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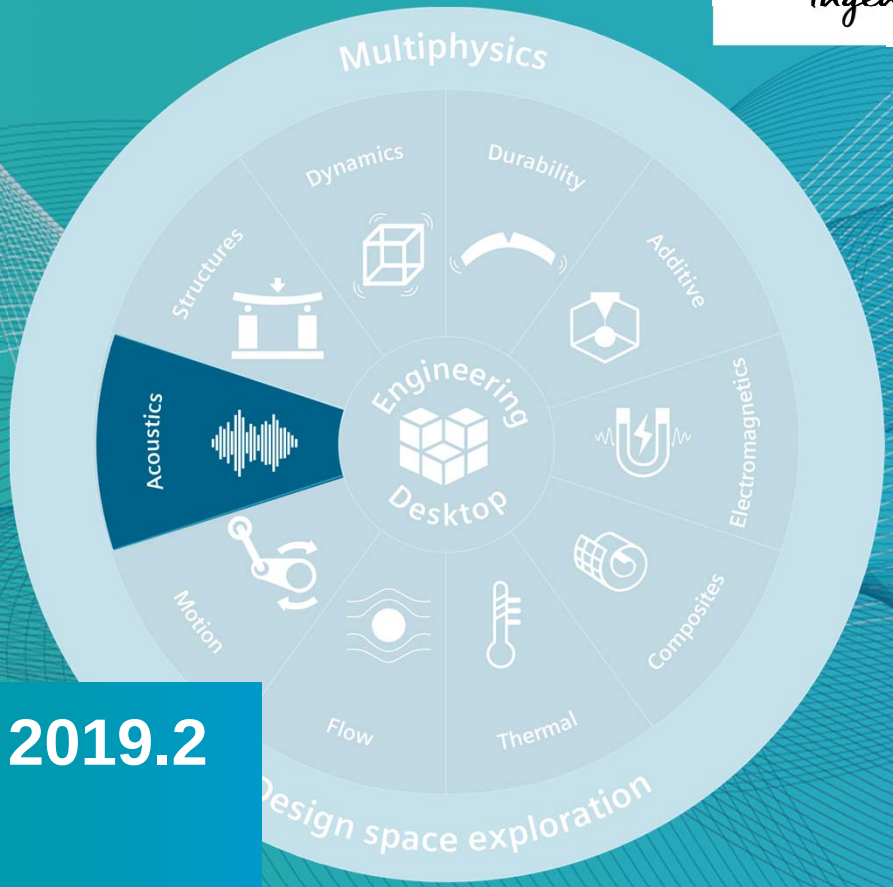

What's New in Simcenter 3D 2019.2
Acoustics

Realize innovation.

Delivering a Platform for Multi-Disciplinary Design

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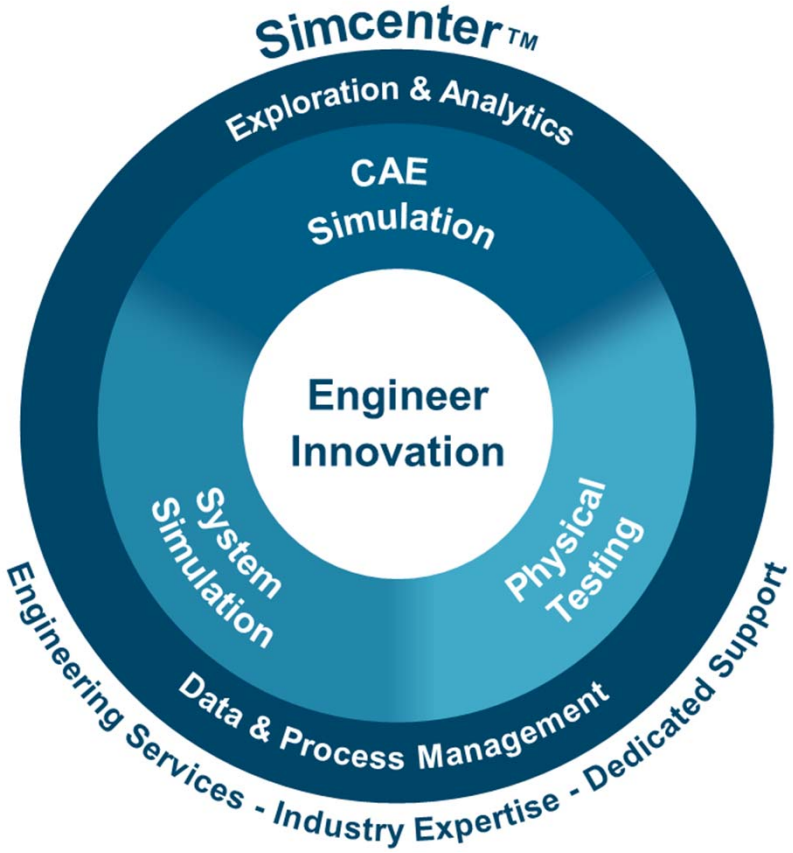

