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Large Eddy Simulation and Reconstruction of Local Fluctuations for the Aero-Acoustic Characterization of Ventilation Nozzles
CHRISTOPH REICHL, CHRISTIAN KRENN, HERMANN LANG, MARTIN MANN, Arsenal Research - Austrian Research Centers — Ventilation nozzles are often identified as significant aero-acoustic sources, the predominant sound generation process being due to turbulence in the shear layer of the nozzle's free jet. Different nozzle types (circular, elliptic and coaxial circular, Reynolds number 100.000) are characterized with respect to local fluctuation spectra and the acoustic far field signal using two different numerical approaches: (1) Velocity, turbulent kinetic energy and dissipation rate from steady RANS calculations are used for the reconstruction of artificial velocity fluctuation time series; (2) transient LES are performed to extract the actual time dependent turbulent velocity field. Both approaches lead to a huge quantity of data (500 GBytes per run), which is processed using Lighthill's Acoustic Analogy to gain the far field acoustic sound pressure and frequency content. Both methods have the potential of characterizing the acoustic behavior. However, local pressure fluctuations showing the typical frequencies of the vortex formation mechanism can only be extracted using unsteady CFD.

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