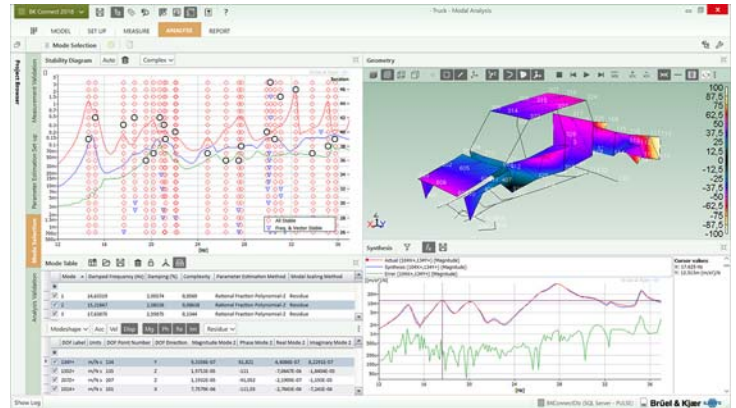


BK Connect Structural Dynamics

## Modal Analysis Type 8420, Modal Analysis (advanced) Type 8420-A and Geometry Type 8410

*BK Connect™ Modal Analysis is an easy-to-use post-processing application that enables you to perform single and polyreference Classical Modal Analysis even in the most demanding situations by using a targeted set of best-in-class mode indicator functions, curve-fitters and validation tools. Accurate results are quickly obtained by following an intuitive, yet flexible workflow process that guides you efficiently through measurement validation, parameter estimation setup, mode selection, analysis validation and reporting.*

*With a BK Connect Structural Measurements and/or Advanced Sine Measurements licence, geometry-guided hammer and shaker measurements can be performed. Setup and measurement tasks are embedded in the Modal Analysis interface, creating a fully integrated solution for modal measurements and analysis.*



### Uses and Features

#### Uses

- Single and polyreference classical modal analysis from measured frequency response functions (FRFs)
- Estimation of modal parameters to be used for finite element (FE) model correlation and updating, design verification, benchmarking, quality control and troubleshooting
- Test planning using finite element analysis (FEA) results
- Integrated solutions together with the following software:
  - From measurement to FEM correlation: With BK Connect Structural Measurements Type 8411, Advanced Sine Measurements Type 8412 and Correlation Analysis Type 8421
  - From measurement to analysis: With BK Connect Structural Measurements Type 8411 and/or Advanced Sine Measurements Type 8412
- Open, stand-alone application with your existing data acquisition system

#### Features

- Efficient workflow with just a few steps to perform a complete modal analysis
- Quick searching, sorting and filtering of large amounts of data
- Easy-to-use and powerful geometry drawing tools using built-in CAD models
- Import of geometry in standard formats, including FE models
- Animation of FE models for test planning and validation
- Selection and validation of test nodes from FE models for test planning
- Decimation of FE models to test models

- Display of selected FRFs from excitation/response DOFs on geometry
- Function-based animation for validation of test setup
- Normal mode indicator function (NMIF), power mode indicator function (PMIF), complex mode indicator function (CMIF), multi-variate mode indicator function (MMIF)
- SDOF curve-fitters: Least squares global partial fraction and quadrature picking
- MDOF curve-fitters: Rational fraction polynomial-Z, poly-reference frequency, polyreference time, eigensystem realization and alias-free polyreference
- Global solve curve-fitters for modal parameter estimation in cases of consistent FRF data
- Local solve curve-fitters for modal parameter estimation in cases of inconsistent FRF data
- Clear stability diagrams for improved overview and straightforward mode selection
- Enhanced mode solution for clear stability diagrams
- Cluster diagrams and pole density diagrams for optimal curve-fitting and mode selection
- Automated mode selection using your preferred curve-fitter
- FRF synthesis including error function and frequency response assurance criteria (FRAC)
- Complexity plots, AutoMAC and CrossMAC tables and 3D plots for validation of mode shape complexity and correlation
- CoMAC geometry plots for comparing paired modal models
- Integrated Microsoft® Office reporting capabilities

BK Connect is the latest addition to Brüel & Kjær’s platform of software products. It provides real-time measurements, analysis and test-FEA integration in a modern, intuitive GUI environment and is the culmination of extensive customer surveys to resolve their most important issues when analysing sound and vibration data.

BK Connect provides:

- Enhanced usability for high productivity with an intuitive user interface that puts the tools you need at your fingertips. The graphical user interface is built around a workflow model that leads you easily through any test setup, measurement and analysis process
- Open data policy that supports a wide range of native and third-party formats for improved import and export of data
- Consistent user interface throughout all applications encouraging faster learning of new applications

BK Connect Structural Dynamics allows you to observe, analyse and document the dynamic behaviour of structures using a single software platform covering setup, measurements, analysis and test-FEA integration. With BK Connect Structural Measurements, you can set up and perform single or poly-reference hammer and shaker measurements, whereas BK Connect Modal Analysis provides accurate and reliable results even in the most demanding situations using a targeted set of best-in-class mode indicator functions, curve-fitters and analysis validation tools.

BK Connect ODS Analysis adds time and spectral ODS measurement and analysis. The time ODS measurements can also be used for operational modal analysis (OMA) in PULSE OMA.

