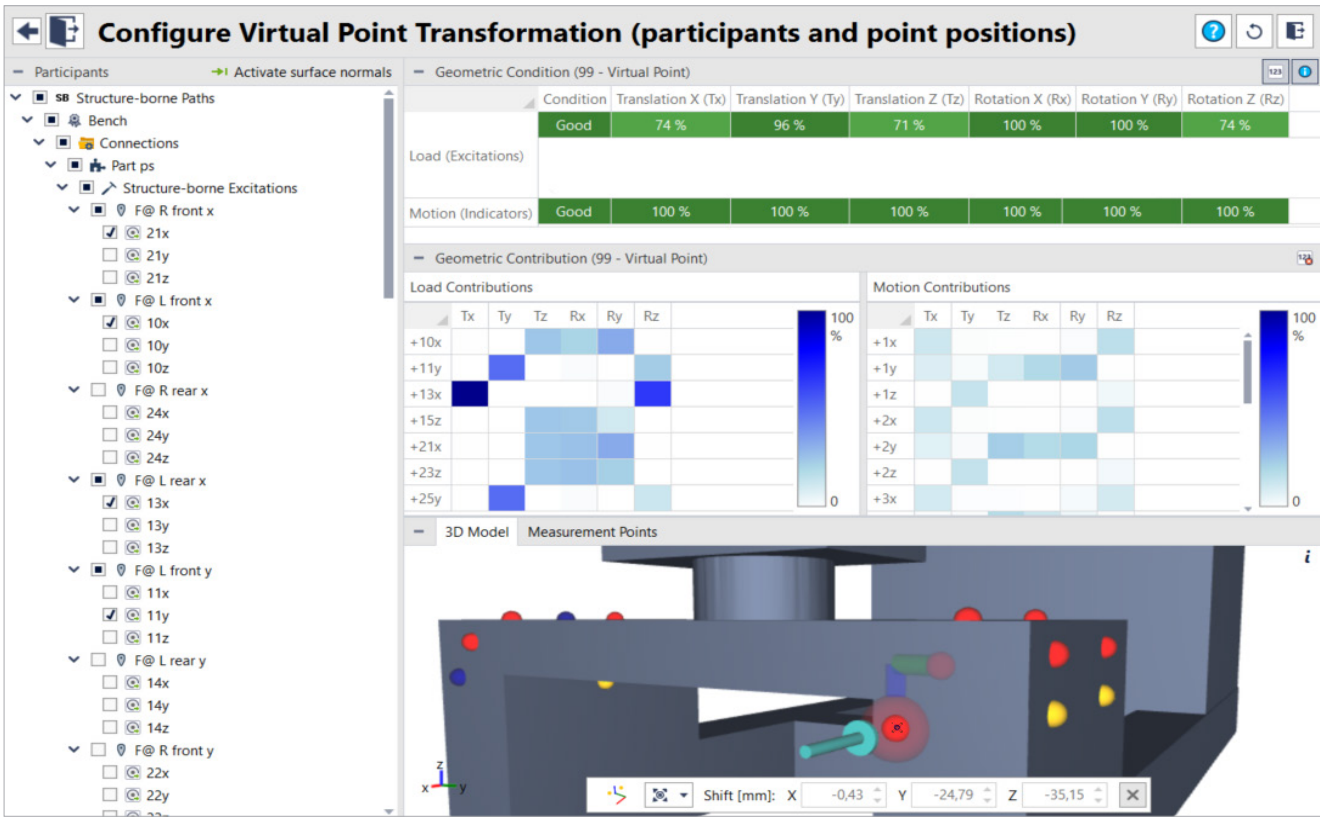
HEAD acoustics

DATA SHEET



ArtemiS SUITE
Signal Processing

Code 51601

ASP 601 TPA – Virtual Point Transformation

TPA – Virtual Point Transformation forms part of the TPA package of ArtemiS SUITE and enables the calculation of forces and moments as well as translational and rotational accelerations at points that cannot be measured physically.

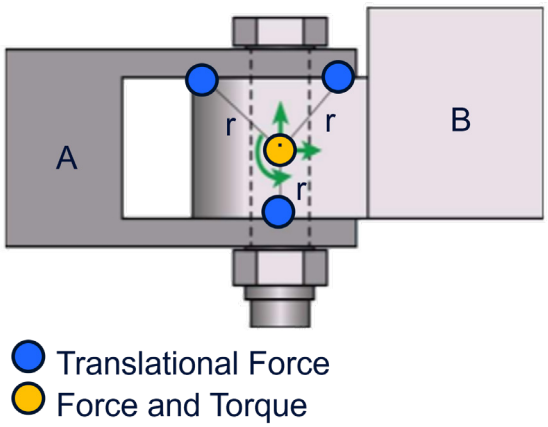
OVERVIEW

ASP 601
TPA – Virtual Point Transformation
Code 51601

TPA – Virtual Point Transformation is an optional extension for the TPA Project. It enables the creation of virtual measurement points on components or assemblies as well as the calculation of resulting forces, moments, and both translational and rotational accelerations at locations where sensors, hammers, or shakers cannot be used.