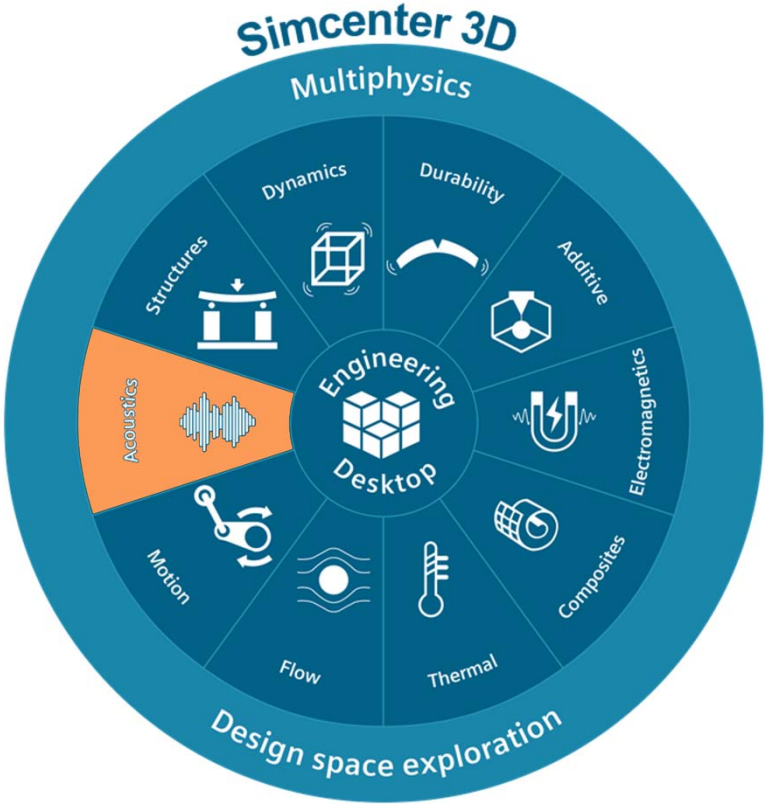

Simcenter 3D Acoustics
Overview slide

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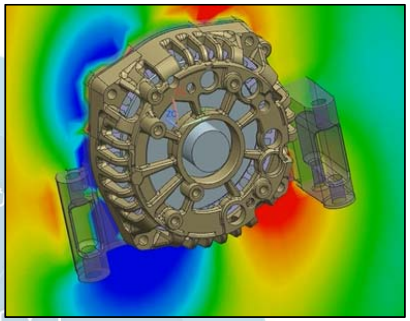
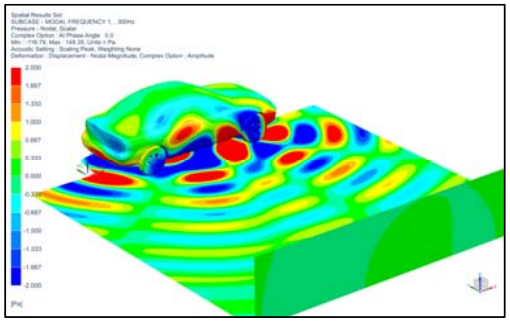
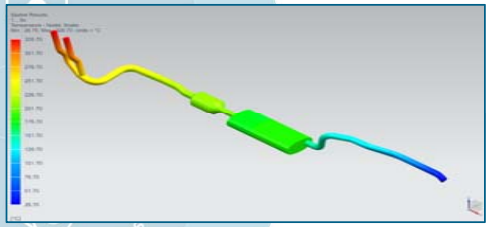
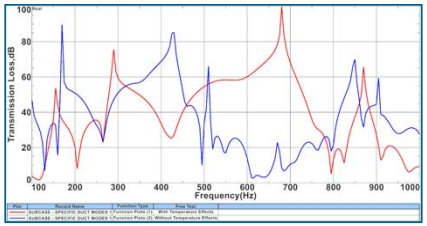




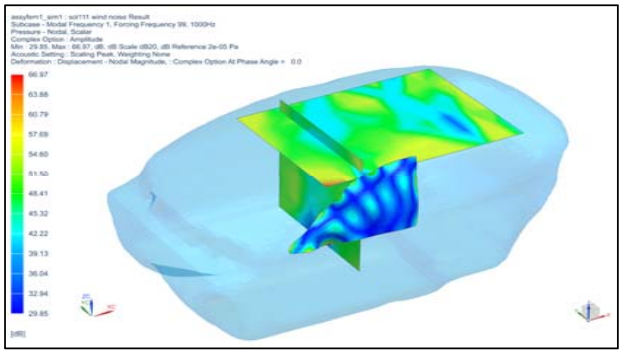




Simcenter Nastran (FEM)

Simcenter 3D Acoustics BEM

- Component Noise Radiation
- Full Vehicle Exterior (Pass-By) Noise
- Duct Acoustics
- Cabin Acoustics
- Aero-Vibro-Acoustics (wind noise)
- Aero-Acoustics (eg HVAC)