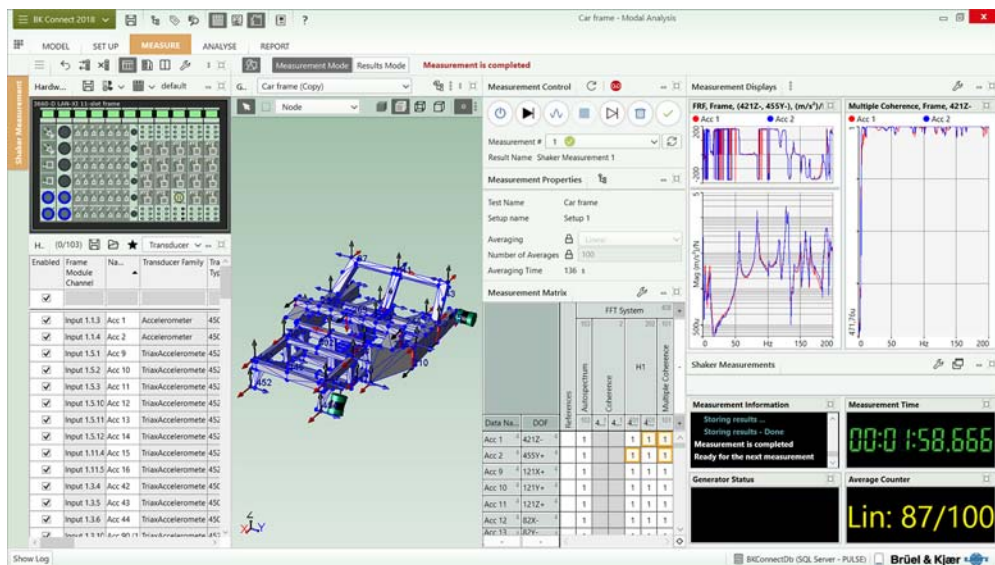
BK Connect Correlation Analysis adds the capability of correlating two modal models, for example, finite element model versus test model using tools such as Geometry Alignment, CrossMAC and Cross-orthogonality calculations.

The open data policy behind the BK Connect Structural Dynamics suite also allows the post-processing applications to be used as stand-alone applications together with your existing measurement and analysis system.

**Measurement and Integration**

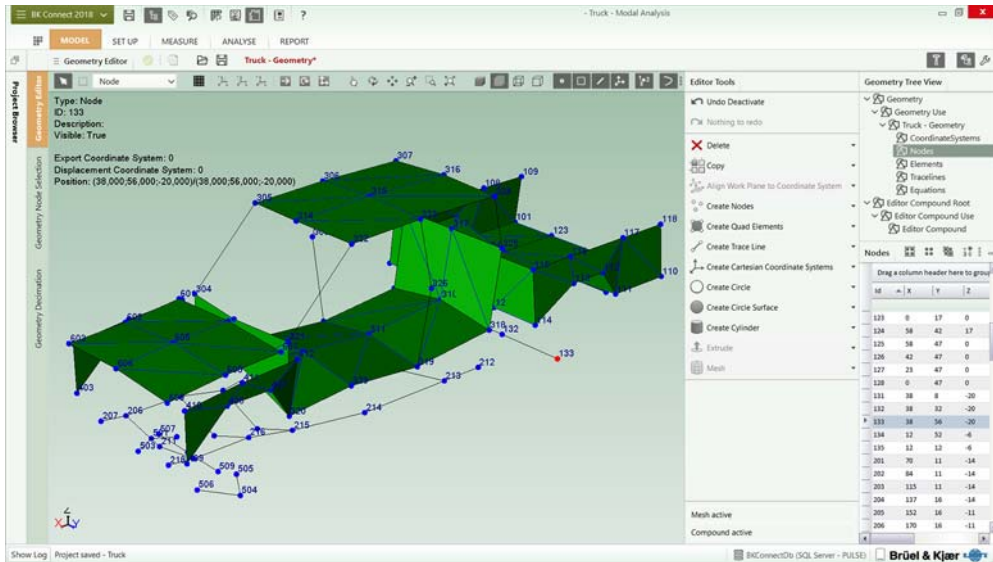
Structural Measurements – Hammer and Shaker Type 8411 contains tasks for setup and measurement to perform hammer and shaker testing. And with the addition of Advanced Sine Measurements Type 8412, tasks for setup and measurement are available for stepped sine testing. All tasks are fully embedded into BK Connect Modal Analysis – creating a single application for modal setup, measurement and analysis. Measurement setup, execution and validation can be performed manually, table-based or geometry-guided.

**Fig. 1**  
Shaker Measurements task with easy setup and monitoring of time and frequency functions



With BK Connect Modal Analysis, geometries can be created from scratch using the embedded drawing tools. You can work with various elements like points, lines, triangular or quad surfaces and you can create 2D and 3D CAD models and mesh them. The geometry can also be created from table entries.

**Fig. 2**  
**Geometry Editor.**  
 Geometries can be created using basic drawing elements, meshed CAD models or in tabular form

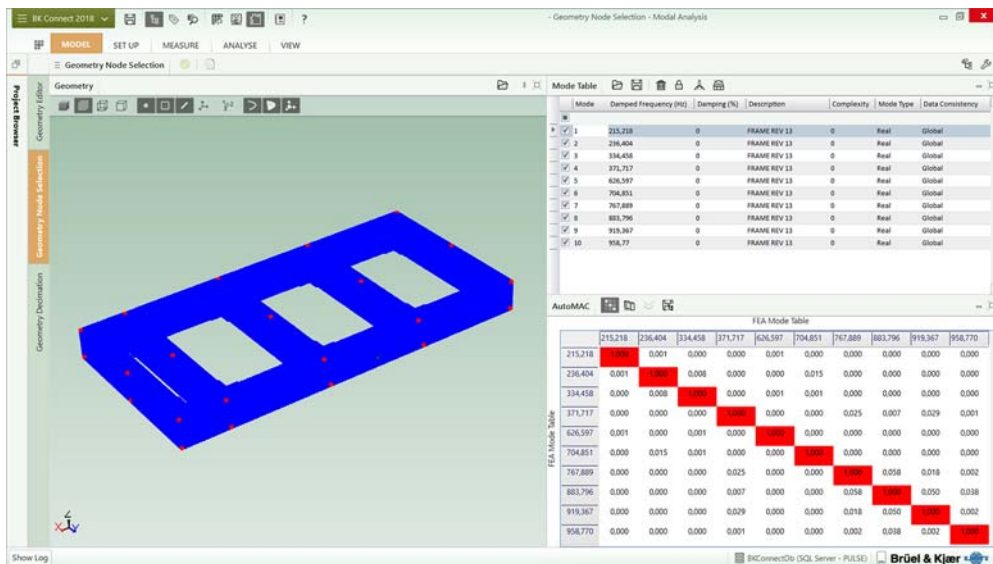


Alternatively, import a geometry in standard data formats like UFF and CSV. Measurement DOFs contained in the measurement files are automatically added to and shown on the geometry in subsequent tasks.

Finite element (FE) models can be imported and used in BK Connect Modal Analysis for test planning and validation.

