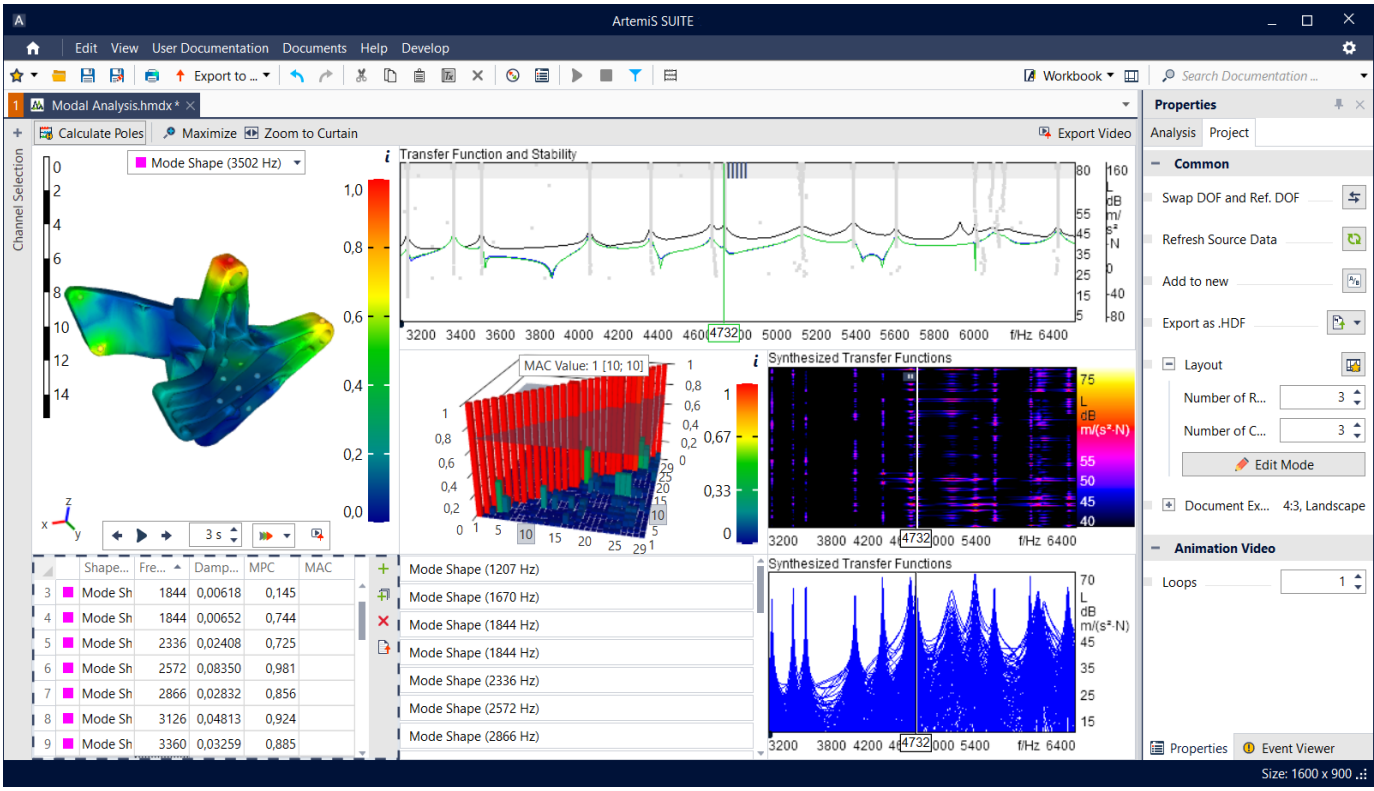
DATA SHEET



ArtemiS SUITE
PRoject

Code 50420

APR 420
Modal Analysis Project

With the Modal Analysis Project of ArtemiS SUITE, users of all levels of experience can easily and efficiently explore the vibration patterns of simulations or test objects. This interactive tool allows for a thorough examination of dynamic behavior without requiring extensive expertise.

