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Variable-Resolution Partially-averaged Navier-Stokes (PANS) simulations of three-dimensional bluff body wakes CHETNA KAMBLE, SHARATH GIRIMAJI, Texas AM University — Accurate simulations of complex high Reynolds number turbulent flows of practical interest mandate spatio-temporally varying physical resolution to optimize computational effort. The objective of this study is to develop and demonstrate the closure models required to account for commutation residue due to spatial filter-width variation in the near-wall region of a turbulent flow. A closure model is derived in the context of Partially-averaged Navier-Stokes (PANS) by invoking energy conservation principles and equilibrium boundary layer (EBL) scaling properties of partially-resolved field. The Wall-Modeled PANS (WM-PANS) equations bridge between RANS (Reynolds-averaged Navier-Stokes) method near the wall and required degree of resolution in the interior of the domain. WM-PANS is used to compute three-dimensional bluff body wake flows over a sphere in subcritical (Re = 3700) and supercritical (Re ˜O(10^6)) Reynolds number regimes. One-point statistics and coherent structure behavior are examined. Preliminary results indicate a clear advantage of this approach in capturing key physics of complex wake flows at lower computational effort.

Chetna Kamble
Texas A
M University

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