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Hybrid Direct Numerical Simulation and Large Eddy Simulating Wall Models Approach for the Analysis of Turbulence Entropy

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Abstract : Turbulent motion is a highly nonlinear and complex phenomenon, and its modelling is still very challenging. In this study, we developed a hybrid computational approach to accurately simulate fluid turbulence phenomenon. The focus is coupling and transitioning between Direct Numerical Simulation (DNS) and Large Eddy Simulating Wall Models (LES-WM) regions. In the framework, high-order fidelity fluid dynamical methods are utilized to simulate the unsteady compressible Navier-Stokes equations in the Eulerian format on the unstructured moving grids. The coupling and transitioning of DNS and LES-WM are conducted through the linearly staggered Dirichlet-Neumann coupling scheme. The high-fidelity framework is verified and validated based on namely, DNS ability for capture full range of turbulent scales, giving accurate results and LES-WM efficiency in simulating near-wall turbulent boundary layer by using wall models.

Keywords : computational methods, turbulence modelling, turbulence entropy, navier-stokes equations
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