreadsheet, MATLAB™, DADiSP™, Microsoft WAV and Universal File Format (UFF). You can also order special file translators for importing data from most popular multi-channel FFT analyzers, data acquisition systems, recorders and portable data collectors.

Data Capacities

ME'scope can hold thousands of measurements, with thousands of samples per measurement, in memory. This data must be in memory in order to support interactive animation. Structure models can have thousands of points, lines and surfaces. ME'scope can also hold hundreds of shapes with thousands of degrees of freedom per shape.

Modal Analysis

Vibrant Technology, Inc., our source supplier of Modal Analysis has recently changed its product structure as follows:

- ❍ Brüel & Kjær Type 7754 G, ME'scopeVES Visual ODS, previously ME'scope Visual Shape
- ❍ Brüel & Kjær Type 7754 H, ME'scopeVES Visual ODS Pro, previously ME'scope Visual ODS
- ❍ Brüel & Kjær Type 7754 I, ME'scopeVES Visual Modal, new option
- ❍ Brüel & Kjær Type 7754 J, ME'scopeVES Visual Modal Pro, previously ME'scope Visual Modal
- ❍ Brüel & Kjær Type 7754 K, ME'scopeVES Visual SDM, new option

Specifications PULSE

Note: PULSE must be used with a version of Windows NT so, if both PULSE and the ME'scopeVES System are being used concurrently, the operating system must be Windows NT or Windows 2000.

PULSE SYSTEM REQUIREMENTS
- For direct use with ME'scopeVES using UFF for data transfer, PULSE v3.0 or later is required
- For use with PULSE Bridge to ME'scope, PULSE v5.2 with service pack 1, or later is required

COMPUTER REQUIREMENTS
- The PC requirements for PULSE, the Multi-analyzer System Type 3560 m
- Noise and Vibration Analysis Type 7700 must be installed

Specifications ME'scopeVES

COMPUTER REQUIREMENTS
Minimum computer requirements are:
- Pentium® class CPU
- 16 MB RAM
- 20 MB available hard drive space
- A mouse or other pointing device
- Microsoft Windows 95/98, Windows NT, Windows 2000

3D MODELLING SPECIFICATIONS
ME'scopeVES contains a variety of drawing tools for building 3D models for animation. Models can be drawn interactively by selecting and dragging drawing objects on the screen, or by editing properties in their spreadsheets. Objects, or portions of objects, can be cut, copied and pasted into drawings, making it easier to build complex models from simple substructures. ME'scopeVES also contains a palette of pre-built substructures which can be used to build models more quickly. ME'scopeVES also contains a Substructure Generator that can be used to rapidly generate structure models in rectangular, cylindrical, and spherical coordinates
- Quad View (3 × 2D views and a user-defined 3D view)
- Surface model with hidden line removal, dashed hidden lines, and colour fill
- Interactive drawing by selecting and dragging objects on screen
- Interactive sizing, shaping, and rotation of drawing objects
- SubStructure Generator rapidly builds structure models using Rect., Cyl., and Sph. coordinates
- Drawing Assistant quickly builds structures using rectangular, cylindrical, spherical and machine coordinates
- Substructure palette with pre-built models
- Tracing of structure outlines from digital pictures or drawings
- Cut, Copy and Paste of drawing objects
- Spreadsheets for editing properties of each type of drawing object
- Local coordinate axes (Rect., Cyl. Sph. and Machine coordinates), graphically oriented and displayed at each point
- Interactive point numbering

Specifications ME'scopeVES (continued)

- Point and measurement labels displayed on model
- Interactive zoom, pan, rotation, perspective
- Imports structure models from UFF, AutoCAD (DXF) and FEMAP files
- Spreadsheets for editing properties of each type of drawing object
- Local coordinate axes (Rect., Cyl. Sph. and Machine coordinates.), graphically oriented and displayed at each point
- Interactive point numbering
- Point and measurement labels displayed on model
- Interactive zoom, pan, rotation, perspective
- Imports structure models from UFF, AutoCAD (DXF) and FEMAP files

MEASUREMENT SPECIFICATIONS

ME'scopeVES is designed to work with your vibration data, no matter how you acquired it. Once imported, measurements can be viewed in a variety of display formats, including row/column, overlaid, strip chart, and cascade with colour fill under the graph, and colour selection for each trace

