

Oofelie::VibroAcoustics, driven by SAMCEF Field, provides engineers and analysts with unique capabilities to analyze vibroacoustic phenomena. With OOFELIE::VibroAcoustics, you are getting the core of the physics in one conveniently integrated simulation package.

Oofelie::VibroAcoustics also provides a solution for coupled analysis. Many vibroacoustic problems exhibit a more or less pronounced coupling behavior, resulting in the mutual influence of the structural and acoustic fields. This coupling can significantly affect the response of the system, such as the shape and the frequencies of the vibration modes. To obtain an accurate prediction of the response, a coupled approach is mandatory. Oofelie::VibroAcoustics offers a built-in, simultaneous solver for the whole system, thus providing a better solution accuracy for strongly coupled cases.

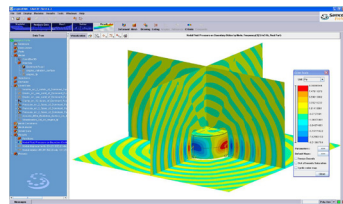
Reduced design time, improved quality and reduced costs are some of the benefits one can now obtain using Oofelie::VibroAcoustics.

MODELING ENVIRONMENT

Oofelie::VibroAcoustics is driven by a user-friendly integrated graphical user interface, SAMCEF Field, for the modeling, the analysis and the post-processing of vibroacoustic systems.

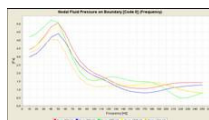
SAMCEF Field, a complete and interactive user environment providing all the tools necessary to design, simulate and analyze a range of configurations, has been tailored to approach efficiently the field of vibroacoustics. Its visual and hierarchically arranged layout will guide you through all the steps of model preparation, resolution procedure and analysis.

A CAD **modeler**, as well as **import capabilities** from other leading CAD providers, is integrated for modeling and **data preparation**. As data are directly defined on the geometry, users can easily switch system components modeling level from one behavior to another.



Parameterized data entry is easily done using contextual pull-down menus and pop up boxes using a wide selection of preprogrammed functions for the definition of time and frequency varying properties and boundary conditions.

As soon as the analysis is completed, the results are easily accessible from a simple click in the navigator. Results may be displayed in different forms over the whole model or through user's defined cross-sections to study detailed behavior. In addition to all the state-of-the-art **standard graphic outputs** (i.e. **X-Y plots, isovalues, animations, etc.**), results may also be inserted in tabular forms in the analysis report. SAMCEF Field is common to all the solutions provided by Open Engineering allowing other analyses to be performed on the same model as for vibroacoustic simulations.

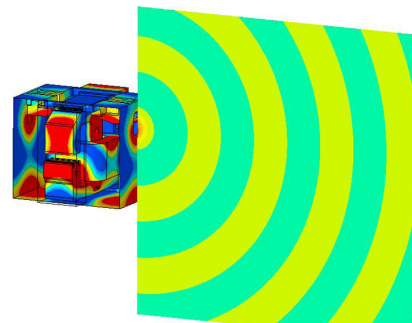


PLATFORMS

Oofelie::VibroAcoustics, driven by SAMCEF Field, is available on Windows and Linux platforms.

STRONGLY COUPLED MODAL AND HARMONIC ANALYSES

Oofelie::VibroAcoustics provides a methodology that allows predicting the acoustic and vibroacoustic behavior of interior, exterior and mixed interior-exterior fluid regions and their interactions with structures. Many vibroacoustic problems exhibit a more or less pronounced coupling behavior, resulting in the mutual influence of the structural and acoustic fields. This coupling can significantly affect the response of the system, such as the shape and the frequencies of the modes. To obtain an accurate prediction of the response, a coupled approach is mandatory. Oofelie::VibroAcoustics offers a built-in, simultaneous solver for the whole system, thus providing a better solution accuracy for strongly coupled cases.



ACOUSTIC ANALYSIS
OF AN ELECTRIC RELAY

FEM-BEM COUPLING

The acoustic mediums can be modeled using Finite Element Method (FEM) or Boundary Element Method (BEM). Then FEM and BEM methods, as well as the coupling between the two methods, have been implemented in Oofelie::VibroAcoustics.

MESH MAPPING CAPABILITIES

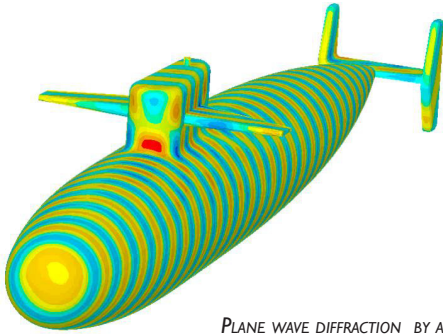
Oofelie::VibroAcoustics allows to deal with incompatible meshes between the structure and the acoustic medium in a strongly coupled way.

FMM INTEGRATION

The Fast Multipole Method is used to simulate acoustic radiation/diffraction problems with large number of degrees of freedom using BEM methodology.

