The Acoustic Behavior of a Loudspeaker Mounted on Different Types of BIW (Body-in-white) Frames

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Abstract

For automotive applications, simulations are used to optimize the position and orientation of a subwoofer (loudspeaker) in a very constrained space to get the best acoustic performances. One solution is to use particular part of the BIW volume as the subwoofer enclosure. The acoustical modes of the BIW volume will influence the behavior of the loudspeaker. These modes depend on the enclosure geometry, while the speaker positioning has an influence on how strong specific modes are excited. To support the development of OEM premium audio systems, Engineers perform Acoustic - Structure Interaction study to predict the performances of a complex BIW structure (use of the CAD data). To speed up any audio development, Harman decided to develop a simulation model and a COMSOL® Application using a fully parametrized loudspeaker and BIW (single or multiple beams designs) model. The validation of the simulation model has been performed by using measurements and theoretical results. This app has become one of the democratization of engineering apps across Harman, which is useful to quickly predict the performances of the loudspeaker in different configurations. Based on this preliminary study, a more detailed simulation on a very accurate BIW geometry would be performed for final optimum configuration. The COMSOL® App is a quick reference tool to predict the interaction between the speaker and the BIW structure. It allows to reduce the speaker and the BIW architectural design time with the help of creating automated report including Sound pressure level, Cone displacement and electrical Impedance plots.
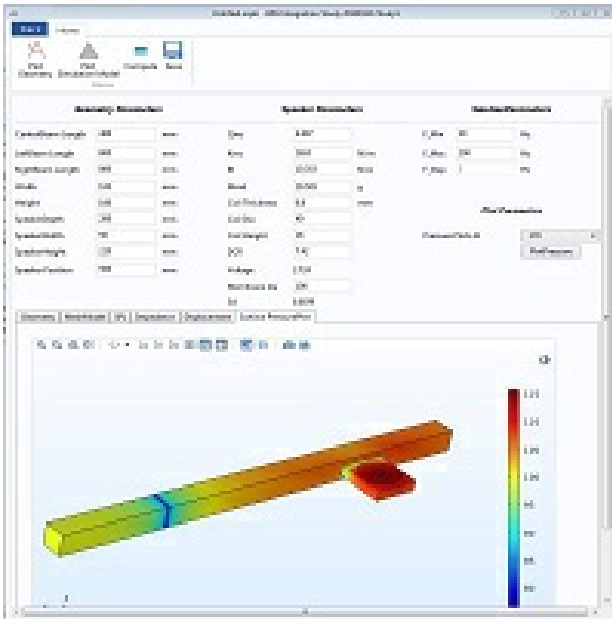
Figures used in the abstract

Figure 1: COMSOL Application GUI with Sound pressure plots on single BIW frame with integrated speaker