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Computational AeroAcoustics of Realistic Co-Axial Engines

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This study, that is relevant from the turbofan engines noise prediction / reduction, aims at CAA-computing the aft fan noise propagation / radiation of a realistic full-3D exhaust (with pylon and internal bifurcations), the latter being affected of (i) typical in-flight (take-off) thermodynamic conditions and of (ii) a representative fan noise modal content. As for previous studies conducted over baseline geometries, this CAA computation is conducted following the usual hybrid process, where a preliminary aerodynamic calculation provides a heterogeneous steady mean flow on which an acoustic calculation is then conducted A RANS computation is first performed, delivering the stationary jet mean flow characterizing the 3D exhaust in its typical 'take-off flight' ($M\infty = 0.25$). A CAA grid (22 blocks, 28 millions cells) is then derived from the CFD one, before the RANS steady jet mean-flow is interpolated on it. After what the CAA computation is computed, a fan noise mode (26, 1) being emitted at a reduced frequency of $kR = 30$ (1 BPF) in the upstream of the engine's secondary exhaust, and numerically propagated along and outside the latter. Finally, a Kirchhoff post-treatment provides the far-field radiation characterizing these engine geometry, modal content and thermodynamic conditions.