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A novel VLES model accounting for near-wall turbulence: physical rationale and applications SUAD JAKIRLIC, CHI-YAO CHANG, LUKAS KUTEJ, CAMERON TROPEA, Technische Universitaet Darmstadt — A novel VLES (Very Large Eddy Simulation) model whose non-resolved residual turbulence is modelled by using an advanced near-wall eddy-viscosity model accounting for the near-wall Reynolds stress anisotropy influence on the turbulence viscosity by modelling appropriately the velocity scale in the relevant formulation (Hanjalic et al., 2004) is proposed. It represents a variable resolution Hybrid LES/RANS (Reynolds-Averaged Navier–Stokes) computational scheme enabling a seamless transition from RANS to LES depending on the ratio of the turbulent viscosities associated with the unresolved scales corresponding to the LES cut-off and the 'unsteady' scales pertinent to the turbulent properties of the VLES residual motion, which varies within the flow domain. The VLES method is validated interactively in the process of the model derivation by computing fully-developed flow in a plane channel (important representative of wall-bounded flows, underlying the log-law for the velocity field, for studying near-wall Reynolds stress anisotropy) and a separating flow over a periodic arrangement of smoothly-contoured 2-D hills. The model performances are also assessed in capturing the natural decay of the homogeneous isotropic turbulence. The model is finally applied to swirling flow in a vortex tube, flow in an IC-engine configuration and flow past a realistic car model.

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