In TPA, virtual points can be used in the context of hybrid models for linking numerical simulation models with real measurement results.

The virtual point transformation features a clear and structured user interface that supports step-by-step guidance through the entire process. There are also various quality assurance steps available, reducing the need for expert knowledge.



KEY FEATURES

Calculating forces, moments, accelerations, and angular accelerations at physically non-measurable points on the basis of measurement data

Seamless integration into the TPA Project

Assistant-guided creation of virtual point models using the Measurement Point Library (included in APR Framework) and 3D models

Validation and basic optimization of the points

Automatic calculation of the transformation matrix

Display of model-quality metrics
- Evaluation of the geometric condition
- Consistency analyses for load and motion
- Evaluation of the overall consistency
- Analysis of the qualities of the six degrees of freedom (translational and rotational)

Straightforward approach to optimizing virtual-point quality with instant feedback

Flexibly configurable export options in the TPA Project

APPLICATIONS

- Hybrid approach in transfer path analysis: linking simulation models with measurement data
- Compact data exchange by aggregating spatially distributed forces in a single point
- Calculation of translational and rotational sensitivities

DETAILS

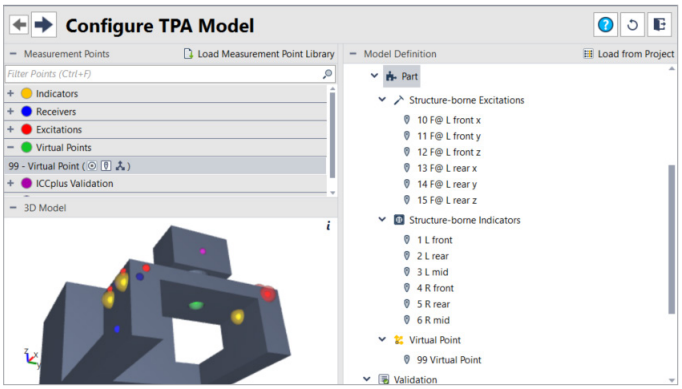
Virtual Point Transformation (VPT)

Based on the geometric positions of spatially distributed force application points or acceleration measurement points respectively, VPT enables translational and rotational forces or accelerations to be determined at one point.

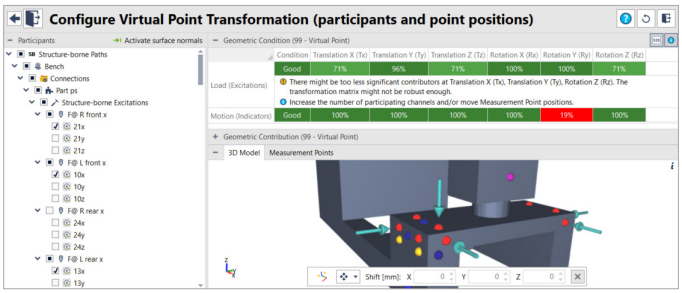
The user interface is clearly structured, and the Measurement Point Library (included in APR Framework), the model tree, and a 3D model can be used to create and configure virtual points without the need for in-depth expert knowledge.

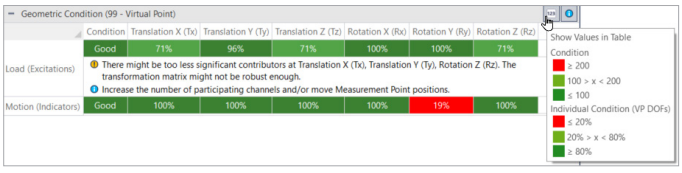
Dividing the TPA Project into several steps facilitates orientation and provides a consistent, step-by-step workflow through the procedure. The VPT is integrated at various stages in the TPA Project.

- Model definition
- Configuration of the virtual points
- Quality analysis – including intuitive optimization of the virtual points
- Export



Model definition





Review of the model definition

Model Definition

APR 600 TPA Project is required.

In this step, the interface between the source and the receiver structure is defined. A Measurement Point Library as well as a 3D model are required for this and the subsequent steps of the TPA Project. While measurement points at force application points are defined by the quantity "force" and measurement points of structure-borne sound indicators by "acceleration", virtual points are characterized by the quantities "force and torque" and/or "acceleration and angular acceleration".

In this context, an automatic verification facilitates the procedure: the TPA Project issues a warning if the number, quality, or positions of the measurement points are insufficient, so additional points can be added or existing ones modified to ensure the validity of the virtual points.

