DESIGN OF AN ANECHOIC PIPE TERMINATION

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The topic of the research project is to design an anechoic termination mounted on a ducted fan setup. The main purpose of the termination is to pretend the duct to be an infinite pipe with practically no reflection of the incident acoustic waves. The resulting equipment will aid the investigation of the fan noise in a HVAC environment.

In the first part of the project the goal is to develop experimentally a termination in resting air, exciting the tube volume by tonal noise over a broad frequency range. Overdetermined plane wave decomposition – by measuring acoustic pressure with six microphones – is used to analyze the behavior of different terminations. In the second part the acoustic behavior of terminations in presence of mean flow is investigated. Only the mean flow is simulated experimentally to allow comparison to the theoretical approach. The turbulence and swirl induced by the fan are not considered.

It is found that the shape of the horn is essential in terms of reflection coefficient of the termination. Horn designs obtained from a numerical optimization approach are investigated experimentally for the first time. Results are compared to data obtained during this project by applying a 1D theoretical approach and by using the acoustic solver Sysnoise. Results are also compared to numerical data from the literature. Feasible and controllable values for the reflection coefficient below 0,1 are achieved over the given frequency range. The investigation has also shown that flow velocities below Mach=0.1 have small influence on the reflection coefficient.

The project serves as a guideline for designing anechoic terminations, enabling future laboratory experiments needing infinite duct approaches.

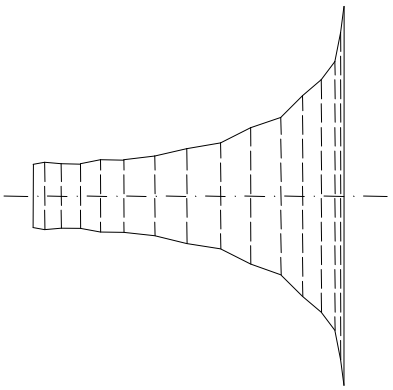

Figure 1: Optimal horn shape

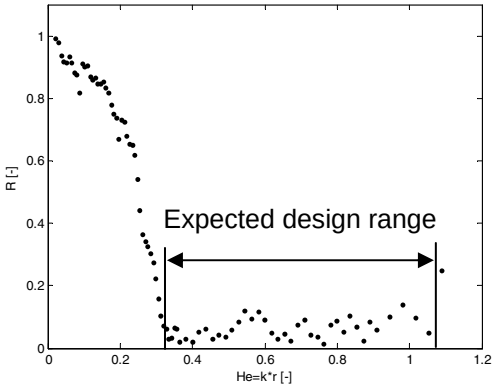

Figure 2: Reflection coefficient for the optimal horn