- Import of data from most popular single- or multi-channel analyzers, data acquisition systems, recorders, and portable data collectors
- Import and export of data in UFF, Spreadsheet, MATLAB, DADiSP, and MS WAV formats
- Displays up to 100 measurements in row/column, 10 in Strip Chart, an unlimited number in Overlay, Colour Map and Cascade formats
- Real, Imaginary, Magnitude (Linear, Log, Log dB), Phase, Bode (Magnitude and Phase), and CoQuad (Real and Imaginary), Nyquist (Real vs. Imaginary) and Nichols (Magnitude vs. Phase) plots
- Orbit Plots, one time trace versus another
- Spreadsheet for editing trace properties (select, show/hide, colour, bold lines, DOFs, units, labels, etc.)
- Grid lines, labels, DOFs, engineering units and cursor values displayed on each measurement
- Maximise vertical axis display
- Play button in spreadsheet, for playing sound of each trace using Windows Media Player
- Time and frequency domain Integration/Differentiation
- Waveform Cut, Copy and Paste
- Simultaneous FFT on all measurements in a file
- Notch and Band windows for removing unwanted data
- Computes PSDs, linear and auto power spectra from time waveforms, using (Hanning, Flat Top, Rectangular) windows, averaging, overlap processing
- Overall power, power in a band
- Auto, Relative, and Fixed vertical axis scaling
- Horizontal zoom with scrolling, vertical zoom
- Line, Peak and Band Cursors
- Linear and Log horizontal axis
- Print and Copy to Windows Clipboard
- Text font selection, window, trace background, fill, line and text colour selection

ANIMATION SPECIFICATIONS

ME'scopeVES can animate in Quad view, showing four views (3 2D views and a user defined 3D view) at once. ME'scopeVES has automatic interpolation, so that unmeasured points will animate realistically using data from neighbouring measured points. One of the most powerful features of ME'scopeVES is its ability to display the shapes of a structure in animation as you interactively move the Line or Peak cursor on your measurements. This capability allows you to view shapes directly from your data, without curve fitting or other processing

- Interactive animation directly from time or frequency domain measurements, in row/column, overlay, strip chart, or cascade format
- Interactive animation using Line, Peak, or Band cursor on measurements
- Animation of shapes by clicking on them in a Shape table
- Automatic interpolation of data for all unmeasured points using nearby measured data
- Animation in Quad view or a Single view
- Side by side and overlaid animated comparison of shapes from two sources (Data Blocks or Shape tables)
- Shape contour lines (including nodal lines), or contour colour fills on surfaces
- Combined animation of temperature, pressure, etc. with vibration or strain data
- Digital Movies™ (documentation of animation as MS AVI files)
- Frames windows shows 16 successive animation frames
- Display of maximum deflection points and shape values
- Interactive display of shape values at selected (monitored) points during animation
- On-screen rotation, elevation, continuous rotation controls
- On-screen speed and amplitude controls
- Animation in local or global X, Y, and Z directions
- Animation with deformation, arrows or text
- Animation with persistence
- Deformed and undeformed structure displayed together
- Print and Copy to Clipboard
- Hidden line display (invisible or dashed)
- Coloured surface fill display
- Auto, Relative and Fixed-shape scaling
- Normal and Shear strain, Min, Max, Average normal strain

MODAL ANALYSIS SPECIFICATIONS

ME'scopeVES has built-in curve fitters: Quadrature fit, Peak fit, an MDOF polynomial fitter, and complex exponential. The MDOF polynomial fitter has proven to be one of the most reliable methods for estimating modal parameters

- Interactive curve fitting of selected modes and measurements
- On-screen buttons for all curve-fitting operations
- Curve fits FRFs, linear and cross-power spectra
- Display of all measurements, fit functions, and modal parameters from memory
- Mode Indicator: Modal Peaks Function with peak counter
- Spreadsheet for viewing and editing of modal parameters from each measurement
- SDOF, Co-Quad, Magnitude and Peak curve fitters
- MDOF Rational Fraction Polynomial curve fitter with easy Quick Fit command requirinf minimal user interaction
- Automatic compensation for residual modes
- Fit function display and storage with measurements
- Sum of Magnitudes function (from real, imaginary or magnitude data)
- Modes indicated and highlighted on Sum of Magnitudes display
- Modal frequencies and damping overlaid and highlighted on Mode Indicator graph
- Synthesises entire FRF matrix from modal parameters
- Modal Assurance Criterion (MAC)
- Import and Export of FEA and modal data in UFF and FEMAP formats
- Exponential window for removing noise or sharpening resonance peaks in measurements