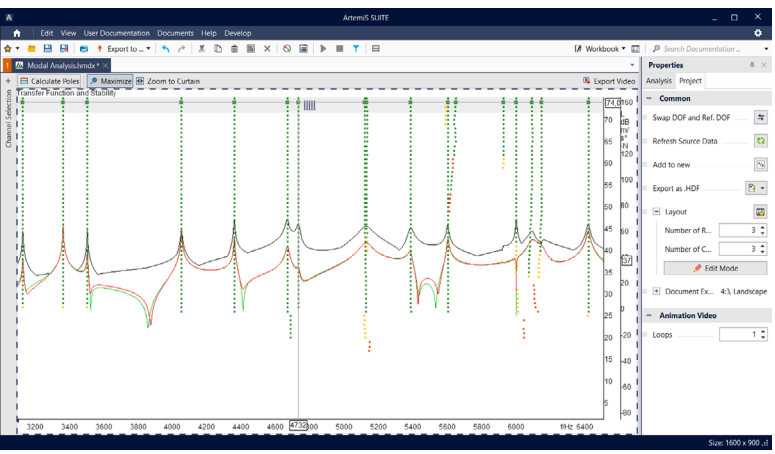
OVERVIEW

APR 420 Modal Analysis Project

Code 50420

The Modal Analysis Project is a part of the ArtemiS SUITE Structural Analysis Package and enables quick and interactive examinations of natural modes of test objects or simulation results on the basis of an Impact Measurement (APR 430 is required), for example. The project combines a clear, intuitive user interface with a high level of functionality. All necessary sections are embedded in the interface, so that users can keep an eye on their analyses at any time.

The core of the project is the stability diagram. At the push of a button, the characteristic poles are determined from the measured transfer functions. The result is displayed in the stability diagram, and synthesized transfer functions are created using curve fitting.



KEY FEATURES

Clearly arranged user interface for intuitive operation

Stability diagram / curve fitting

- LSCF (Least Squares Complex Frequency) method used for pole calculation
- Automatic selection of the model size using an artificial intelligence (AI)
- Displaying the calculated poles as points using color coding to evaluate the pole stability
- Calculating the synthesized transfer functions using curve fitting
- Interactive optimization of the stability diagram by adjusting poles, model size, and stability criteria

Interactive 3D or 2D animation of all model points or individual measurement groups with setting options

Detecting patterns and identification of interesting frequencies directly in the diagram

Calculating the Mac Matrix with MAC (Modal Assurance Criterion) values of all possible comparisons

Displaying the Shape Table (stored deflection shapes) with MAC and MPC (Modal Phase Collinearity) values

Grouped Shape Table for identifying similar shapes

Export of animated shapes, measured or synthesized transfer functions (set target quantity: accelerance, mobility, compliance)

APPLICATIONS

Easy and intuitive examination of the oscillation behavior of test objects

Quick validation of simulation results and troubleshooting

DETAILS

Individual editing

In the Edit Mode, users individually select the number, the size, and the position of the elements visible during the analysis as well as the corresponding contents.

Stability diagram / curve fitting / AI

The stability diagram, which relies on the LSCF (Least Squares Complex Frequency) algorithm expanded with the help of AI, forms the centerpiece of the Modal Analysis Project. With a push of a button, the transfer functions are curve-fitted in a multi-stage iteration procedure from different numbers of poles (natural frequency and the associated modal damping). Users can decide, whether the selection of the model size should be done manually or automatically using an artificial intelligence (AI).

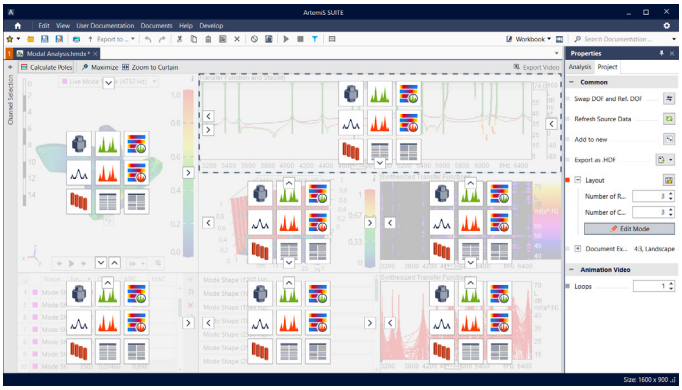
The algorithm creates transfer functions through curve fitting by using stable poles that have the least deviation from the averaged frequencies in each iteration.

After curve fitting, manual adjustments are quickly performed in the stability diagram. For visual convenience, each pole is displayed as a color-coded point, and the colors symbolize the level of pole stability (red, yellow, green).

