

# Simcenter 3D environment for BEM acoustics

## Using the boundary element method for setup and postprocessing of vibro-acoustic analyses

### Benefits

- Create models for acoustic BEM simulation with a dedicated user interface
- Provide standard configuration for BEM acoustics analysis, supporting uncoupled, weakly coupled and strongly coupled vibro-acoustic analyses

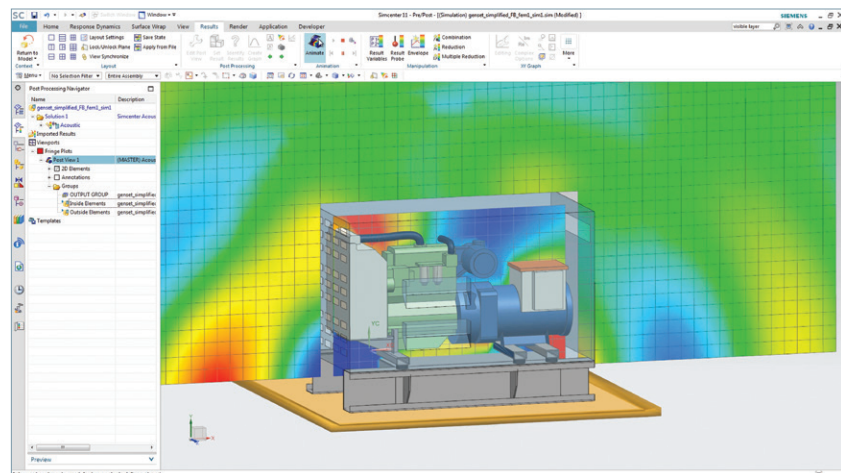
### Summary

The Simcenter™ 3D environment for boundary element method (BEM) acoustics software contains the required functionality to prepare a BEM acoustics or vibro-acoustics model for the Simcenter 3D BEM acoustics solvers and postprocess the results. The

environment supports setup for both direct BEM (for closed meshes only) and indirect BEM. You can rapidly create boundary conditions and acoustic sources and optionally couple it with a structural model, generating a ready-to-run acoustic or vibro-acoustic simulation model. The modeling environment also includes dedicated postprocessing tools to analyze acoustic results and study structural panel and modal contributions.

### Simcenter 3D BEM vibro-acoustic analyses

- Direct BEM – Pure acoustic radiation of a closed model
- Indirect BEM – For interior/exterior acoustics, weakly coupled and strongly coupled vibro-acoustic analysis. Random acoustic and vibro-acoustic analyses are supported with diffuse acoustic field loading using distributed random plane waves sources



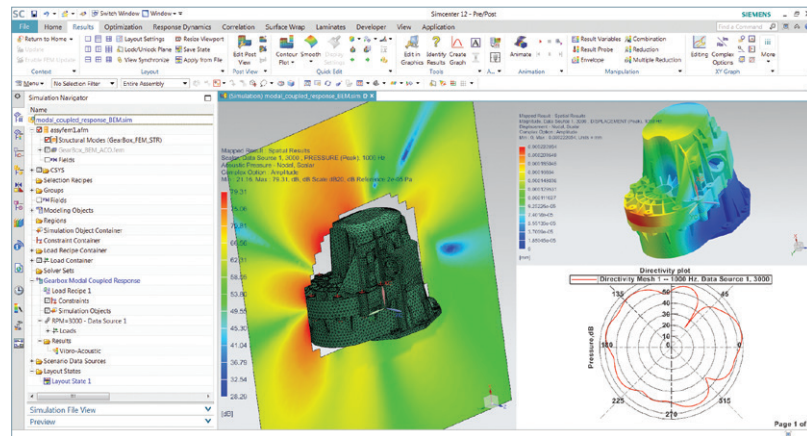
# Simcenter 3D environment for BEM acoustics

## Loads and boundary conditions

- Apply acoustic pressure and normal acoustic velocity manually on 2D acoustical elements
- Define monopole acoustical sources in free space representing a pulsating sphere
- Define dipole acoustical sources in free space representing two pulsating spheres in opposition of phase
- The user can define acoustic plane waves by specifying their location in space and the direction of propagation
- Apply a diffuse acoustic field using distributed plane waves
- Automatically transfer structural vibrations to the acoustical boundary with a weakly coupled setup
- Structural force loads on a structural model, represented by a Mode Set, for weakly-coupled or strongly coupled vibro-acoustic analysis
- Impedance and admittance boundary conditions can be defined on elements
- Structural panels can be defined to analyse contributions to the total acoustical response
- Transfer admittance can be applied on 2D acoustical elements to represent perforated sheets and filters
- Infinite planes can be created to simulate a global zero normal velocity plane or zero pressure release plane

## Vibro-acoustic coupling

For BEM indirect weakly coupled vibro-acoustics analysis, a coupling algorithm ensures the accurate transfer of structural vibrations to the acoustical elements. You can use parameters and coupling quality color maps to control and accurately visualize the coupling, which is established by the solver. The same algorithm is also used in a strongly coupled context to capture the influence of the fluid on the structure (pressure loads) as well as the influence of the structure on the fluid (volume velocity loads).



## Solution definition, solver control and input file creation

- Fully control the frequencies to be calculated. Frequencies can be manually defined or automatically retrieved from structural vibrations
- Control and compute acoustic quantities in a graphical user interface (GUI). Users can analyze results for groups of elements or individual microphones
- The simulation model is automatically verified before it is exported to the solver. The consistency of the mesh, material and property is checked. User feedback is provided to avoid errors prior to solving

## Application-specific postprocessing of results

- Application-specific scenarios can be created to efficiently filter and display function results or directivity plots related to microphones
- Postprocessing functionalities can be used to represent structural results such as displacement, velocity and acceleration
- Dedicated panel contribution tools allow you to study the contribution of structural panels to the total acoustic response
- Specific modal contribution tools allow you to study the contribution of structural modes on the total acoustic response

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