

Complete Modeling of a Vented Box Loudspeaker in COMSOL Multiphysics®

R.VAUCHER¹

¹NEXO, Plailly, France

Abstract

This paper describes the use of COMSOL Multiphysics® during the design of a vented box loudspeaker. Several templates have been created to model the different needs of a complete design. Based upon those templates a real box has been prototyped, measured and confronted to simulation. The paper will describe some of the templates with the different validation done. (issue with the PML width, the distance between farfield and PML, symmetry of the far field...)

The cabinet prototyped may be described as a vented box design, featuring two low frequency drivers mounted in a "V Shape" with a horn loaded compression driver. Several uses of COMSOL Multiphysics® have been considered in this study. Optimization of the coverage of the V shape design with different configuration in 3D (angling, phase plug devices -figure 1-); Optimization of the tuning and shapes of the vent (using ODE -figure 2-); Optimization of the horn polar pattern and radiating impedance (confronting 2D, 3axy and 3D); Calculation of the acoustic modes within the box (with the problem created by the vent linking the inside and outside); Calculation of the structural modes of box itself. Most of the models have been confronted to real measurements of a prototype made with fast prototyping machine.

All geometries were linked to the LiveLink™ with SolidWorks®. Post processing has been done in MATLAB® in order to have a better vision of the coverage patterns.

Figures used in the abstract

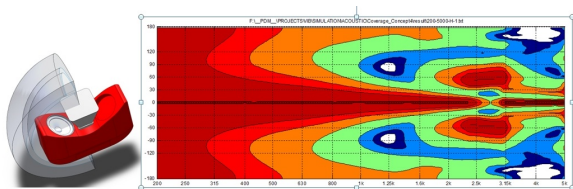


Figure 1: LF Directivity pattern

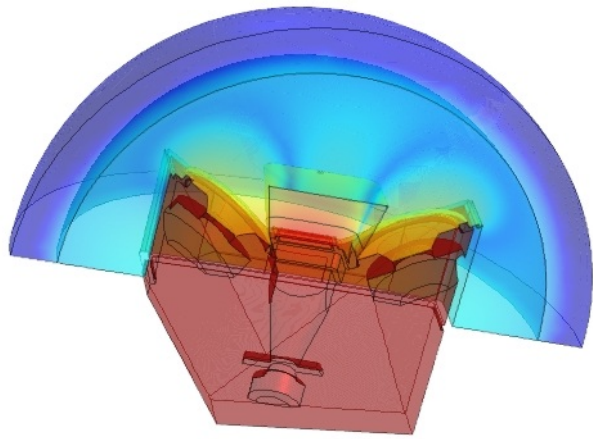


Figure 2: Port tuning