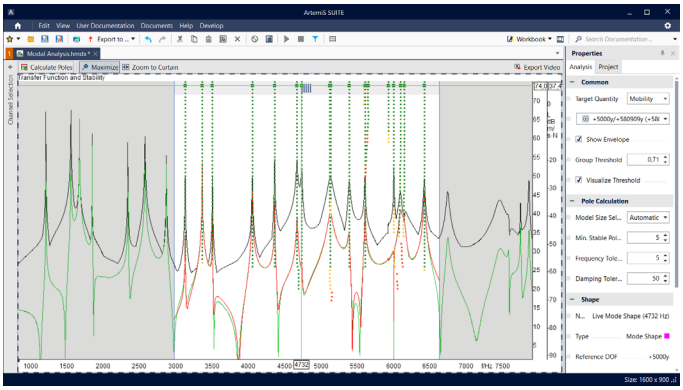
If necessary, the selection of poles can be changed, whereby the combination of poles from different iterations is possible, too. With a click, poles can be deactivated or activated, in order to optimize synthesized transfer functions interactively as well.

Furthermore, the maximum number of iterations, the minimum number of stable poles per mode, and the frequency and damping tolerance can be set individually. In addition, the envelope of the transfer functions can be switched on or off.

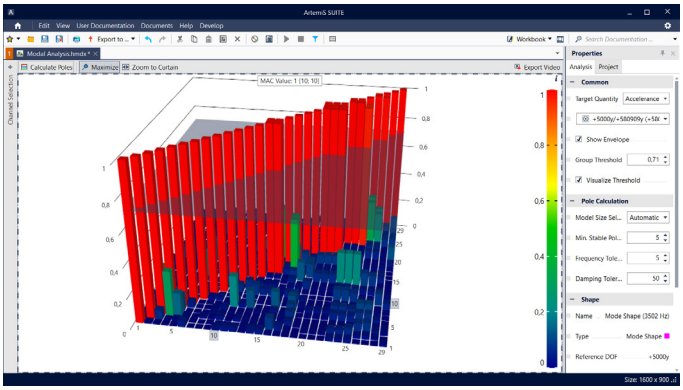
After calculating the poles, most adjustments are live implemented without the need to recalculate the fit.



Edit Mode: The number and contents of the elements can be individually configured and one element selected can be maximized.



Stability diagram: The stability diagram enables to adjust the cut-off frequencies with the mouse, which determines the data range to be considered for curve fitting.



The integrated AutoMAC Matrix offers a rapid summary of the similarity in shape among all stored shapes to the user.

3D and 2D animation

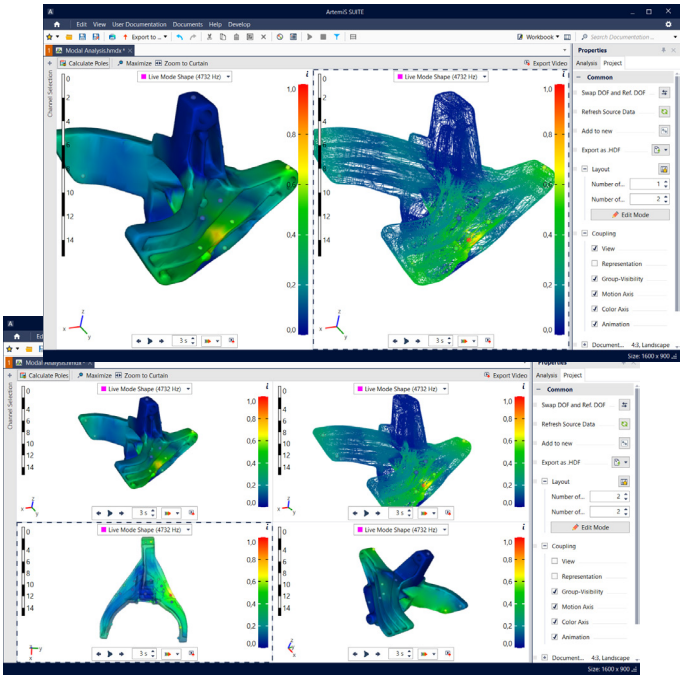
The animation serves for the representation of the measurement points contained in the selected Measurement Point Library and of an optionally existing model, whereby multiple references may also be considered and animated simultaneously. Users have various options for animating the data.

Optionally, all model points of an existing model or only those model points that belong to the same measurement group can be interpolated globally.

In order to highlight interesting areas, the Trace Tool is available. During the animation, the Trace Tool visualizes the movement of each measuring point selected in the Channel Selection in the form of a fading trace. This makes it easier to follow the movement course of individual measuring points.

If users have chosen several animations to be displayed in the interface of their Modal Analysis Project, all animations can be coupled or played back independently of each other.