- Animate FE models to investigate frequency range of interest, mode density/order, critical modes, etc.
- Based on the animations, select optimal excitation and response locations for modal testing
- Select test node locations on an FE model until a satisfactory finite element AutoMAC is created
- Decimate FE models to test models for modal testing
- Compare test results with FEA results

**Fig. 3**  
**Geometry Node Selection.**  
 By selecting nodes on a FE model, you can investigate how the AutoMAC builds up for the reduced geometry consisting of the selected nodes (highlighted)



Selecting nodes on a FE model helps determine which nodes on the FE model to include in a test geometry to identify and separate the modes of interest. The geometry with highlighted nodes is automatically loaded into the Geometry Decimation task for connecting the selected nodes with tracelines and/or elements.

By logically grouping features and display of results, BK Connect Modal Analysis allows you to do a complete modal analysis in just four main steps:

- Measurement Validation
- Parameter Estimation Setup
- Mode Selection
- Analysis Validation

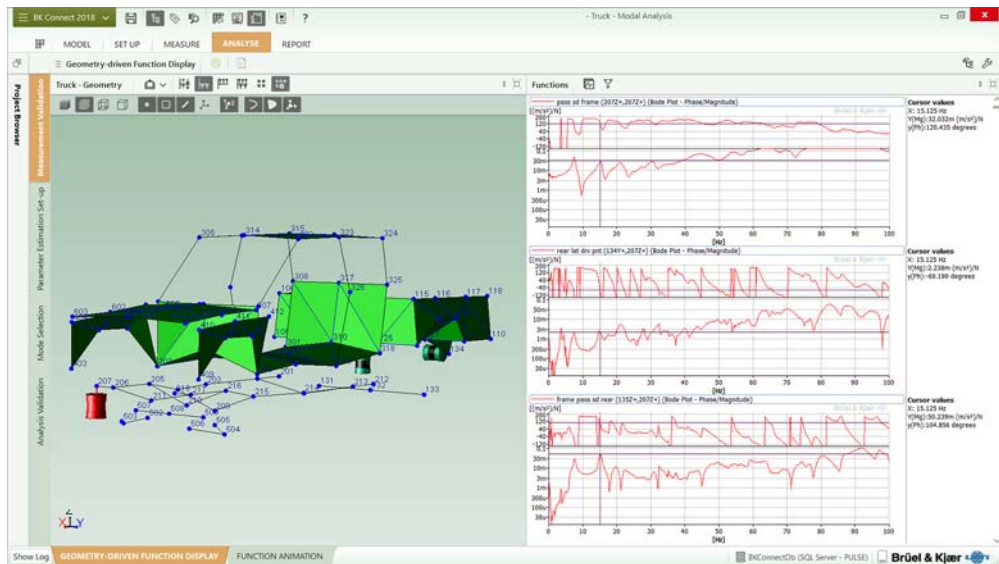
In addition, a User-defined Displays task is available, and extensive live reporting can be done in Microsoft® Word, Excel® or PowerPoint® at any time in the analysis using integrated reporting functions.

**Measurement Validation**

The Measurement Validation task is used to check the quality of the measurement data prior to performing the modal parameter extraction. Functions like ordinary and multiple coherence, reciprocity and driving point FRFs, or all FRFs from selected references can easily be shown by simply dragging the functions from the Project Browser.

The Geometry-driven Function Display provides a graphical tool that allows you to select on the geometry the DOFs that are to be used for the displayed function types. Data can also be sorted and filtered in a table to easily select individual functions to be displayed.

**Fig. 4**  
Measurement Validation.  
In the Geometry-driven Function Display, functions are selected by clicking on the desired excitation and response DOFs on the geometry. In this example, the FRFs are those related to the shaker at the front. You can easily scroll up and down to view all selected FRFs related to this shaker



For validation of test setups, such as identifying cable breaks and faulty and incorrectly mounted transducers, animations can be done based on FRFs. For structures with lightly damped and well-separated modes, the FRF shapes will resemble mode shapes.

Operating deflection shapes (ODS) from phase-assigned spectra can also be shown and saved, for example, to compare with mode shapes.

With Time ODS Option Type 8410-B installed, a dedicated Time ODS task is available.

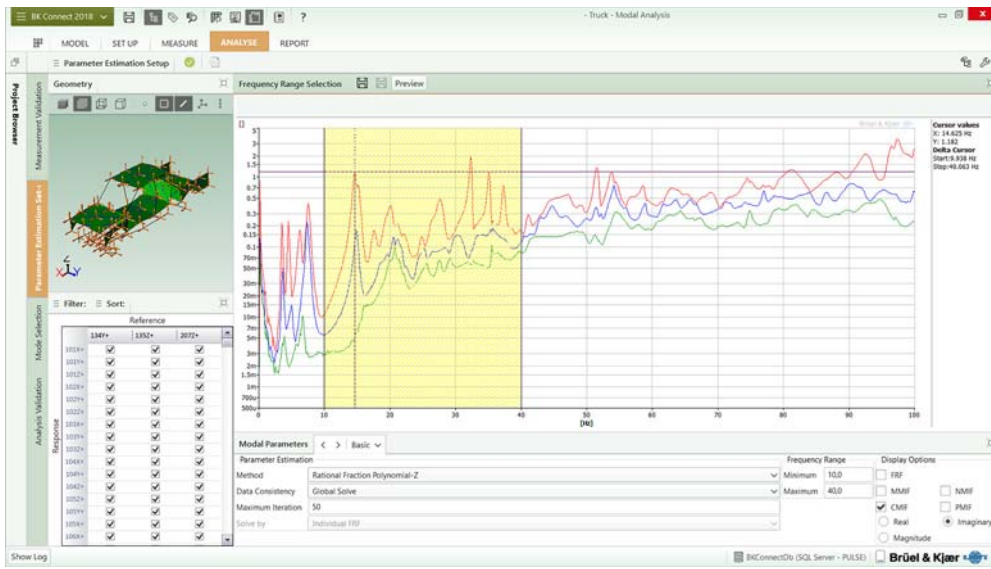
**Parameter Estimation Setup**

The Parameter Estimation Setup task is where you prepare and execute the curve-fitting. FRF data to include in the analysis are easily filtered, sorted and then selected using the Data Matrix Selector table. In the same screen layout, the geometry with DOF information is shown together with a graph area for investigating potential modes using different mode indicator functions. Various SDOF and MDOF curve-fitters can be selected and the frequency range of interest can be set, including the time range, when using time domain curve-fitters. Both global and local solve curve-fitters are available.

