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Numerical simulation of aerodynamical noise generated by a cylindrical cavity

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Cylindrical cavities are mounted at some positions on fuselage and wings of commercial transport aircraft for various service functions. Such cavities were identified as potential airframe noise sources generating high intensity whistles at frequencies situated in the audible range of 0.5-0.8 kHz. The present paper focuses on the numerical simulation of the far field noise generated by the unsteady flow passing over a cylindrical cavity with an aspect ratio (diameter/height) equal to unity, using a numerical methodology combining a LES and a Kirchhoff integration method. The LES computation was done using ONERA's cell-center / finite-volume / CFD code named FLU3M. A laminar boundary layer profile was applied upstream the computational domain, without forcing any turbulence. The LES results were coupled with a 3D Kirchhoff method in the frequency domain. The computed far field noise was compared to dedicated experimental data, showing very good agreement, especially regarding the emission frequency. The final paper will present in detail the involved numerical methods, the computational procedure, and several comparisons to experimental data. This study was completed in the framework of the AEROCAV (AEROacoustique d'une CAVité cylindrique) project funded by the FRAE (Fondation Recherche Aéronautique et Espace).