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[Extended Abstract]

RANS based analytical modeling of broadband noise for a low-speed fan

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The broadband noise sources are investigated on an isolated low-speed fan typical of engine cooling system. RANS simulations have performed on a single blade passage for several flow rates at the same rotational speed. The flow structures responsible for the different noise contributions are indentified by a systematic analysis of the simulation results. The aeroacoustic noise predictions are based on the Amiet's model for rotating sources in free-field. The contribution of the turbulence impact at leading edge and the boundary layer diffraction at trailing edge are considered by the appropriate isolated blade response and statistical model of the turbulent sources. The flow parameters of the aeroacoustic response and the turbulent models are extracted from the RANS simulations. The radial evolution of the flow parameters for the different flow rates is analysed are related to the three dimensional flows in the machine. The acoustic predictions are validated with experimental spectra measured upstream of the fan in a reverberant room. The two considered mechanisms evolve differently with the flow rate. The leading edge sources are dominant at low flow rate up to design point and the self noise becomes dominant at high flow rate for which the secondary flow structures are limited.