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Computational Aeroacoustic Modelling Using Hybrid RANS/LES Methods With Modified Acoustic Analogies

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This study considers a numerical approach to identifying noise mechanisms in tandem cylinders to understand aircraft landing gear as a primary contributor to airframe noise during approach and landing. Fluctuations in the flow properties induced by turbulence are computed as well as the corresponding propagations. A hybrid IDDES turbulence model is employed, to compute the boundary layer and fluctuations in the flow properties. Larsson et al. modified Curle's analogy leading to the derivation of a version of
Curle's analogy that makes use of strictly time derivatives which has been proven to be less sensitive to numerical errors. Brentner and Farassat derived a formulation of the Ffowcs-Williams and Hawkings analogy for a permeable surface enclosing the acoustic sources which accounts for the quadrupole acoustic sources in the flow without the costly calculation of a volume integral. This study will consider the impact of neglecting the volume sources through a comparison of the two modified versions of Curle's and FWH analogies with the results of other CFD practitioners as well as experimental data.

HPC content

For this study, the CHPC large cluster was used. This is because the resolution requirements were high due to the need to be able to resolve tiny noise producing turbulent structures as well as achieving a W wall-normal distance (y+) that is approximately equal to one.

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