Previews of the stability diagram for the different curve-fitters aid in the selection of the preferred curve-fitter for the task. To assist in this, powerful tools like cluster diagrams and pole density plots are also available.

The unique enhanced mode solution algorithm provides very clear stability diagrams, making it easy to discriminate true physical modes from non-physical modes.

**Fig. 5**  
Parameter Estimation Setup. Prepare and preview curve-fitting. This example shows the CMIF

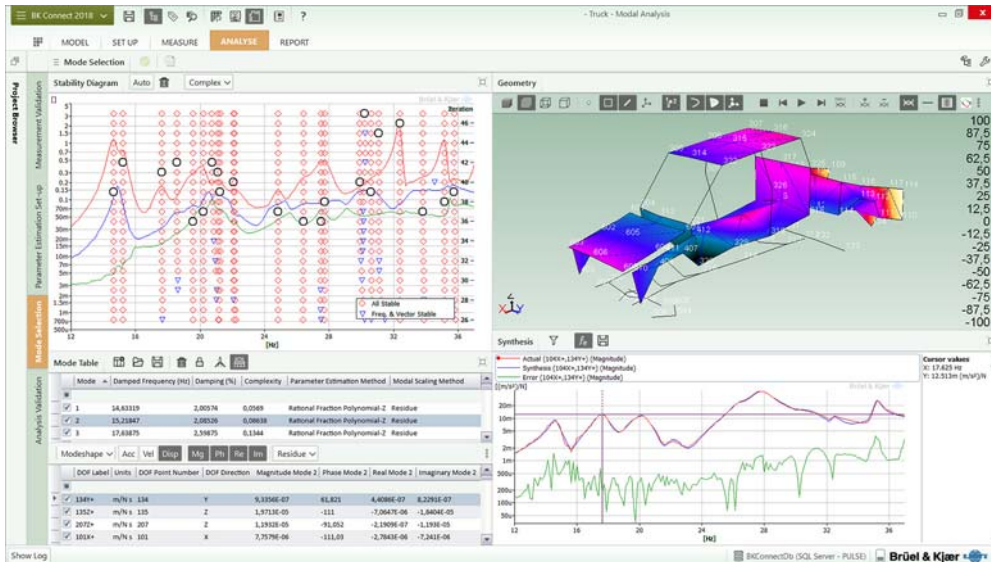


The powerful set of mode indicator functions and curve-fitters gives you the best possible tools in any given situation whether weakly excited modes, heavily damped modes, repeated roots or inconsistent FRF data are present.

### Mode Selection

In the Mode Selection task, the modal results are shown in terms of natural frequency, damping ratio, mode shape animation and synthesis of FRFs. Once a mode is selected using one of the stability diagrams (with MDOF curve-fitters) or FRFs (with SDOF curve-fitters), it will immediately show up in the Mode Table, the mode will be animated and the synthesized FRFs will be compared to the measured ones.

**Fig. 6**  
Mode Selection. Modes selected are shown in the mode table, animated, and the FRFs synthesized. In this example, automated mode selection was applied. The enhanced mode solution algorithm provides clear stability diagrams



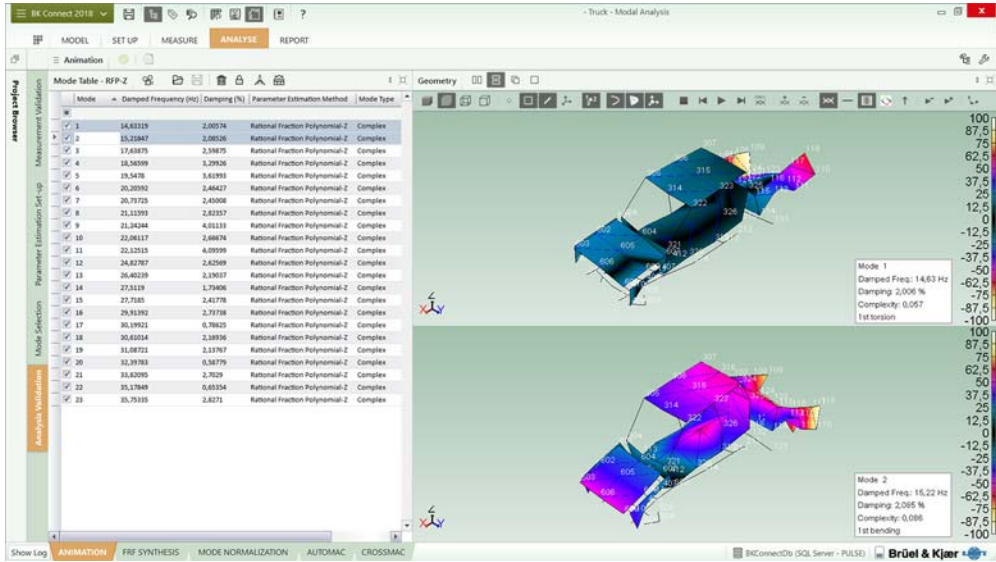
Automated mode selection is supported for fast preliminary investigations of unknown structures or when conducting repetitive testing. It also eliminates the potential risk of user-dependent results. Automated mode selection works for all MDOF curve-fitters by indicating the modes in the stability diagrams, populating the Mode Table, animating the first mode and showing the synthesis functions.

The Mode Selection task provides full flexibility for selection and comparison of modes from different curve-fitting methods for creation of the best possible modal model.

