ABSTRACT

Noise generated by jet flows has been investigated actively for many years. However, there are still many open questions in aeroacoustic research. In real life, jet flows are often characterized by a density gradient between the jet and the outer fluid. The most important problem of that kind is the sound generated by the exhaust of aviation engines, where the density of the hot turbine exhaust is lower when compared to the coflowing air.

Experiments revealed a clear similarity of the acoustic emission of heated jets and jets composed of multiple species [1]. To understand the relevant noise generating mechanisms related to density fluctuations, large eddy simulations (LES) of a single and a coaxial jet composed of a Helium-air mixture have been conducted. The acoustic field is determined by a hybrid approach using the acoustic perturbation equations [2].

Figure 1(a) shows a snapshot of the emitted acoustic field for the coaxial Helium-mixture jet case. The dots in the plot indicate the positions of virtual microphones used to obtain farfield measurements. The corresponding overall sound pressure level over the polar angle is depicted in figure 1(b). The results for the low angles are in very good agreement with experiment while there is a certain offset towards the sideline direction where the sound generation field is more induced by small turbulent structures not resolved by LES.

References