Simcenter 3D Acoustics – Highlights 2019.2
Overview slide

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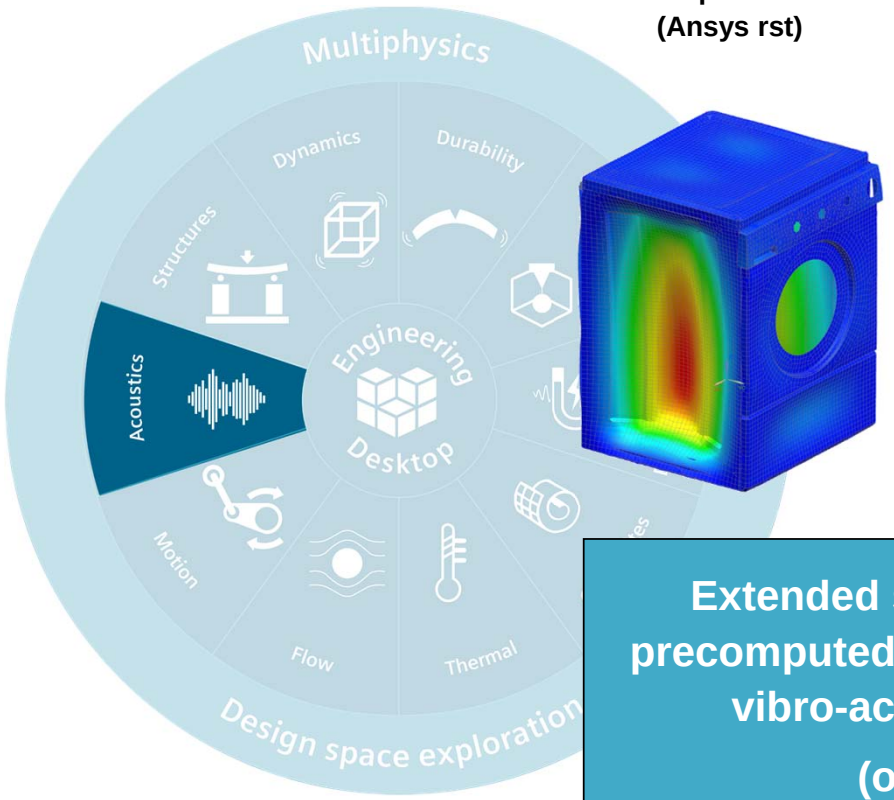
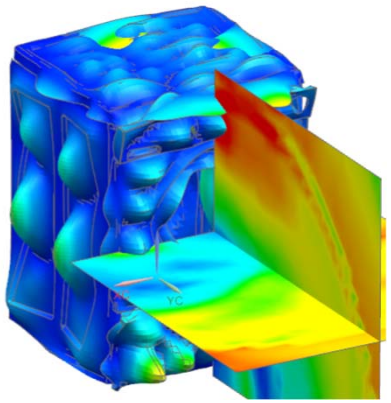


Pre-computed modes (Ansys rst)

Vibro-Acoustic Response Simcenter Nastran op2



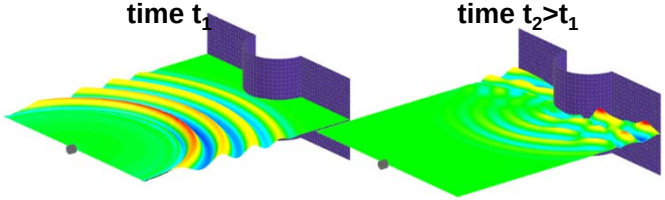
Simcenter 3D

Time Domain BEM

For impulsive noise simulation in time domain

Parking sensor, time t_1

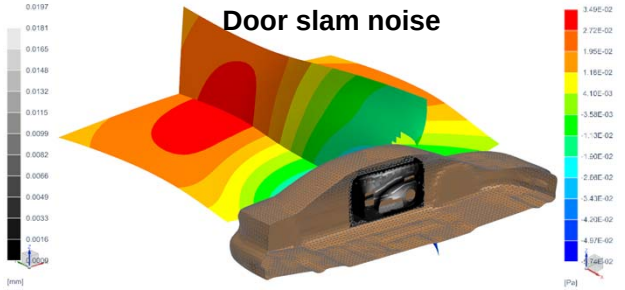
Parking sensor, time $t_2 > t_1$



Extended support for re-use of precomputed structural FE results in vibro-acoustic simulations

(op2, rst, odb)

Door slam noise



Acoustics - Binary Loads and Modes from Simcenter or 3rd party FE data for increased performance

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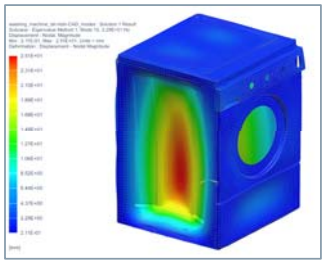
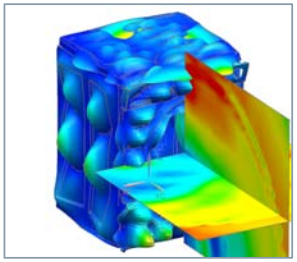
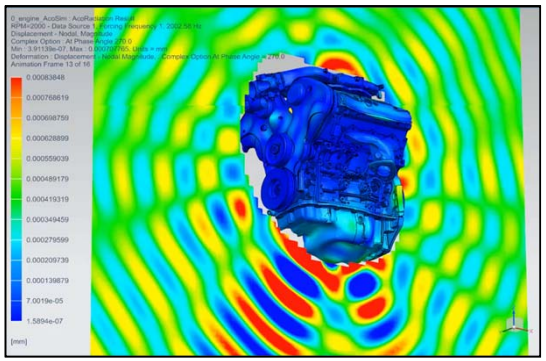
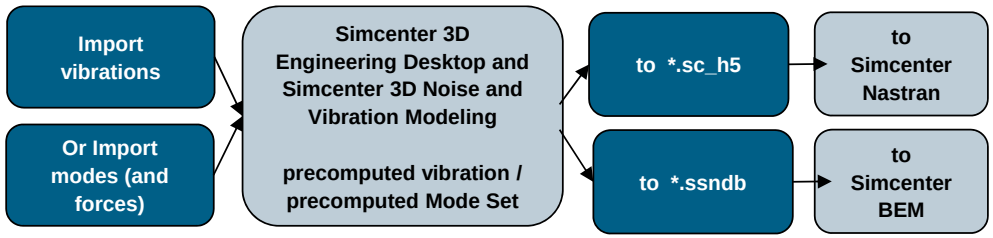
Speed up vibro-acoustic simulations by re-using precomputed vibrations or modes

Challenge:
- Re-use of precomputed structural FE vibrations/modes for vibro-acoustics
- Efficiently passing such data to Simcenter solvers

Solution:
- Model and Load Preprocessing now supports reading vibrations from NASTRAN “.op2” , ANSYS “.rst” , ABAQUS “.odb”
- Mode Set now supports same filetypes
- Data is passed to Simcenter solvers using lean, binary (HDF5) files,

Benefits:
- **Openness**: support of re-using 3rd part FE results
- **Performance**: data is passed via compact binary files, yielding faster writing and reading and hence faster overall solution time



Acoustics - Random VATV Forced Response

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Faster and more accurate Random TBL Response

Challenge:

- The current TBL response workflow requires two steps (Pre Solver to compute the loads and Simcenter Nastran to compute responses)
- The loads computation require an unfeasible amount of memory.

