CASE STUDY

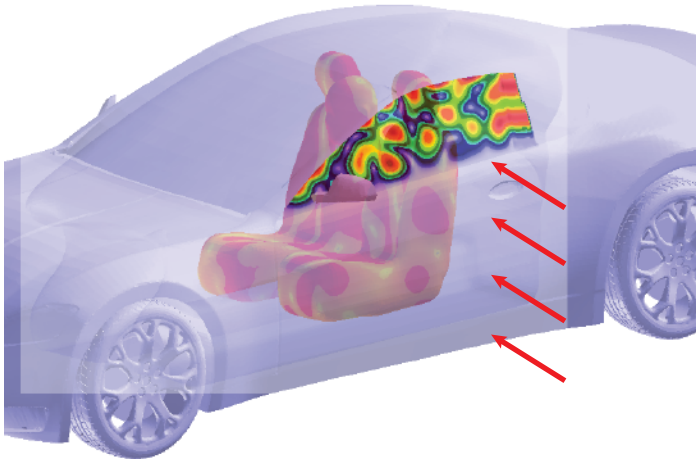
COUSTYX

Fast Multipole Acoustics

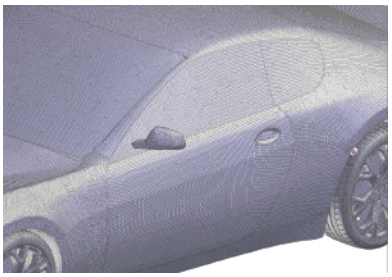
Multiple Domain Acoustic-Structural Coupling: Window Panel Coupled to Car Interior and Exterior Acoustic Domains

Model Description

Noise transmission from the exterior to the car interior through a window panel is evaluated using Coustyx. The feeback coupling between the acoustic pressure and the window panel vibration is considered by a fully coupled analysis[1]. The car exterior and interior acoustic domains are modeled using boundary element formulations. The window panel is modeled using finite element formulation. Invacuo structure modes are used to further reduce the finite element model.

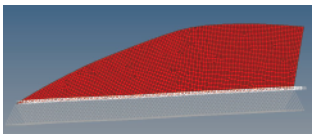


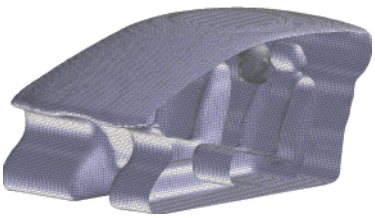
Number of BE elements: Exterior	600000
Number of BE elements: Interior	70000



Surface mesh for exterior BE acoustic domain

FE shell mesh for window panel

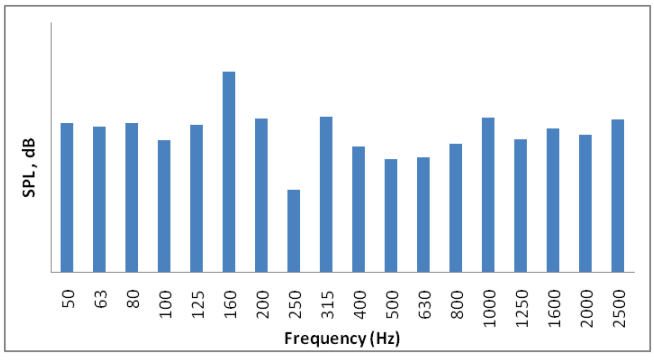




Surface mesh for interior BE acoustic domain

Results & Discussion

Sound Pressure Level measured at driver's ear for an external acoustic plane wave excitation is shown below. The detailed coupled analysis helps to understand the transmission loss properties of the window panel. Similar analysis could be performed to evaluate other vibro-acoustic properties of the coupled system such as the effectiveness of different acoustic liners on the transmitted sound, etc.



SPL at driver's ear

[1] V.K. Ambarisha, "Coupling between multiple acoustic domains through elastic structures: Rapid solutions using Fast Multipole BEM", Internoise, Aug 19-22, 2012, Newyork