Configuration

In this step, the participating force and acceleration channels are configured.

The TPA Project automatically generates the transformation matrix and calculates the conditioning. To facilitate orientation and provide an overview of the modeling quality, the TPA Project displays a color-coded table indicating the quality of the forces and accelerations as well as the percentage quality of each degree of freedom.

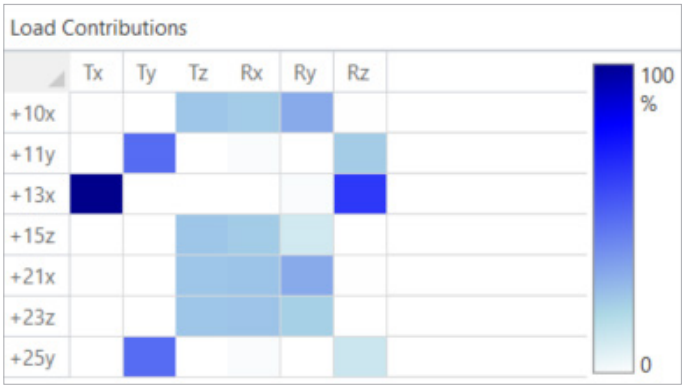
For each virtual point, the six degrees of freedom (translation in the X, Y, and Z directions as well as rotation around the X, Y, and Z directions) are displayed both in color (from red to green, i.e., from bad to good) and with percentage values. As an alternative, the table also displays the numerical values of the individual conditions.

With the graphical assistance of the 3D model and the table, the quality of the virtual points can be optimized with just a few steps. To obtain a good configuration for both the geometric conditioning and the individual degrees of freedom, the participating channels can be intuitively added or removed to determine whether this improves the geometric conditioning. Another option is to move the measurement points within the 3D model to find the optimal positions.

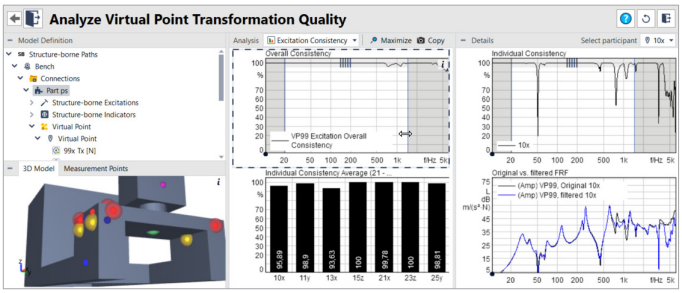
The geometric contributions are presented in a table that functions as an orientation aid for determining which participant contributes to the respective degree of freedom of a virtual point. In this representation, the contribution intensity is visualized through the intensity of the blue coloration.

This helps identify redundant channels and assess robustness because the transformation matrix is prone to errors when the degrees of freedom of a virtual point depend primarily on a single strong contribution channel.

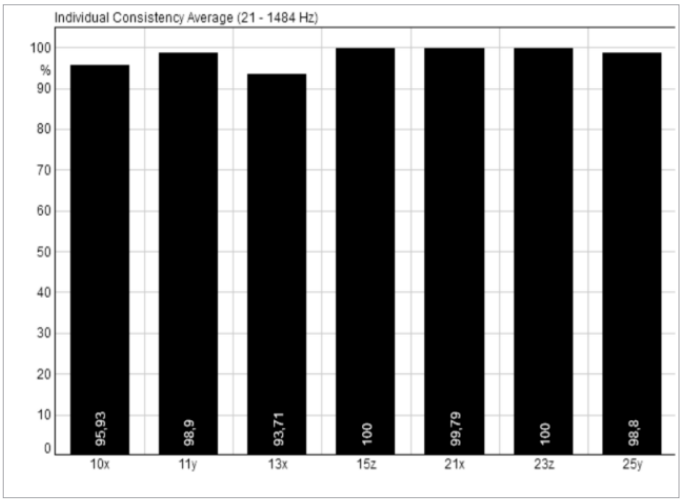
For immediate feedback, all adjustments and changes are visualized in color in the evaluation table as soon as they are made.



Geometric contributions: assessment of the contribution intensity of the degrees of freedom



Model tree, 3D model, and quality analyses



Quality analysis: averaged consistency

Quality Analysis

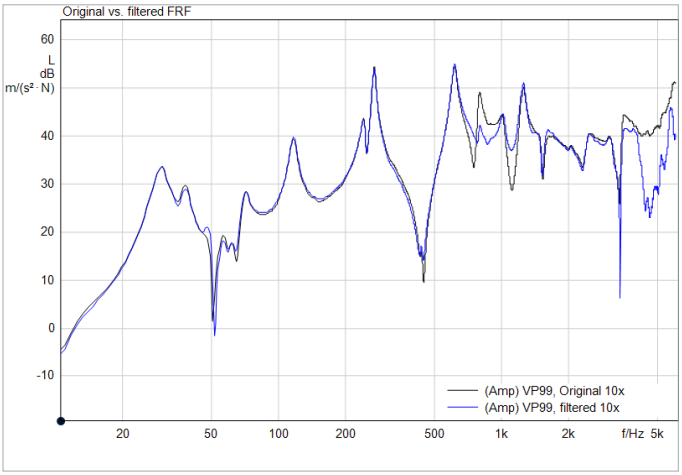
APR 600 TPA Project is required.

