Duct Silencer Modeling With COMSOL Multiphysics®

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Abstract

Duct silencers are used to reduce noise in Heating, Ventilation and Air Conditioning (HVAC) as well as noise from exhaust gas chimneys. For a duct silencer, an important trade-off has to be made between the achieved noise reduction and the pressure drop.

Using an example model, we will show some insights in how COMSOL Multiphysics® fits in the workflow of ASCEE for custom silencer design. Our focus lies on the class of minimal pressure drop (free flow-through) silencers. To obtain the optimal required reduction in the limited space available, these silencers should be tuned to the source power spectrum. To this end, a hybrid combination of reactive (Helmholtz resonators) and absorptive (mineral wools / micro perforates) components is required.

As a starting point for silencer design, we use typically a 1D transfer matrix optimization program. This results in starting points for dimensions for the chambers of a silencer. After that, the silencer design is further shaped in COMSOL Multiphysics®, where the hole sizes are tuned but also 3D effects come in. We will show how we speed up the modelling process using the Parts Library and "Port" boundary conditions of the Acoustics Module.

Figures used in the abstract

Figure 1 : Example of a hybrid duct silencer model