MIMO (FORCED RESPONSE ANALYSIS) SPECIFICATIONS

MIMO analysis computes FRFs from multiple Inputs and Outputs, multiple Outputs from FRFs and Inputs, and multiple Inputs from FRFs and Outputs. MIMO can be used to compute FRFs, transmissibilities, and ODS FRFs from time domain data, using

windows, spectrum averaging, and overlap processing, or directly from Cross and Auto Power Spectrum measurements

Outputs from FRFs and Inputs: Time or frequency Output waveforms are computed from Inputs and FRFs. Elements of the FRF matrix can be obtained from measurements, or synthesized from modal parameters. The resulting Output waveforms, (the forced response) can be displayed in animation on a structure model

Inputs from FRFs and Outputs: Starting with multiple Outputs and an FRF matrix, the Input waveforms required to yield the Outputs can be computed. This capability is useful for computing the forces necessary to cause measured responses

- Calculates multiple forced responses (time or frequency waveforms) from modes or FRFs and excitation forces
- Calculates ODSs from modes and excitation forces
- Calculates multiple excitations (time or frequency waveforms) from FRFs and structural responses
- Computes FRFs, Transmissibilities, and Coherences from multiple Input and Output time waveforms, using (Hanning, Flat Top, Rectangular, Force or Exponential) windows, averaging, overlap processing, or directly from Auto and Cross Power Spectra
- MDOF Complex Exponential curve fitter for frequency and damping estimates
- Stability diagram, graphical display of frequencies and damping for a range of model sizes (number of modes)
- CMIF (Complex Mode Indicator Function) and MMIF (Multivariate Mode Indicator Function), indicate closely coupled modes and repeated roots
- Multiple reference curve fitting
- Modal Assurance Criterion (MAC)
- Mode shape complexity plot
- Computes ODS FRFs from time or frequency domain operating data
- Computes multiple Outputs (time waveforms or linear spectra) from FRFs and Inputs
- Computes multiple Inputs (time waveforms, or linear spectra) from FRFs and Outputs

STRUCTURAL MODIFICATIONS SPECIFICATIONS

ME'scopeVES contains a variety of standard finite element modelling (FEM) elements for simulating more realistic modifications to a structure. Beams, plates, and rod elements, as well as solid elements (tetrahedra, prisms, and bricks) can be added to a structure model to simulate physical modifications. ME'scopeVES displays all modification elements on the structure model. The physical properties of each element type are displayed in a spreadsheet, making them easy to view and edit

Modal Sensitivity Analysis: ME'scopeVES has a unique Modal Sensitivity Analysis, with which you can search for the optimum element modifications required to change modal parameters to specific values

Element Modes: ME'scopeVES also allows you to solve for the modes of the modification elements themselves. This command allows you to populate a structure with finite elements, and solve for its modes. This simple finite element analysis (FEA) capability is useful for finding the modes of many types of test structures

- Interactive graphical addition of modification elements to the structure model
- Displays modification elements on the structure model
- Point mass, linear spring and linear damper elements
- Rod and beam elements
- Triangular and quadrilateral plate elements
- Tetrahedron, prism, and brick solid elements
- Solves for modes of simple finite element models
- Separate property spreadsheet for each type of finite element
- Modal Sensitivity Analysis
- Substructuring
- Tuned Absorber (mass, spring, damper element)
- Mode Shape Scaling using a known modification

Ordering Information Type 7754

7754 G	Brüel & Kjær ME'scopeVES Visual ODS[1]
7754 H	Brüel & Kjær ME'scopeVES Visual ODS Pro[1]
7754 I	Brüel & Kjær ME'scopeVES Visual Modal[1]
7754 J	Brüel & Kjær ME'scopeVES Visual Modal Pro[1]
7754 K	Brüel & Kjær ME'scopeVES Visual SDM[1]

Software Functionality Expansion

BZ 5286 A	Software Functionality Expansion from Brüel & Kjær ME'scopeVES-ODS to Brüel & Kjær ME'scopeVES-MODAL
BZ 5287 A	Software Functionality Expansion from Brüel & Kjær ME'scopeVES-MODAL to Brüel & Kjær ME'scopeVES-SDM
BZ 5288 A	Software Functionality Expansion from Brüel & Kjær ME'scopeVES-ODS to Brüel & Kjær ME'scopeVES-SDM

1.NOTE: All ME'scopeVES™ software is developed by Vibrant Technology, Inc. Jamestown, California, USA.

Ordering Information Type 7755 A

7755 A	Brüel & Kjær PULSE Bridge to ME'scope Software

Brüel & Kjær reserves the right to change specifications and accessories without notice

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