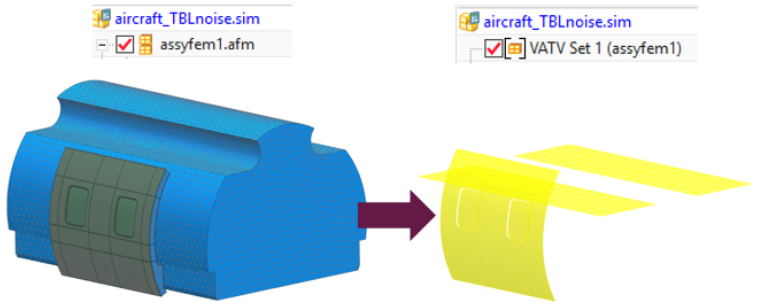
Solution:

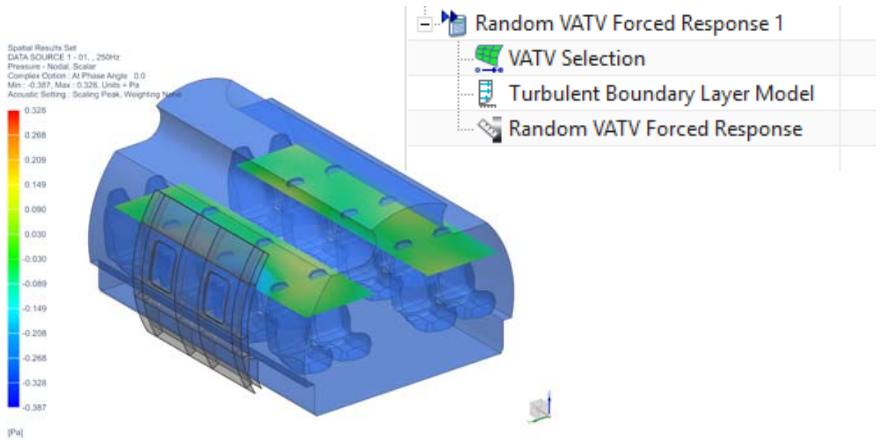
- Implement a random response using directly VATVs
- Perform the triple product by blocks to allow low memory consumption:

$$VATV \cdot TBL \cdot VATV^* = PP^*$$

Benefits:

- When using VATV representations, larger Random Vibro-Acoustic problems, with **larger** amount loaded surfaces (more DOF), can now be tackled, **faster**
- Random sampling technique to reduce load size, can be omitted, which assures **highly accurate loads and ditto responses**





Acoustics – Other FEM Extensions

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Extend contribution computations and increase performance of standard FEM and FEMAO solutions

Challenge:

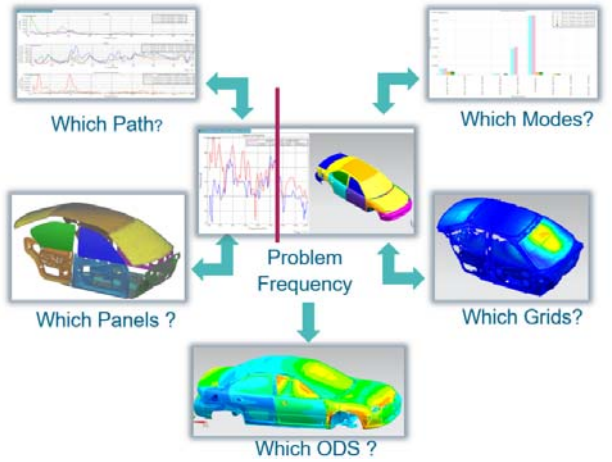
- Not all contributions (panel, modal, grid) to the acoustic response available
- Maximum frequency for acoustics not available before solving
- FEMAO did not support all types of constraint DOF (MPC, RBEx, SPCD) in Fluid Structure Interaction surface

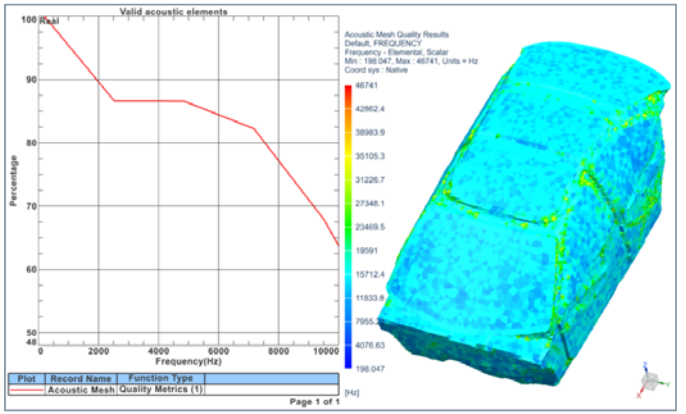
Solution:

- Extended contribution support
- New FEMAO quality computation in “check-mode”
- Support of constraint dofs in FEMAO vibro-acoustic problems

Benefits:

- **Ease of Use**:
  - upfront optimization of FEMAO mesh is more easy now
  - More complete insight in root causes for vibro-acoustic problems, thanks to extended support for contribution analysis: which panel, mode, grid ?
- **Capability**: wider range of models are supported with FEMAO





