

# Simcenter 3D Acoustic Transfer Vector

## Speeding up multiple-RPM acoustics computations

### Benefits

- Faster multi-load case acoustic radiation simulation, typically useful for engines, gearboxes and other rotating machinery
- Accelerate acoustic transfer vector computation through reciprocal technologies
- Integrate acoustic transfer vector in NX Nastran, allowing you to easily couple with structural simulations

### Summary

The Acoustic Transfer Vector (ATV) relates the normal structural velocity of a sound radiating surface and the sound pressure level at a specific field point. You can combine these ATVs with vibration response simulation results to efficiently calculate the noise radiated from a vibrating surface. Simcenter™ 3D Acoustic Transfer Vector software includes an NX Nastran Solution that launches an acoustic FEM model to compute and store ATV. The results of a vibration-response simulation can then be combined afterwards with an ATV set to efficiently calculate the noise radiated from a vibrating surface. The stored ATVs can be re-used for various load conditions involving multi-revolutions per minute (RPM) loading. Another benefit is that ATV supports frequency interpolation when used for computing the acoustic forced response.

### Methodology

The ATV methodology computes transfer vectors, which are sets of frequency-dependent relationships between acoustic pressure

contributions at microphone locations for unit volume velocities on each node of the radiating surface. ATVs are independent of loading condition and depend only on the configuration of acoustic domain, the geometry of the radiating surface, the microphone-point location and the frequency.

The ATV can then be weakly coupled with a structure exhibiting vibrations (precomputed or not). These vibrations yield the enforced volume velocities for the fluid at the coupling surface, and the latter can then be multiplied with the ATV to obtain actual acoustic pressure results at a specified microphone locations. This step is performed when using the ATV as fluid representation in forced response context.

The ATVs are stored in the NX™ Nastran output file (op2) and can be re-used with any number of velocity inputs, providing an efficient solution process for multi-subcase problems and structural redesign iterations.

### Model management

Simcenter 3D ATV computation and utilization:

- Optimize performance and storage through a user-defined filter on input (radiating surface) and output (microphones)
- Quick and easy reference to an op2 file with ATV results

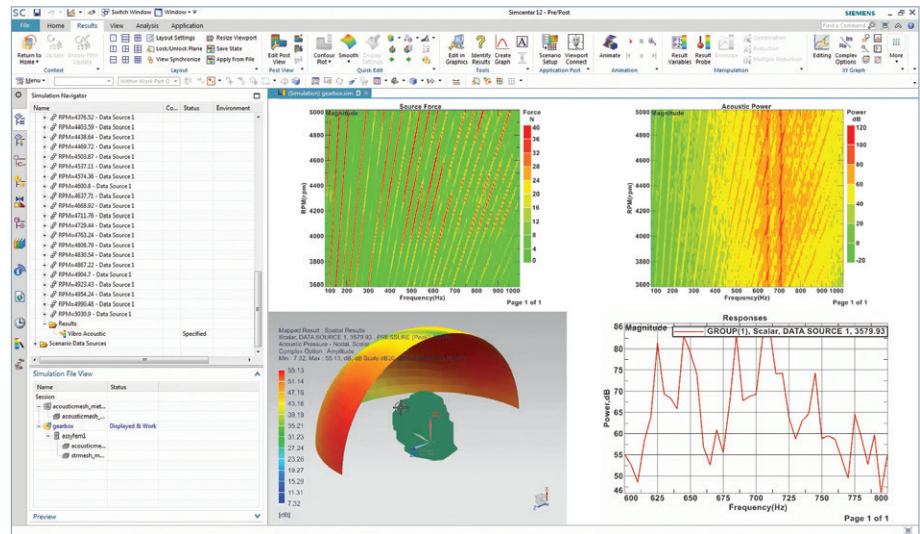
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## Computation of ATV

- Frequencies for the ATV (master frequencies) are independent of the frequencies used in forced final response context. Single values, linear or logarithmic sweeps are supported
- Simcenter 3D ATV requires NX Nastran Advanced Acoustics and uses automatically matched layer (AML) technology to compute ATV for exterior acoustic problems, allowing for small fluid models and therefore fast computation

## Using ATV as fluid representation in forced response

- Supports weak coupling of the ATV represented fluid to a structural model. Vibrations on the structural model can be computed upfront and provided as enforced vibrations (displacement, velocity, acceleration); or one can send a vibro-acoustic model to NX Nastran (SOL108 or SOL111) and let the vibrations be computed together with the acoustic radiation results using ATV
- Supports and speeds up computations for multiple load cases, such as a vibration spectrum for multiple RPMs in an engine run-up
- Supports frequency spectra, waterfalls of frequency spectra (order maps) and order cuts
- Forcing frequencies can be chosen independently of the ATV master frequencies (extrapolation not allowed)
- Interpolation of the ATVs at the excitation frequencies
- Supports enforced vibration applied on the structural model (displacement, velocity or acceleration)
- Supports sound pressure and sound power as result types
- Evaluates power radiated through microphone mesh: coarse mesh using International Organization of Standardization (ISO) 3744 or any fine microphone mesh



- Evaluates panel contributions to pressure results
- Evaluates modal contributions to pressure results
- Evaluates grid contribution to pressure results

## Pre- and postprocessing

Both the setup and postprocessing of ATV representations and their use are fully supported in Simcenter 3D (requires Simcenter 3D Noise and Vibration Modeling).

- Access to binary op2 result file for retrieval of model mesh, visualization mesh and ATVs when needed in solution sequences
- Storage and retrieval of ATVs with a Simcenter 3D document (external op2 file storage)
- Display of the ATV values on the model mesh

## Prerequisites

Simcenter 3D ATV requires NX Nastran Advanced Acoustics.

For setup and postprocessing, it is recommended to use Simcenter 3D Noise and Vibration Modeling.

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