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HYBRID RANS-LES SIMULATIONS WITH THE DISCONTINUOUS GALERKIN METHOD

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In recent years, a growing interest has been shown for hybrid RANS-LES approaches and their application to high-fidelity simulations of massively separated flows. Such modelling approach is intended as a way to go beyond the known limitations of the RANS in simulating massively separated flows and the computational cost of LES, which is nowadays still too demanding for a practical use.

The aim of this work is to show recent developments and applications of eXtra-Large Eddy Simulation (X-LES) model [1] in the discontinuous Galerkin (DG) solver named MIGALE [2]. The main features of the X-LES formulation are: (i) a clearly defined subgrid-scale (SGS) model based on the k-equation, (ii) a single turbulent kinetic energy equation switching dynamically between the RANS and LES formulations, (iii) the independence of the model from the wall distance.

The LES formulation of the X-LES method has been validated and recalibrated using the decay of homogeneous and isotropic turbulence (DHIT). The sensitivity of the energy spectrum to X-LES model constants and mesh size has been evaluated. The X-LES prediction capabilities have been demonstrated in the computation of external aerodynamic problems with massively separated flows, *i.e.* the flow past a circular cylinder at $Re = 10^5$ and the shock wave/boundary layer interaction on a swept bump.

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