Acoustics - Transient BEM

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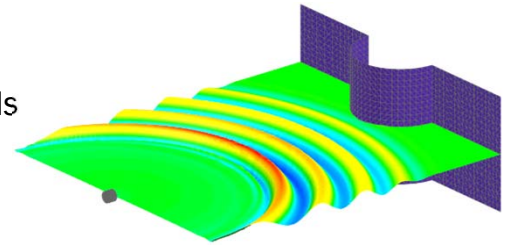
Simcenter 3D Acoustics Time Domain BEM for time domain acoustic response simulation

Challenge:
- Solve acoustic response for scenarios with impulsive excitation signals

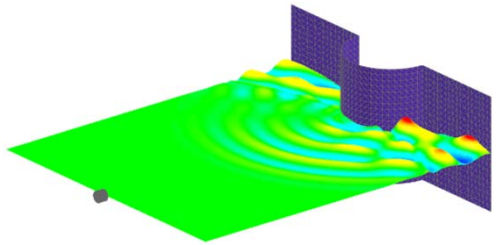
Solution:
- Simcenter 3D Acoustics Time Domain BEM for simulation of acoustic and vibro-acoustic response in time domain
- Support for acoustic monopole, plane waves, structural forces or precomputed vibrations
- Propagation domain realistically represented thanks to support for Infinite plane, acoustic absorber, transfer admittance

Benefits:
- **Accurate** modelling of **time** domain problems with BEM, yielding reduced modeling effort (only surface boundary)
- **Fast, efficient** solver in time domain, also for large models

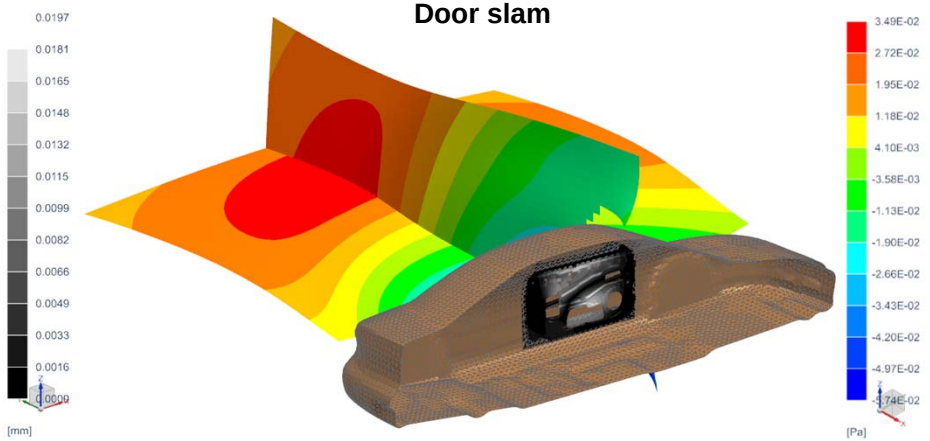
Parking sensor, at time t_1



Parking sensor, at time $t_2 > t_1$



Door slam



Acoustics – Structural Vibrations in Simcenter 3D Accelerated BEM

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Structural vibrations as input for acoustic radiation solutions in Simcenter ABEM

Challenge:

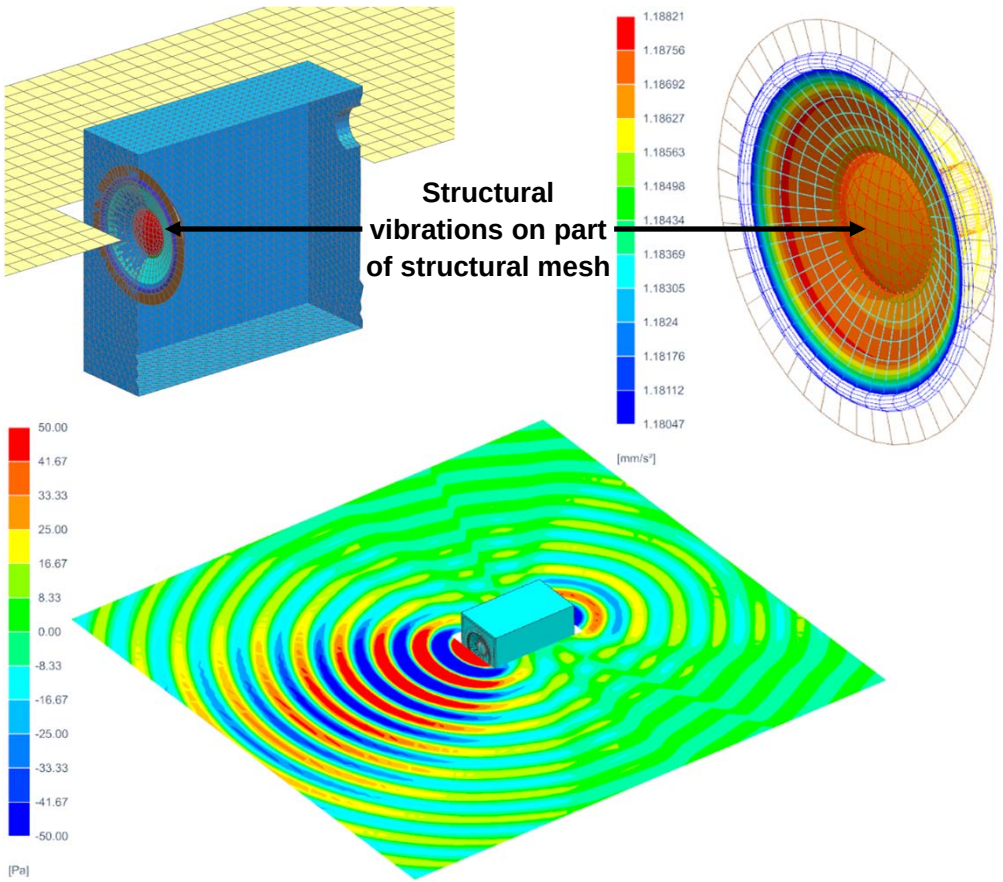
- Use of precomputed structural vibrations in Simcenter ABEM