Animations can be exported as AVI (video), PowerPoint, PDF, and image (PNG, JPEG, TIFF, GIF).



3D and 2D animation: Different display modes can be selected.

Shape Table

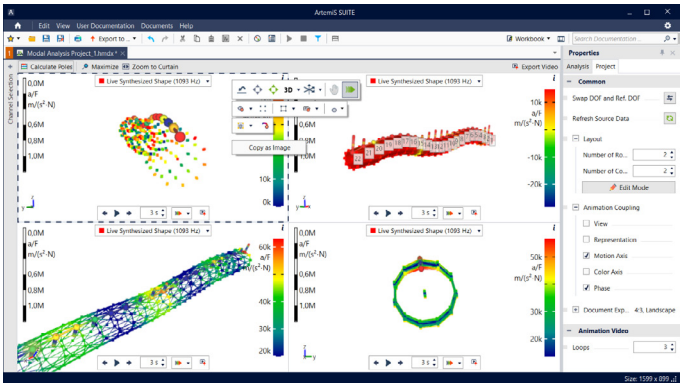
The Shape Table can be used to store and compare interesting shapes. The color coding displays whether it is a shape based on measured or synthesized transfer functions or a modal shape.

For each shape, the MPC value, the corresponding frequency, and, if modes are included, the corresponding damping values are displayed. By means of the MPC value, users get a meaningful evaluation of the collinearity of the modal phases of all contained channels.

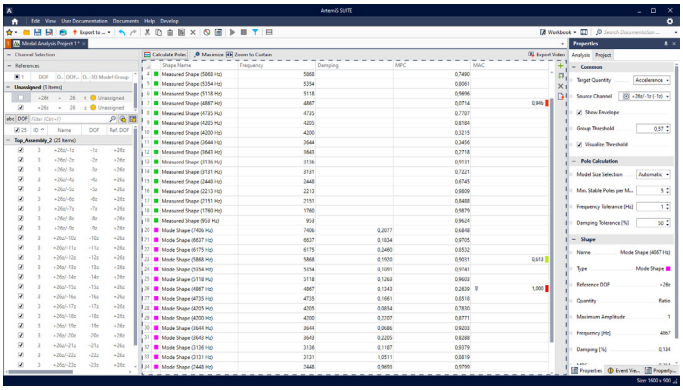
In addition, the MAC value is calculated for evaluating the similarity of shapes.

For the examination of the recorded signal, users can switch between the shapes, enabling direct views of the corresponding animations.

Users may export the Shape Table in order to compare different shapes from different projects directly with the Shape Comparison Project (APR 410 is required).



3D and 2D animation: The animation enables color adjustments using the color axis on the right side. Furthermore, users are enabled to scale the deflection of the shape. The animation speed can be adjusted via the input field Loop Duration.



The Shape Table displays information in tabular form. Frequency, Damping and MPC are values that are available for each shape. For further shape comparison analysis the MAC values are available, too.

Diagrams for displaying transfer functions

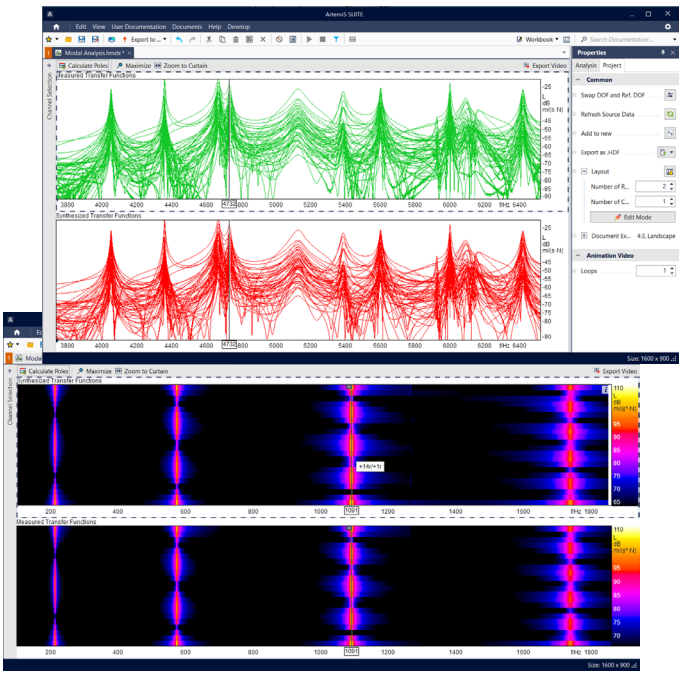
The measured and the synthesized transfer functions can each be displayed in 2D diagrams as well as in Color Band diagrams. This enables a more detailed view of the signal and the pattern detection related to relevant modes.

