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A Split Forcing Technique to Reduce Log-layer Mismatch in Wall-modeled Turbulent Channel Flows[1] REY DELEON, University of Idaho, Boise State University, INANC SENOCAK, Boise State University — The conventional approach to sustain a flow field in a periodic channel flow seems to be the culprit behind the log-law mismatch problem that has been reported in many studies hybridizing Reynolds-averaged Navier-Stokes (RANS) and large-eddy simulation (LES) techniques, commonly referred to as hybrid RANS-LES. To address this issue, we propose a split-forcing approach that relies only on the conservation of mass principle. We adopt a basic hybrid RANS-LES technique on a coarse mesh with wall-stress boundary conditions to simulate turbulent channel flows at friction Reynolds numbers of 2000 and 5200 and demonstrate good agreement with benchmark data. We also report a duality in velocity scale that is a specific consequence of the split forcing framework applied to hybrid RANS-LES. The first scale is the friction velocity derived from the wall shear stress. The second scale arises in the core LES region, a value different than at the wall. Second-order turbulence statistics agree well with the benchmark data when normalized by the core friction velocity, whereas the friction velocity at the wall remains the appropriate scale for the mean velocity profile. Based on our findings, we suggest reevaluating more sophisticated hybrid RANS-LES approaches within the split-forcing framework.

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