TPA
Transfer Path Analysis

CDH

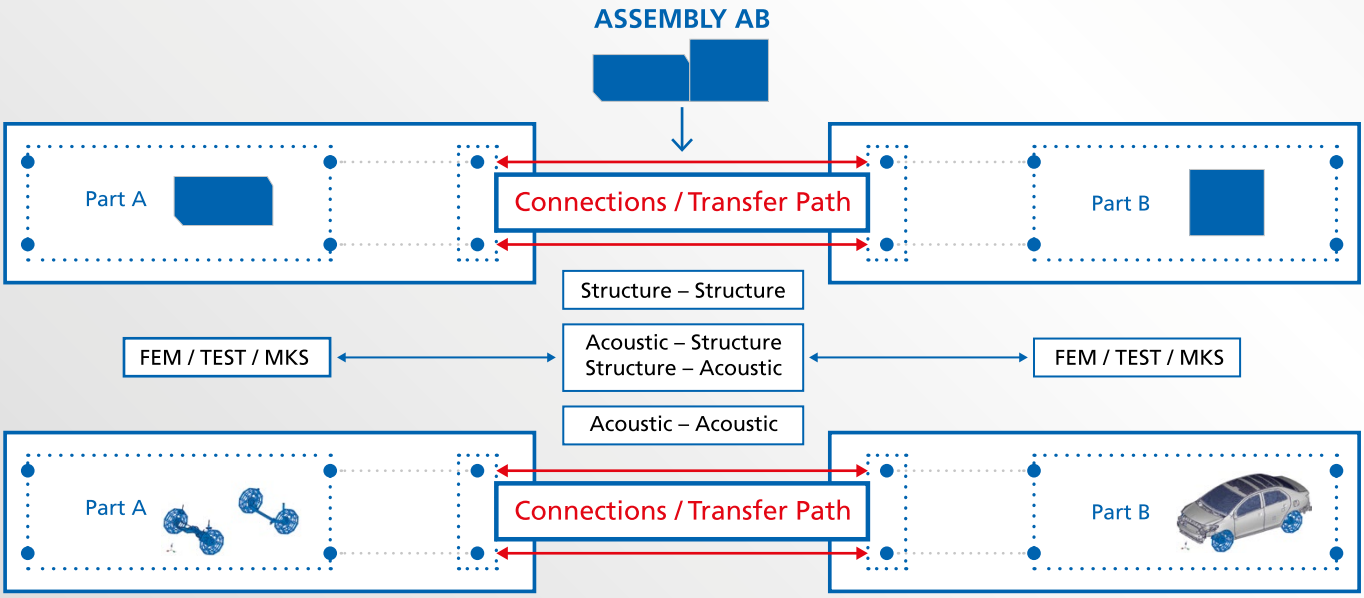
VIRTUAL TRANSFER PATH ANALYSIS

allows vehicle CAE engineers to identify and understand dominant noise and vibration transmission paths.

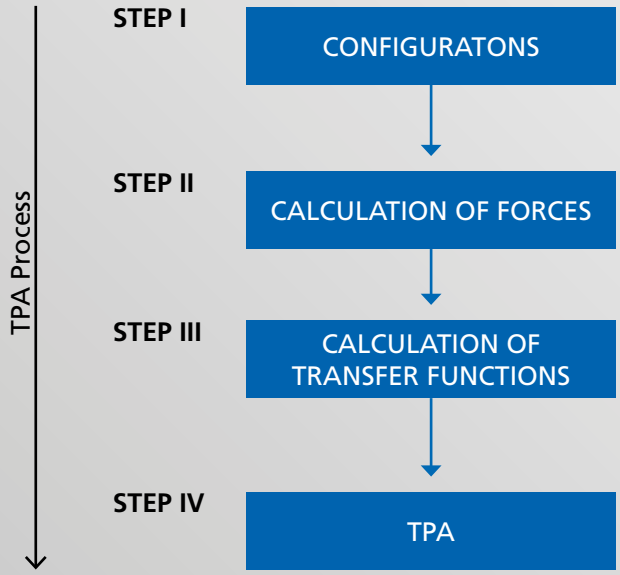
WHAT IS CDH/TPA ?