Solution:

- Support of precomputed structural vibrations for weakly coupled vibro-acoustic response in Simcenter ABEM solvers (Fast Multipole BEM and H-Matrix BEM)
- Vibrations can be expressed on full or part of the structural model

Benefits:

- Support for **higher frequencies for surface vibration driven acoustic radiation,** by enabling this type of boundary condition for Simcenter ABEM



Acoustics – Acoustic Chamber Mesh

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Automatically generate acoustic meshes around structural panel for Transmission Loss computation

Challenge:

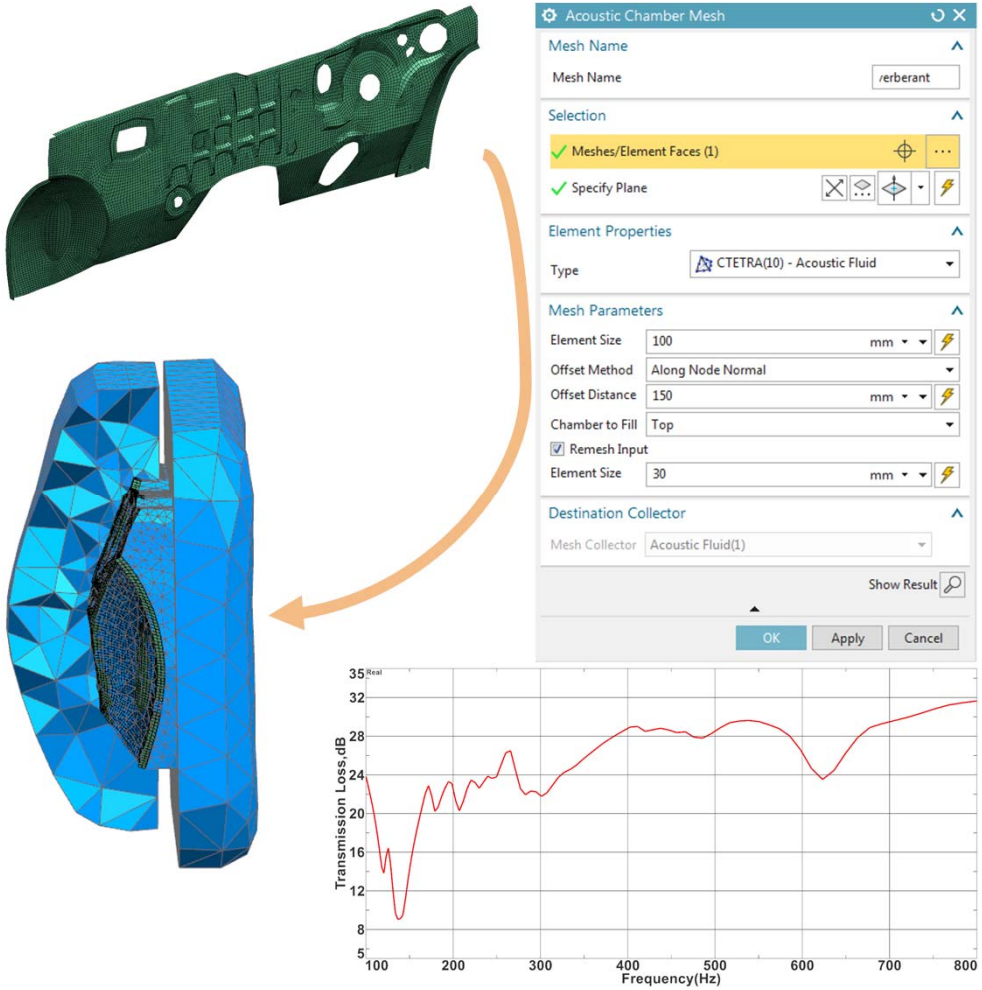
- Panel transmission loss computation requires specific meshes for representing the acoustic rooms used in a physical test
- Difficulty of preparing acoustic meshes without CAD support, and still requiring multi-step process

Solution:

- New tool “Acoustic Chamber Mesh” to automatically generate 3D acoustic meshes around input panel, including hole filling, panel remeshing, 3D volume mesh creation in front and behind the panel, groups creation (AML surfaces, contact surfaces)
- Parameters: input panel, trim plane, element size, offset distance

Benefits:

- **Ease of Use: highly-reduced meshing work**, more automatic, faster preparation



Acoustics – Mesh from Point Cloud

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Automatically generate 1D wireframe and 2D shell meshes from cloud of points in pre-processing phase for vibro-acoustics

Challenge:

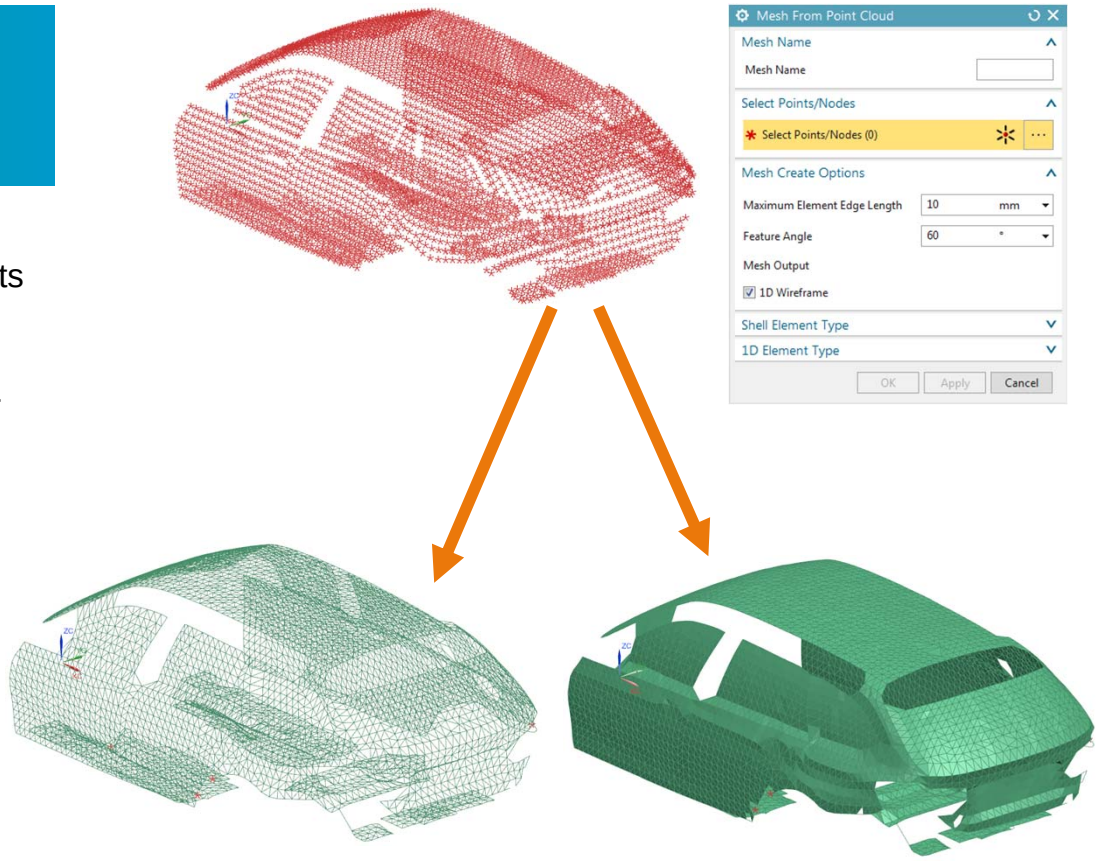
- Imported data, from Test for instance, might be provided only on points
- Data on points is not sufficient, as we need:
  - For optimal visualization, at least a 1D wireframe mesh
  - For vibro-acoustic coupling with a fluid, at least a 2D shell mesh for the structure

Solution:

- New tool “Mesh from Point Cloud” to automatically generate 1D wireframe and 2D shell meshes
- Parameters: nodes/points selection, edge length, feature angle

Benefits:

- **Ease of Use: no manual work** to generate meshes, fast tool



Acoustics – XY Plot – Double Cursor Operations

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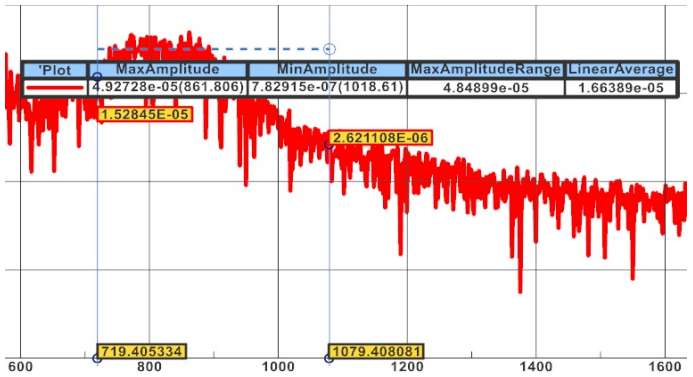
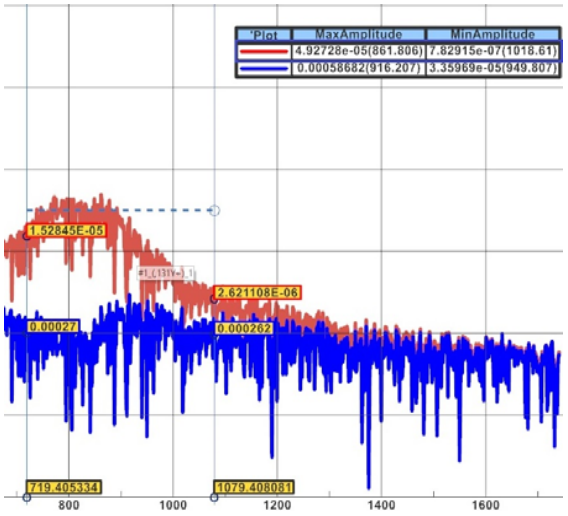
Quick computations directly on your XY plot

Challenge:
- Simcenter 3D does not allow to retrieve information from a curve directly in the XY Plot environment
- Most users ended up exporting the results and moving to other tools for further processing

Solution:
- Introducing a double probe mode
- Allowing quick computations on a curve (or part of it)
- Providing a set of usual functions: Max, Min, Average, Integral,..