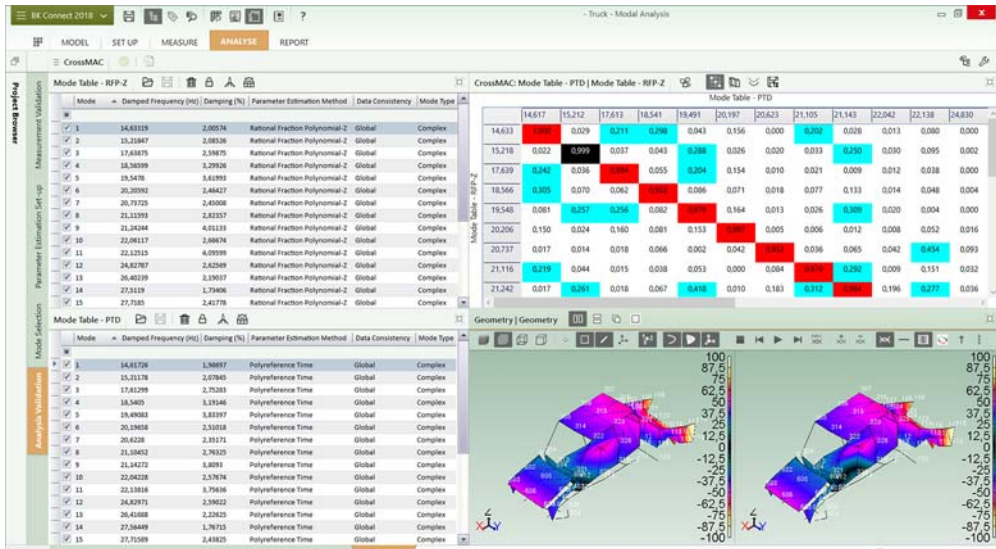
## Analysis Validation

The Analysis Validation task supplies you with a number of tools for further investigation of the obtained modal results for maximum confidence in your obtained modal model. This includes FRF Synthesis, Mode Shape Animation, AutoMAC and CrossMAC tables and 3D plots, CoMAC geometry plots and Complexity plots. Modes can be normalized to non-complex values (normal modes) for comparison with real-valued FE modes.

**Fig. 7**  
Analysis Validation.  
Side-by-side  
animation of first  
torsional and bending  
modes

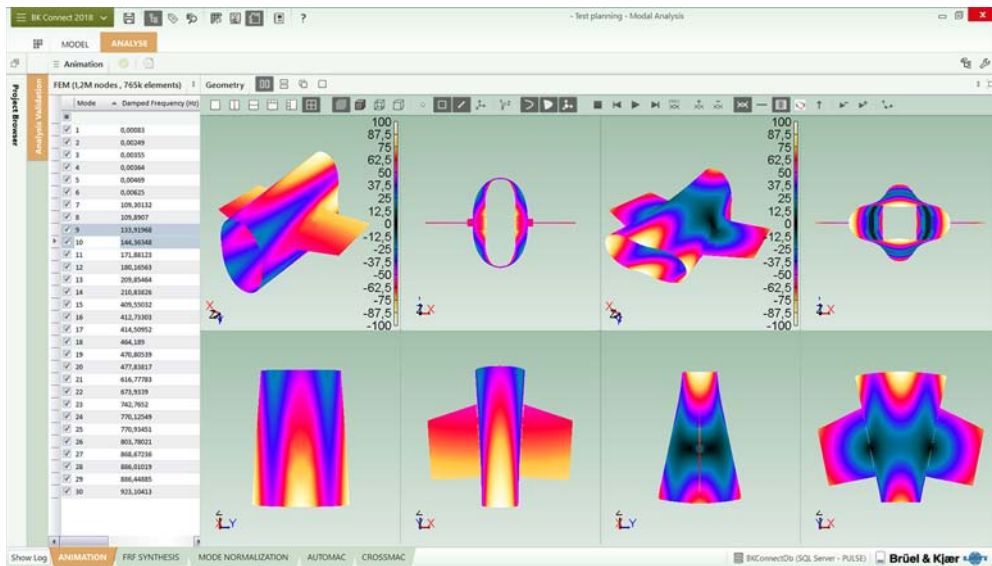


**Fig. 8**  
Analysis Validation.  
CrossMAC comparing  
the mode shapes  
found using the  
Rational Fraction  
Polynomial-Z and  
Polyreference Time  
curve-fitters. The  
mode pair selected is  
automatically  
animated



The Analysis Validation task can also be used to animate FE models for test planning or validation.

**Fig. 9**  
 Quad View colour  
 contour animation of  
 two mode shapes  
 from a MSC Nastran  
 FE model with more  
 than 1 million nodes



### Reporting

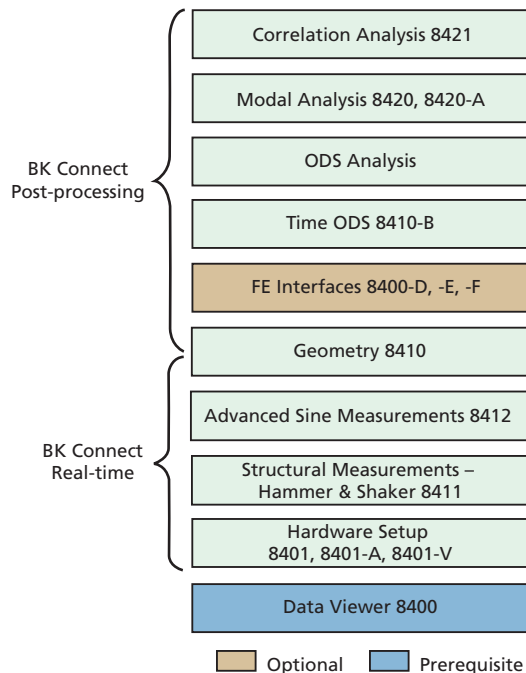
The Report task enables reports to be prepared in parallel with the analysis process, linking important results as they are produced. Store geometries, displays, tables and text in the Project Browser as report elements and generate the report when you are ready. Reports can be based on standard embedded or customized templates you define, or on-the-spot. High-quality, active or static reports are easily created directly in Microsoft® Word, Excel® or PowerPoint®.

### User-defined Displays

The User-defined Displays task enables you to create customized layouts consisting of graphs, geometries (with or without animation), shape tables, MAC tables/plots and complexity plots. Data can be linked between displays in the layout so that source data in one display is reflected in a result display. For example, when linking a mode table to a geometry, changes to the mode table will be automatically updated in the geometry. This allows for fast and flexible data viewing and ad hoc analysis.

## Product Structure

**Fig. 10**  
 BK Connect structural  
 dynamics product  
 structure – from setup  
 and measurements to  
 analysis and test-*FEA*  
 integration



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## Core Applications

### *BK Connect Data Viewer Type 8400*

BK Connect Data Viewer provides the framework, including BK Connect database, Project Browser, reporting, Notes and help system. This module must be installed to run most BK Connect applications.