In addition to geometric conditioning and geometric contributions, consistency (the validity of the stiffness assumption) can also be analyzed. Depending on which quantities have been assigned to the virtual point, excitation consistency and/or indicator consistency can be selected.

The overall consistency of the VPT is displayed as a percentage over frequency. This makes it easy to see at a glance in which frequency range the stiffness assumption is valid. In the diagram, the frequency range over which the individual consistency is to be averaged can be configured.

The averaged individual consistency is shown in a bar diagram below the overall consistency.

In the 'Details' section, the upper diagram shows the individual consistency of selected channels over the frequency range. Below it, the underlying data for the individual consistency are shown in the 'Original vs. Filtered Transfer Function' diagram. The deviation between the two curves determines the individual consistency.



Original vs. filtered transfer function

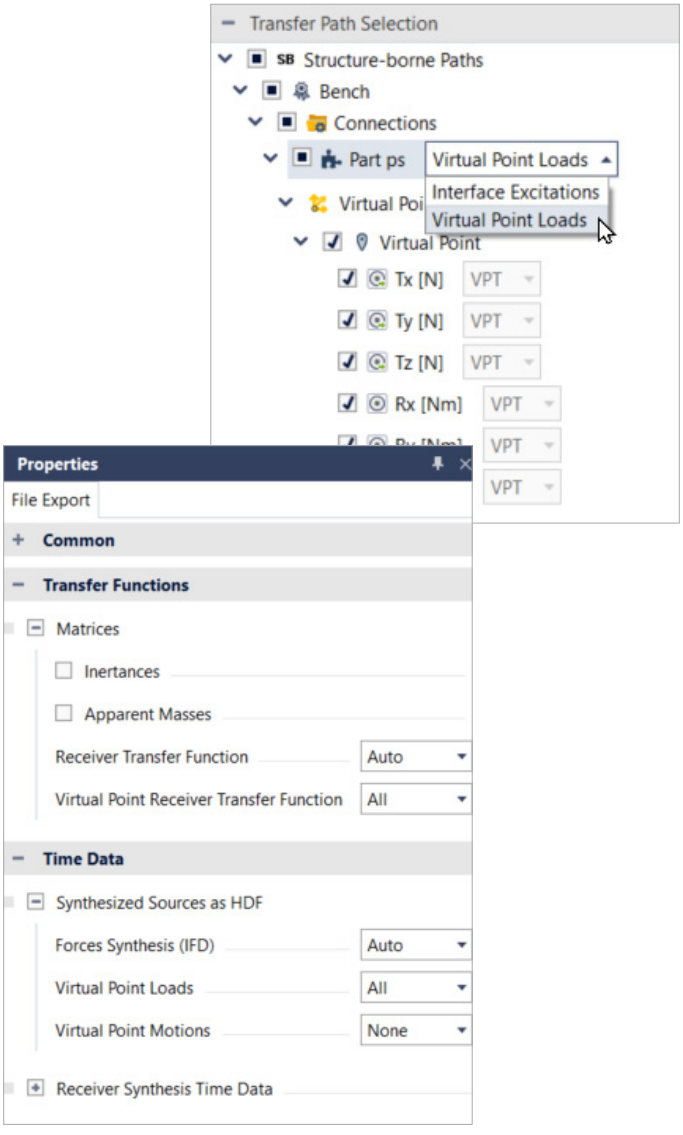
Export

APR 600 TPA Project is required.

All model elements relevant for export, along with their associated transfer paths, are displayed in a clear tree structure. Here, a selection can be made as to whether all or only selected data are exported, and whether the export comprises only the real measured points or only the virtual points.

For the virtual points, there is an option to export the virtual point loads, i.e., the moments and forces of the virtual points. The same applies to the virtual point motions.

If required, all TPA data or all possible syntheses for each operational measurement can also be exported to a separate HDF file and used for further analysis.



Export options

LICENSES

Required

(Licenses of ArtemiS SUITE)

Code	Product Name	Description
50000	APR 000 APR Framework	Basis of ArtemiS SUITE
51601	ASP 601 TPA – Virtual Point Transformation	Calculating forces, moments, accelerations, and angular accelerations at points that cannot be measured physically
50600	APR 600 TPA Project	Performing transfer path analyses

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