Transfer path analysis (TPA) is a technique, well established both experimentally and analytically, to estimate and rank contributions to noise and structural vibration levels through individual structural transmission paths.
TPA is particularly valuable when the structure system is complex and many structure modes contribute to the frequency response. In computer based analytical, or virtual, TPA the structure is represented by an assembly of its finite element components. Responses are determined using the forces at the interface between components and the transfer functions relating the interface forces and responses.

Therefore, TPA may be used to reduce the response to the component level and identify the dominant noise and vibration transmission paths. In the automotive industry, virtual TPA may be used to optimize body structure and mount stiffness to ensure satisfactory noise and vibration performance at the CAE stage of the vehicle development process. CDH/TPA software is designed as a tool to be used in a Nastran-based CAE process. Forces and transfer function data is imported in Nastran punch format.
CDH/TPA may be used in a graphic user interface (GUI) mode or in a batch mode that is suitable for handling multiple TPA analyses with many load cases.



EXECUTION FLOW



Define transfer paths using a configuration file in which force elements, attachment points, response points, load cases and mount groups are defined.

Forces are calculated and output in Nastran punch format file format. Typically, this involves calculations using the full vehicle model.

Transfer functions are calculated and output in Nastran punch file format. Typically this involves calculations with the trimmed-body model.

Path contributions are calculated in the TPA tool by multiplying the force with the corresponding transfer functions.

WHY USE CDH/TPA ?

- CDH/TPA makes it very easy to perform TPA analysis. It is suitable for both the experienced and novice NVH engineer. The user needs no in-depth theoretical knowledge and no postprocessor knowledge.
- CDH/TPA GUI is developed for engineers to interactively investigate NVH responses in a complex model.
- All plotting options for viewing the analysis result of the TPA can be updated with the selection of paths or DOFs and the switch between different views is simple and fast.
- The easy use of selection boxes in combination with user defined path groups makes it simple and fast to identify and filter dominant paths and their relevant information.
- CDH/TPA is presentation-friendly. Once the analysis is completed, the results for the specific load case, frequency and response can be visualized and output for presentations purpose with a few mouse clicks.
- Once the configuration file has been created, CDH/TPA can be used in batch mode to carry out multiple TPAs and create a TPA database.
  For example, the result database can be opened by a link in the Simulation Data Manager.
- Using the modelling standards established within your organisation, even the creation of the configuration file (and input files) can be automated, providing maximum possible automation in the CAE process.

SYSTEM REQUIREMENTS

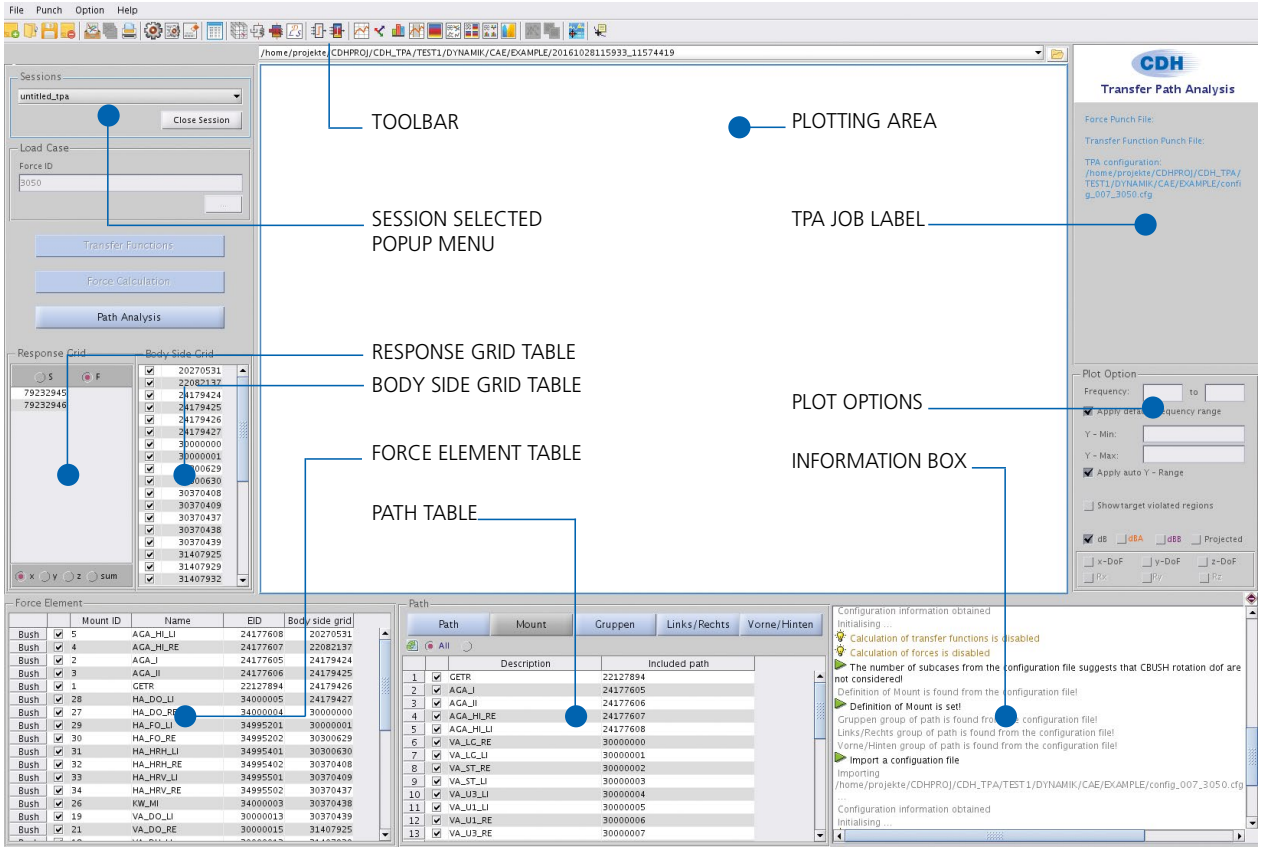
Red Hat and SUSE Linux 64bit
Microsoft Windows 64bit