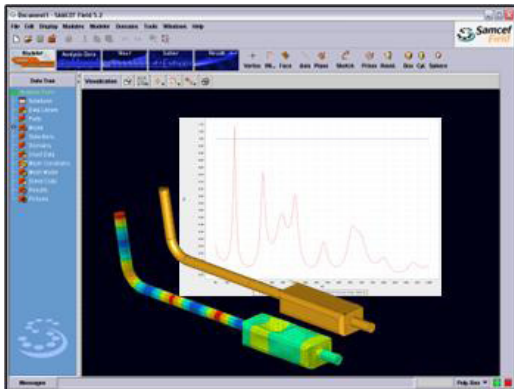
EXAMPLES OF APPLICATIONS

Oofelie::VibroAcoustics, driven by SAMCEF Field, allows covering many applications in the low to mid frequency range. The general three-dimensional models offer generalized methods that can be adapted and used for many different applications in the transportation (aircraft, automotive), equipment (machinery, motors, sound systems) and building industries, for instance.



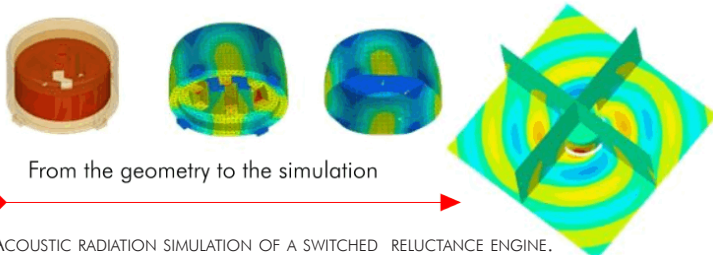
PLANE WAVE DIFFRACTION BY A SUBMARINE USING FMM

The plane wave diffraction by a submarine is a typical application for FMM solver. Here, the radiating surface is supposed to be fixed and we compute essentially the blocking-pressure generated at the surface with more than 50K nodes. The submarine is about 37 meters long and is immersed in an infinite water medium. On a classical computer, the FMM solver permits to compute the solution in less than one hour (compared to the 44 hours that would be necessary using a classical resolution technique).



VIBROACOUSTIC ANALYSIS OF A MUFFLER

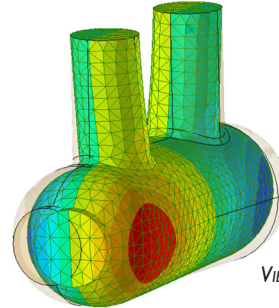
In the muffler analysis, the cavity and the structure are modelled with FEM. A unit pressure field is imposed at the inlet and a non-reflecting boundary condition is imposed at the outlet. On the 2D display, the pressure field at the outlet is measured and we can see that the muffler reduces significantly the pressure field for all the frequency range.



ACOUSTIC RADIATION SIMULATION OF A SWITCHED RELUCTANCE ENGINE.

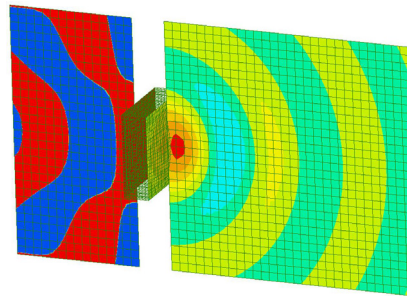
In the switched reluctance engine analysis, the prediction of the noise generated by the vibration of the housing is performed. Here, we are able to compute the acoustic power generated by the engine but also to predict how the engine sounds like (wave file generation).

The coupled eigen modes of a water filled tank are extracted using Oofelie::VibroAcoustics. In this case, even if we are not interested in acoustic field inside the cavity, we have to take it into account since it has a strong impact on the global behaviour of the system.



VIBROACOUSTIC BEHAVIOR OF A TANK

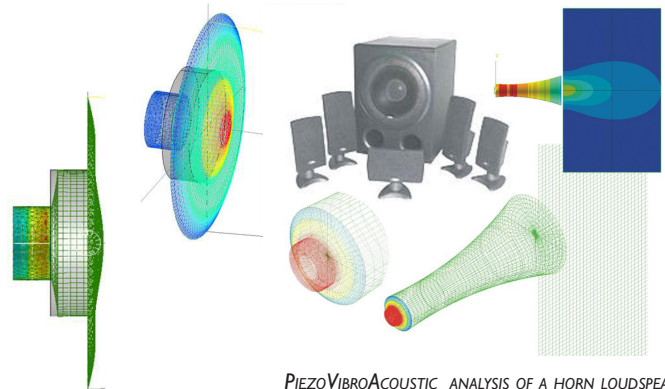
The effect of a double layer window on noise transmission can be modeled too. Here, two separated semi-infinite acoustic mediums are modeled using two different Rayleigh BEM conditions. In the first medium, the acoustic source is located and in the second one, we visualize the acoustic pressure level transmitted through the window.



EXAMPLE OF TRANSMISSION

EXTENSION

Oofelie::VibroAcoustics is compatible with other analysis fields available in Oofelie Multiphysics. For instance Oofelie::VibroAcoustics can be strongly coupled with Oofelie::PiezoElectric. Hereafter, a piezo stack is used to actuate a vibrating membrane in a horn loudspeaker.



PIEZOVIBROACOUSTIC ANALYSIS OF A HORN LOUSPEAKER



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