### *BK Connect Hardware Setup Type 8401*

This is a prerequisite for measurements in BK Connect. It provides the Hardware Matrix, the HW Setup Table and Monitor including a built-in monitor recorder as well as the Transducer Manager and Transducer Verification tasks. Up to two LAN-XI data acquisition modules are supported.

### *BK Connect Hardware Setup (advanced) Type 8401-A*

Adds support of more than two LAN-XI data acquisition modules and Accelerometer Mounting Check, Brüel & Kjær's patented method of validating the mounting of your accelerometers and thus the integrity of the measurement chain.

### *BK Connect Virtual Hardware Setup Type 8401-V*

This free software makes it possible to set up your hardware without having it connected thereby freeing it up for other purposes.

For more information on BK Connect Data Viewer Type 8400/8400-A, Hardware Setup Type 8401/8401-A and Virtual Hardware Setup Type 8401-V, see product data [BP 0005](#).

## Measurement and Modelling Applications

### *BK Connect Structural Measurements – Hammer and Shaker Type 8411*

Adds dedicated setup and measurements tasks for hammer and shaker testing, including measurements for MIMO analysis. Geometry-guided measurement setup, execution and validation is supported.

### *BK Connect Advanced Sine Measurements Type 8412*

Type 8412 adds dedicated setup and measurement tasks for single and multi-shaker stepped sine testing. Geometry-guided measurement setup, execution and validation is supported.

### *BK Connect Geometry Type 8410*

Geometry allows the importation and creation of geometries and is used across the various BK Connect Structural Dynamics solutions. FE models can be imported using UFF and decimated to test models.

A variety of animation types are supported including wire frame, surface contour, point and arrow animation as well as overlaid, difference, top-bottom, and side-by-side animation in single-, dual- or quad-view format. The animations can be recorded as GIF files or AVIs and included in Word and PowerPoint® reports.

For more information on BK Connect Structural Measurements – Hammer and Shaker Type 8411, Advanced Sine Measurements Type 8412 and Geometry Type 8410, see product data [BP 1524](#).

## Modal and ODS Analysis Applications

### *BK Connect Modal Analysis Type 8420*

An application designed for single-reference modal analysis with a basic, yet comprehensive, set of mode indicator functions (MIFs), curve-fitters and analysis validation tools. For use with single shaker FRF data and single-reference hammer testing data.

Modal Analysis includes:

- Mode indicator functions: Normal MIF (NMIF) and Power MIF (PMIF)
- Curve-fitting:
  - SDOF: Least Squares Global Partial Fraction, Quadrature Picking
  - MDOF: Polyreference Time, Polyreference Frequency – limited to one reference
  - Global solve curve-fitting
  - Local solve curve-fitting (Polyreference Time)
  - Stability diagram with Enhanced Mode Solution (Polyreference Time)
  - Advanced stabilization diagrams: Cluster diagram and Pole Density plot
  - Automated mode selection
- Analysis validation: AutoMAC, CrossMAC, Complexity plot and CoMAC geometry plot



### *BK Connect Modal Analysis (advanced) Type 8420-A*

Adds polyreference modal analysis capabilities and advanced MIFs, curve-fitters and analysis validation tools to the Modal Analysis application. For use with shaker MIMO (multiple-input multiple-output) FRF data, polyreference hammer testing data or for advanced analysis and validation of both single and polyreference data.

Modal Analysis (advanced) adds:

- Geometry Node Selection task
- Mode indicator functions: Complex MIF (CMIF) and Multi-variate MIF (MMIF)
- Curve-fitting:
  - MDOF Curve-fitters: Polyreference Time and Polyreference Frequency (no reference limitations), Rational Fraction Polynomial-Z (RFP-Z), Eigensystem Realization and Alias-Free Polyreference (AFPoly™)
  - Local solve curve-fitting (RFP-Z)
  - Stability diagram with Enhanced Mode Solution (RFP-Z)
- Analysis validation: Complexity plot and CoMAC geometry plot

### *BK Connect ODS Analysis*

With Type 8400 and Type 8410 licences installed, a BK Connect ODS Analysis application is available for frequency-based spectral ODS post-processing analysis or for viewing modal analysis results.

BK Connect Time ODS Option Type 8410-B adds a dedicated task for Time ODS analysis. Results can be converted between acceleration, velocity and displacement and shown as peak, peak-peak or rms using SI or imperial units.

For more information on BK Connect ODS Analysis including Time ODS Option Type 8410-B, see product data [BP 0018](#).

### **Test-FEA Integration Applications**

#### *BK Connect FE Interfaces Types 8400-D, -E, -F*

FE Interfaces enable you to import FE models from Nastran, Ansys and Abaqus.

#### *BK Connect Correlation Analysis Type 8421*

Correlation Analysis adds the ability to correlate two modal models: FEM vs Test, Test vs Test or FEM vs FEM. For more information, see product data [BP 2577](#).

## Complete Measurement Chain

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With Brüel & Kjær's complete and fully integrated measurement chain, including accelerometers, impact hammers, force transducers, modal exciter systems, data acquisition front ends and measurement and post-processing software, you can select the optimal solution for your structural dynamics needs. The openness and flexibility of BK Connect Structural Dynamics applications support your needs today and in the future. You are never limited to a vendor-specific system configuration and can easily assemble the system of your choice.