FEATURES

- CDH/TPA support two operating modes: GUI and batch.
  - In GUI mode, the user interactively imports forces and transfer functions, pre-calculated to perform path analysis and stored in Nastran punch file format.
  - Batch mode is suitable for carrying out multiple TPAs for a large number of load cases without using GUI. Results are saved and may then be loaded into the GUI tool for plotting.
- GUI mode support for multiple TPA sessions, enabling comparisons between results from variants of the vehicle design or different load cases.
- Support for five hierarchy levels describing transfer paths in vehicle structure systems.
- Capability to aggregate contributions of grouped paths at the component level with simple switch between different path groups to view path contributions.

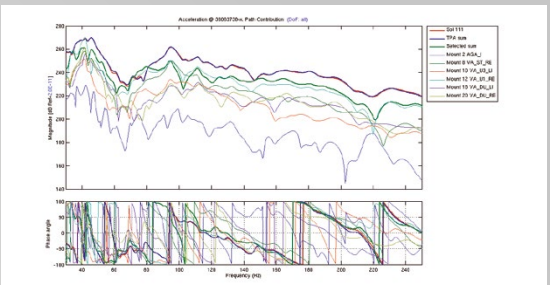
CDH / TPA GUI

- One simple GUI specifically developed and optimized for TPA
- All important information, plot configurations and selection menus are accessible in the main application window
- Easy switch between mount groups
- Easy selection of mounts for filtering
- One-action button for every plot type



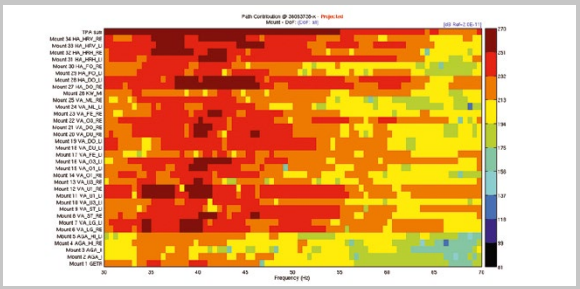
Various plot options available for visualisation of results to enhance the diagnosis and presentation process:

Path contribution curve plot



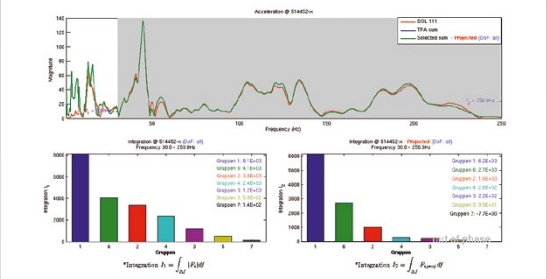
Also available for selected forces, transfer functions and LDS.

