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Direct simulations of unstratified and stratified turbulent flow past a sphere using a body-conforming grid KARU CHONGSIRIPINYO, SUTANU SARKAR, Univ of California - San Diego — Direct numerical simulations of unstratified and stratified flows past a sphere are conducted in the sub-critical regime at Re = 3700. The objective is to investigate the flow at and near the body. This study takes advantage of a body-conforming grid which provides better accuracy and boundary layer representation than possible with the immersed boundary method. The body-fitted grid is generated by creating half of a C-type grid using a hyperbolic grid generation method and then rotating it around the wake-cut axis. The incompressible Navier-Stokes equations are solved using a semi-implicit scheme with the Crank-Nicholson method and the low storage RKW3-ADI. The Poisson equation for pressure correction is solved using semi-coarsening multigrid (SMG) from the HYPRE library. The singularity problem at the wake-cut is resolved by rewriting the discretized governing equation in finite-volume formulation and then set all fluxes across the cut to zero. For flux terms at nodes in the proximity of the wake cut, one-sided finite difference is used to avoid crossing the wake cut. Boundary layer separation and vortical structures immediately behind the sphere are examined. Turbulence statistics in the near wake region for unstratified and stratified flows are also compared.

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