## Specifications – BK Connect Modal Analysis

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### **SYSTEM REQUIREMENTS**

- BK Connect 2018.1 or later
- The following BK Connect™ applications:
  - BK Connect Data Viewer Type 8400
  - BK Connect FE Interface Types 8400-D, -E and -F: To import Nastran, Ansys and Abaqus FE models and results, respectively
  - BK Connect Geometry Type 8410: For all geometry functionality
  - BK Connect Modal Analysis Type 8420: To run Type 8420-A
  - BK Connect Structural Measurements Type 8411: For hammer and shaker measurements
  - BK Connect Advanced Sine Measurements Type 8412: For stepped sine measurements
- Microsoft® Windows® 10 Pro or Enterprise (x64) with either Current Branch (CB) or Current Branch for Business (CBB) servicing model; or Windows® 7 Pro, Enterprise or Ultimate (SP1) (x64) operating systems
- Microsoft® Office 2016 (x32 or x64) or Office 2013 (x32 or x64)

- Microsoft® SQL Server® 2014 Express (SP2) (included in installation), SQL Server® 2014 (SP2), SQL Server® 2012 R2, SQL Server® 2008 or 2008 R2 Express Edition SP1

### **RECOMMENDED PC FOR USE WITH FE MODELS**

- Intel® Core™ i7, 3 GHz processor or better
- 32 GB RAM
- 480 GB Solid State Drive (SSD) with 20 GB free space, or better
- 1 Gbit Ethernet network\*
- Microsoft® Windows® 10 Pro or Enterprise (x64), CB
- Microsoft® Office 2016 (x32)
- Microsoft® SQL Server® 2014 (SP2)
- Screen resolution of 1920 × 1080 pixels (full HD)

This will support FEM import, visualization and animation of models up to 1 M nodes

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\* A dedicated data acquisition network (LAN or WAN) is recommended; a network that only handles data from the front end improves the stability of the data

## Data Input

- Requires FRF data as input for the curve-fitting process
- Can be acquired using BK Connect Structural Measurements
- Measurement data and geometry seamlessly transferred from PULSE LabShop Modal Test Consultant (modal analysis) or from PULSE LabShop ODS Test Consultant (ODS analysis)
- Standard measurement data formats: UFF type 58 (Binary & ASCII), UFF type 1858 (damping correction)
- Test for I-deas data: Function (.afu) and shape (.ash) files

## Geometry Creation, Import, Node Selection and Decimation

Requires BK Connect Geometry Type 8410

### GEOMETRY CREATION AND EDITING

- Basic geometries using nodes, trachelines, triangle and quad elements
- Geometries based on built-in CAD models:
  - Curves: Circle, Circular Arc, Ellipse, Elliptical Arc, Hyperbolic, Parabolic, Line, Polyline, Interpolation Spline and Control Points Spline
  - Surfaces: Circular, Circular Arc, Ellipse, Elliptical Arc, Hyperbolic, Parabolic, Triangular, Rectangular, Polygon, Interpolation Spline and Control Points Spline
  - Solids: Cylinder, Hemisphere, Sphere, Box, Cone and Conical Frustum
- CAD models with selectable colour and transparency
- Move (translate, rotate) and copy (linear, radial) operators for CAD models and meshes using interactive handles or manual entry
- Definition of locations with three directions on a CAD model (Sites)
- Definition of locations with three directions on a CAD model (Sites)
- Meshing of CAD models
- Extrusion of CAD models: Curves can be extruded to surfaces. Plane surfaces can be extruded to solids. Preselection of colour is available
- Hierarchical geometry tree view with subfolders for Coordinate Systems, Nodes, Elements, Trachelines and Equations
- Tables for Coordinate Systems, Nodes, Elements, Trachelines and Equations with sorting, filtering, multiple selection and editing
- Support of Cartesian, Cylindrical and Spherical coordinate systems. Local and Global coordinate systems
- Automated point numbering. Partial or complete semi-automated point renumbering
- Visual link between selections in Geometry 3D View and Geometry Tree

### GEOMETRY IMPORT FORMATS

UFF data set types 15, 18, 82, 2411 or 2412, Microsoft® Excel® (\*.csv), UFF, Nastran (MSC, NX, NEI), Ansys and Abaqus FE models (requires Type 8400-D/E/F)

### GEOMETRY EXPORT FORMATS

UFF data set types 15, 18, 2412 or 82, and Microsoft® Excel® (\*.csv)

### GEOMETRY NODE SELECTION (Modal Analysis (advanced) only)

Select test node locations on a FE model until a satisfactory FE AutoMAC is created.

A-set nodes from an imported Reduced Mass Matrix or Reduced Stiffness Matrix from MSC Nastran (.op2) are automatically selected for validation and potential modification.

Nodes selected are automatically high-lighted in the Geometry Decimation task for connection with trachelines and/or elements

### DECIMATION

Imported FE models can be decimated to test models by manually selecting nodes on the FE model or by entering the nodes directly in a table. Selected nodes can be connected with trace lines and/or elements

### DYNAMIC POINT NUMBERING

Show more point numbers (IDs) when zooming in on parts of the geometry (user-definable) – also during animation

### GEOMETRY VIEWS

- Single, Side-by-Side, Top-Bottom and various Quad views
- Definition of front, back, left, right, top and bottom view axis
- Isometric view

- Perspective, orthographic and stretched projections of geometry
- Hidden lines and transparency
- Pan, zoom and rotate options for viewing geometries
- Symbols for shaker, impact hammer, force transducer and accelerometer positions shown on geometry with customized colours and sizes

### CUTTING PLANES

Cut through a geometry in three user-definable 2D planes to view the interior or exclude viewing parts of the geometry – also during animation

### ANIMATION

- Deformed and undeformed animation with Max. Deformation
- Single, overlaid and difference animation
- Wireframe, contour (solid/solid edge), points and arrow animation
- Animation of non-measured DOFs using interpolation equations
- GIF and AVI file generation with selectable codec

### Measurement Validation

Requires BK Connect Geometry Type 8410

**Geometry-driven Function Displays:** Show FRFs based on selected excitation and response DOFs on the geometry

**Function Animation:** Animate geometry using, for example, FRFs or PAS (ODS). Saving of shapes in Shape Table

### Parameter Estimation Setup

#### FUNCTION SELECTOR

Selection of FRF data to be included in curve-fitting

#### MODE INDICATOR FUNCTIONS

**Modal Analysis:** Normal Mode Indicator Function (NMIF) and Power Mode Indicator Function (PMIF)

**Modal Analysis (advanced):** Complex Mode Indicator Function (CMIF) and Multi-variate Mode Indicator Function (MMIF)

#### CURVE-FITTERS

**Modal Analysis:**

- SDOF: Least Squares Global Partial Fraction, Quadrature Picking
- MDOF: Polyreference Frequency and Polyreference Time (with single reference)

**Modal Analysis (advanced):** MDOF: Polyreference Frequency and Polyreference Time (with multiple references), Rational Fraction Polynomial-Z (RFP-Z), Eigensystem Realization, Alias-Free Polyreference (AFPoly)