Benefits:
- Retrieve relevant information from a curve in a quick way
- Live update of computations
- No need to export curve data to other applications





Acoustics – Probes Extensions

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Enhanced capabilities to post-process results

Challenge:

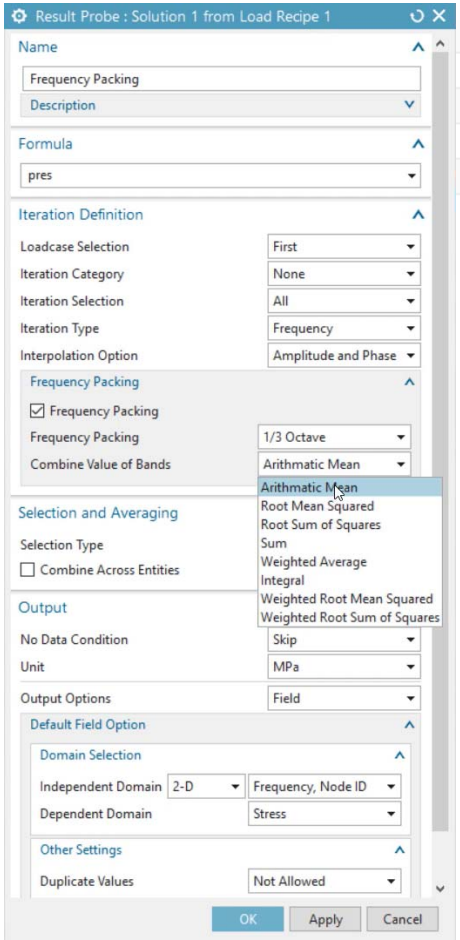
- Simcenter 3D offered limited functionality to post-process Acoustics and NVH results.
- Most users ended up exporting the results and moving to other tools for further processing

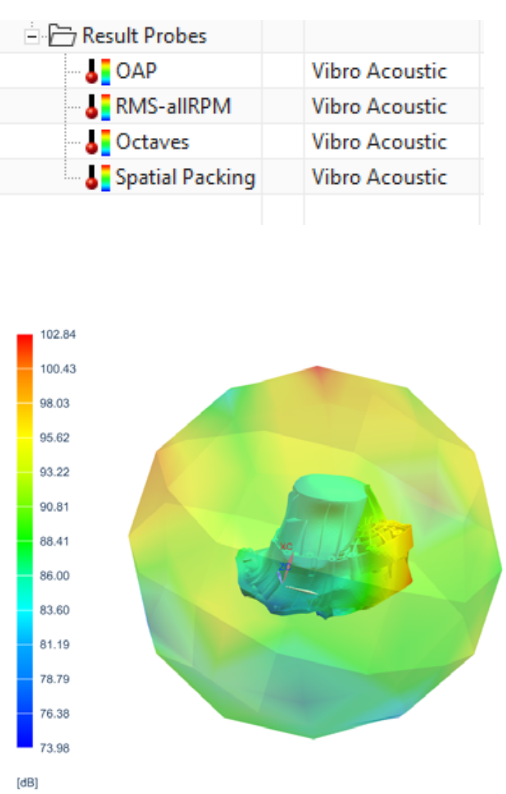
Solution:

- Enhancing Results probes
  - Support of **Frequency Packing** in **Octave** bands
  - Support of **Subcase Packing** to combine RPMs or Engine Orders
  - Support of **Spatial Packing,** Including spatial integration and multiple panels defined by Groups
- Providing a set of usual functions: **RMS, RSS**,..

Benefits:

- User has more flexibility to post-process results
- Less need to export data to other applications





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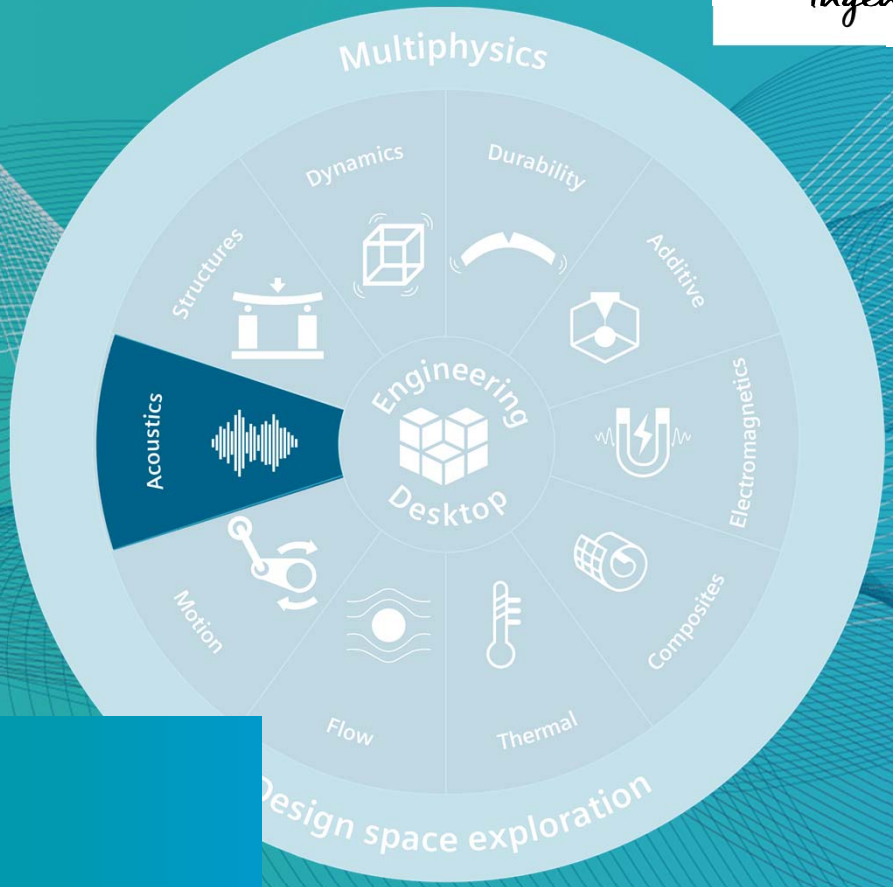

Thank You!

Realize innovation.