Path contribution color plot



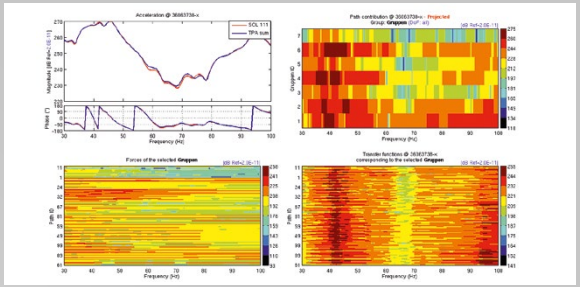
Also available for selected forces and transfer functions.

Path contribution Integration plot



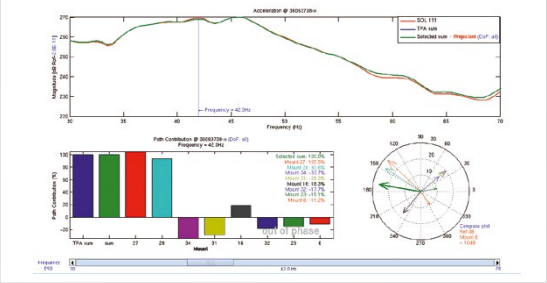
The path contributions can be integrated over a specified frequency band to estimate the overall contribution of the mounts. Two types of integral are available, path magnitude and projected contribution.

Transfer path contribution color plot



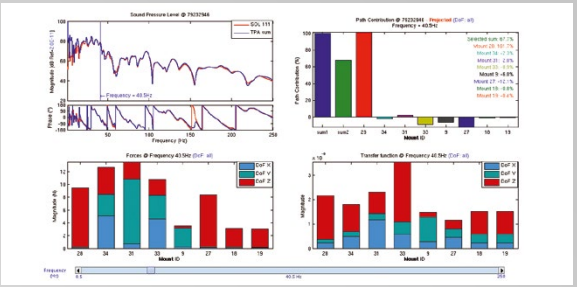
Combined color-map views for the transfer path contributions, section forces and transfer functions for user-defined frequency range.

Transfer path contribution bar/polar plot



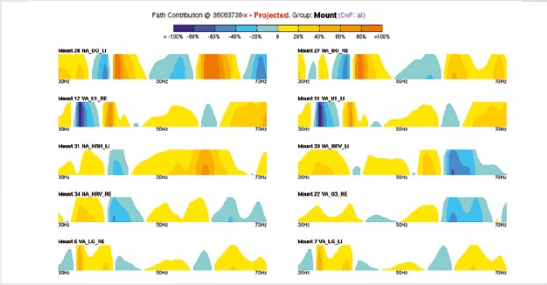
Shows the transfer path contributions curve (top), the bar plot (bottom-left) and the polar plot (bottom-right) for selected mounts at a frequency conveniently specified with slider. Rank path contribution and filter the rank by the mount hierarchy and degrees of freedom of paths.

Transfer path contribution bar plot



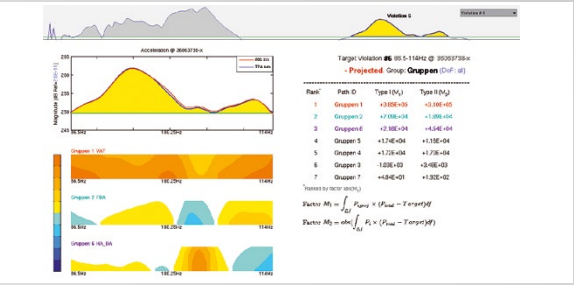
Total transfer path contributions (top-left) and a bar plot for selected path contributions at a specific frequency (top-right) are shown. The frequency can be quickly changed by a slider. The lower bar plots shows the resulting forces and transfer functions, where the subdivisions of the bars provide the information of the x, y, z components.

Area plot



This plot shows the most dominant paths or groups of paths and the in-phase or out-of-phase participations over the complete frequency range.

Target violation report



Having set a response target, the path contributions are integrated over the target-violated frequency range and ranked.

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