**Enhanced Mode Solution:** Optimal clarity of the stability diagrams with Polyreference Time and RFP-Z

**Solve Method:**

- Global: All curve-fitters
- Local: Polyreference Time and RFP-Z

### Mode Selection

**Mode Selection:** Manual or Automatic

**Shape Types:** Real or Complex

#### DIAGRAMS

**Stability Diagram:** For indication and selection of modes. Plotted in an Iteration versus Frequency diagram

- Mode stability indication: Computational, New, Frequency Stable, Damping Stable, Vector Stable, All Stable
- Selectable mode symbols, colours and tolerance properties
- Cluster Diagram** Modal Analysis (advanced) only: For indication and selection of modes. Plotted in a Damping versus Frequency diagram
- Mode stability indication: Computational, New, Frequency Stable, Damping Stable, Vector Stable, All Stable
- Selectable mode symbols, colours and tolerance properties

**Pole Density Diagram** Modal Analysis (advanced) only: For indication and selection of modes. Plotted in a colour-coded Damping versus Frequency diagram

## MODE TABLE

Contains the modal model in terms of natural frequency, damping and mode shapes. Comprehensive documentation of modal results including:

- Mode number, Mode Description, Estimation Method, Mode Complexity, Stability Level, Mode Shape Scaling, Modal Mass, Stiffness and Damping, Mass Sensitivity, Overcomplexity etc.
- Columns with Sorting and Filtering
- Damping correction: Accurate damping estimates by correcting for the effects of exponential weighting in hammer testing

Mode tables created using different parameters or curve-fitting algorithms can be combined into a single mode table

## SYNTHESIS

Comparison of measured and synthesized FRFs; Error Function; Frequency Response Assurance Criteria (FRAC)

## Analysis Validation

### Synthesis:

- FRFs or Mode Indicator Functions
- Displacement, velocity or acceleration
- Mass, stiffness, both or none

## Ordering Information \*

Type 8420-X	BK Connect Modal Analysis
Type 8420-A-X	BK Connect Modal Analysis (advanced)

## PREREQUISITE SOFTWARE

Type 8400-X	BK Connect Data Viewer
Type 8410-X	BK Connect Geometry

## SOFTWARE FOR EXPANDED MODAL ANALYSIS FUNCTIONALITY

Type 8400-A-X	BK Connect Data Viewer (advanced) (for Data Viewer Table and Result Matrix tasks)
Type 8400-D-X	BK Connect Nastran Interface (for Nastran FEM support)
Type 8400-E-X	BK Connect Ansys Interface (for Ansys FEM support)
Type 8400-F-X	BK Connect Abaqus Interface (for Abaqus FEM support)
Type 8401-A-X	BK Connect Hardware Setup (advanced) (for accelerometer mounting check task and multiple LAN-XI hardware support)
Type 8401-V-X	BK Connect Virtual Hardware Setup (for virtual front end support)
Type 8410-B-X	BK Connect Time ODS Option (for time ODS support)
Type 8411-X	BK Connect Structural Measurements – Hammer and Shaker (for hammer or shaker measurements)
Type 8412-X	BK Connect Advanced Sine Measurements (for stepped sine measurements)

## MAC:

- AutoMAC and CrossMAC tables and 3D plots with animation of selected mode pairs
  - CoMAC geometry plots Modal Analysis (advanced) only
- Complexity Plot:** Display of mode complexity and Mode normalization functionality Modal Analysis (advanced) only

## User-defined Displays

For user-specific definition of layouts. Supports geometries with animation, function data, tables (mode shapes and MAC), plots (Complexity and MAC), etc.

## Reporting

Integrated live reporting using Microsoft® Word, Excel® and PowerPoint®. Reports can be prepared in parallel with the analysis process and generated at any time

## PACKS

Type 8411-XS	BK Connect Structural Measurements and Analysis Pack
Type 8411-A-XS	BK Connect Structural Measurements and Analysis Pack (advanced)
Type 8420-XS	BK Connect Modal Analysis Pack
Type 8420-A-XS	BK Connect Modal Analysis Pack (advanced)

## OTHER STRUCTURAL DYNAMICS SOFTWARE

Type 8421-X	BK Connect Correlation Analysis
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## Maintenance and Support

M1-8400-X	Software Maintenance & Support for Type 8400
M1-8400-A-X	Software Maintenance & Support for Type 8400-A
M1-8400-D-X	Software Maintenance & Support for Type 8400-D
M1-8400-E-X	Software Maintenance & Support for Type 8400-E
M1-8400-F-X	Software Maintenance & Support for Type 8400-F
M1-8401-A-X	Software Maintenance & Support for Type 8401-A
M1-8401-V-X	Software Maintenance & Support for Type 8401-V
M1-8410-X	Software Maintenance & Support for Type 8410
M1-8410-B-X	Software Maintenance & Support for Type 8410-B
M1-8411-X	Software Maintenance & Support for Type 8411
M1-8411-XS	Software Maintenance & Support for Type 8411-S
M1-8411-A-XS	Software Maintenance & Support for Type 8411-A-S
M1-8412-X	Software Maintenance & Support for Type 8412
M1-8420-X	Software Maintenance & Support for Type 8420
M1-8420-A-X	Software Maintenance & Support for Type 8420-A
M1-8420-XS	Software Maintenance & Support for Type 8420-S
M1-8420-A-XS	Software Maintenance & Support for Type 8420-A-S
M1-8421-X	Software Maintenance & Support for Type 8421

\* "X" indicates the licence model, either N: Node-locked or F: Floating

**Table 1** Overview of BK Connect Modal Analysis and Structural Measurement packs)

	Packs			
	8411-S	8411-AS	8420-S	8420-AS
	Structural Measurements and Analysis	Structural Measurements and Analysis (advanced)	Modal Analysis	Modal Analysis (advanced)
<b>Comprises</b>				
Data Viewer Type 8400	•	•	•	•
Hardware Setup Type 8401	•	•		
Hardware Setup (advanced) Type 8401-A		•		
Geometry Type 8410	•	•	•	•
Structural Measurements – Hammer and Shaker Type 8411	•	•		
Modal Analysis Type 8420	•	•	•	•
Modal Analysis (advanced) Type 8420-A		•		•

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