In the case of synthesized transfer functions, the synthesis is performed on the basis of the poles selected in the stability diagram.

Users can select the desired frequency for the animation with the Value Cursor or via an input field.

› The 2D diagrams display the measured and the synthesized transfer functions of all channels activated in the Channel Selection. This simplifies the detection of patterns of relevant modes which are characterized by the fact that the curves of many channels overlap and have a similar course overall.

› The Color Band diagrams display the transfer functions of all channels activated in the Channel Selection as individual color bands over a common abscissa.

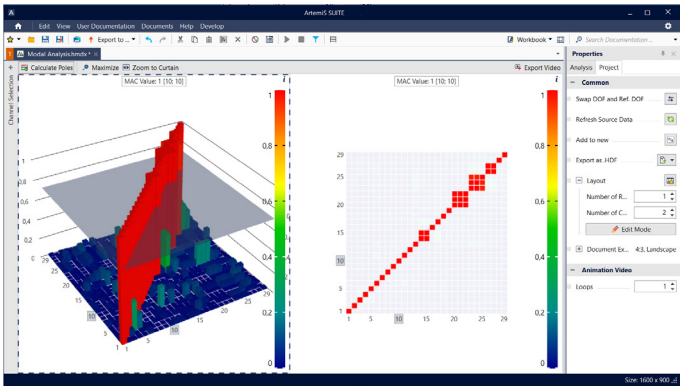


Diagrams: 2D and Color Band Diagrams are available for displaying the measured and the synthesized transfer functions. Via the mouse wheel, users zoom on the x- and the z-axis and adapt the displayed area while holding down the left mouse button.

MAC Matrix

In a 3D or 2D diagram, the MAC Matrix displays the MAC values of all possible comparisons between all shapes contained in the Shape Table. Thereby the MAC values are represented via the height of the bars and via their color.

By means of the Group Threshold, which is displayed as a partially transparent layer, users get an optical grouping of relevant MAC values.



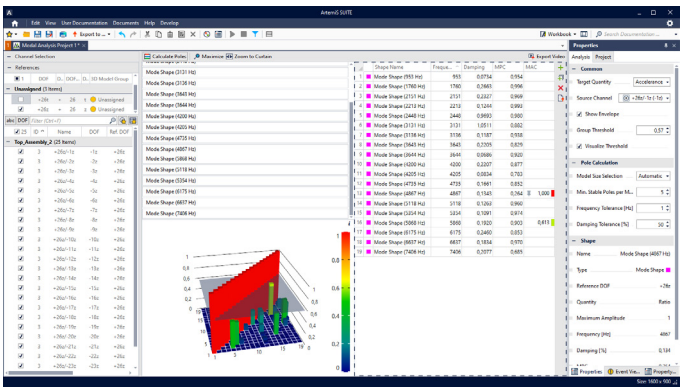
MAC Matrix: In the MAC Matrix, tooltips display the MAC values and the numbers of the involved modal shapes. Switching from 3D to the 2D representation, a possible occlusion of bars further back is avoided.

Grouped Shape Table

The Grouped Shape Table combines all shapes of the Shape Table that have a MAC value above the set Group Threshold. This enables the users to identify similar or identical shapes.

Channel Selection

The Channel Selection provides the channels to be used. The tabular arrangement of the channels as well as additional information, such as the measurement point number, channel name, and DOF facilitate filtering, sorting, selection, etc.



Channel Selection: The Channel Selection enables a filtered channel selection via the input field. Channels can be activated or deactivated by means of multiple selection. The Grouped Shape Table makes it easier to identify similar or identical shapes.

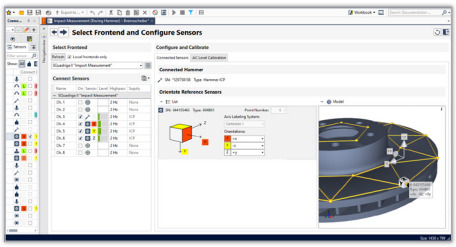
STRUCTURAL ANALYSIS

The Modal Analysis Project is a part of a powerful and perfectly matched ArtemiS SUITE Structural Analysis Package that enables users to intuitively examine and understand the complex relationship between stimulus and structure.

MEASURING / PREPARING

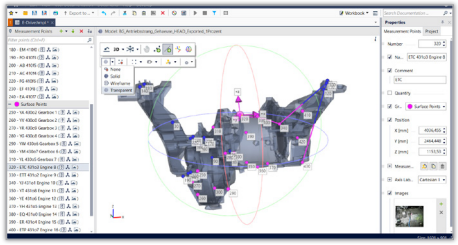
IMPACT MEASUREMENT (APR 430)

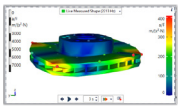
Impact Measurement enables structural analysis measurements using the methods Roving Hammer and Roving Accelerometer.



MEASUREMENT POINT LIBRARY (APR 000)

The Measurement Point Library can be used to create a 3D grid model and to import a corresponding CAD model very easy.

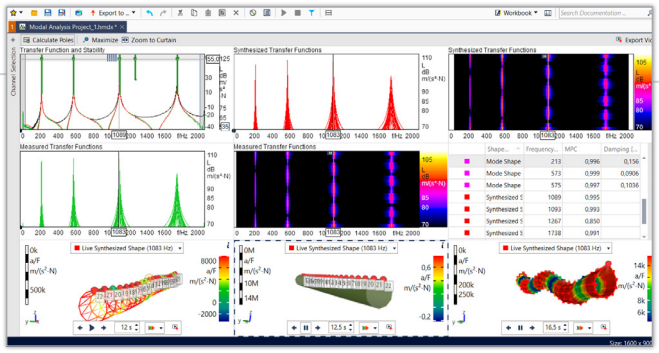




LIVE COUPLING (APR 430 & APR 420)

During the measurement, the analysis of the recorded data can be performed by means of live coupling in the Modal Analysis Project.

ANALYZING

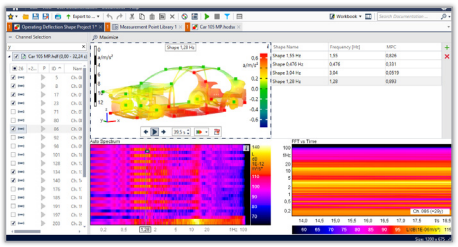


MODAL ANALYSIS PROJECT (APR 420)

The easy-to-use Modal Analysis Project enables easy recognition of interesting frequency ranges as well as the comparison, for example, with reference measurements. Alternatively, users can also validate simulation results in this way.

ODS PROJECT (APR 400)

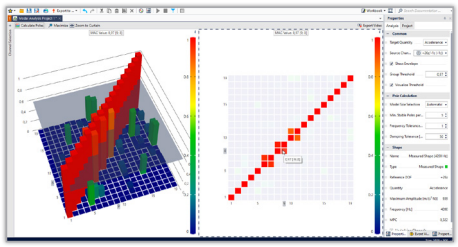
The ODS Project (Operating Deflection Shape) includes the Time Domain Animation Project (TDA) and can be used to animate and analyze structures in a defined stationary operating status as well as time-variant motions.



LIVE COUPLING A MAC MATRIX (APR 410 with APR 420 & APR 400)

SHAPE COMPARISON PROJECT (APR 410)

The Shape Comparison Project is used for analyzing and comparing deflection shapes.



REQUIREMENTS

- Measurement Point Library (*.hmpl) including measurement points
- A measurement file with transfer functions (*.hdf) matching the Measurement Point Library (included in APR 000), which was ideally recorded with Impact Measurement (APR 430 is required) or the Recorder (APR 040 is required) of ArtemiS SUITE

  Compatibility criteria:
  - Each combination of measured degree of freedom and reference degree of freedom must only exist once
  - In the channels,
    - the accelerance (acceleration/force, also called inertance),
    - the mobility (velocity/force, also called admittance),
    - or the compliance (displacement/force) has to be stored
  - Sampling rate and block size must be the same in all channels
- The Modal Analysis Project checks the requirements and the compatibility of the files. After this, the analysis can be started immediately
- When monitoring impact measurements (Roving Hammer or Roving Accelerometer) with Impact Measurement, users specify
  - the path to the Impact Measurement to be monitored or
  - the folder with a measured Impact Measurement

RECOMMENDED

- Impact Measurement (APR 430 is required)
- ODS Project (APR 400 is required)
- Shape Comparison Project (APR 410 is required)
- Recorder (APR 040 is required)

Required: APR 000 Framework (Code 50000)

HEAD acoustics

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