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DNS-DEM of Suspended Sediment Particles in an Open Channel Flow[1] PEDRAM PAKSERESHT, SOURABH APTE, Oregon State University, Corvallis, OR, JUSTIN FINN, NETL, Albany, OR — DNS with point-particle based discrete element model (DEM) is used to study particle-turbulence interactions in an open channel flow at Re_τ of 710, corresponding to the experimental observations of Righetti & Romano (JFM, 2004). Large particles of diameter 200 microns (10 in wall units) with volume loading on the order of 10^{-3} are simulated using four-way coupling with closure models for drag, added mass, lift, pressure, and inter-particle collision forces. The point-particle model is able to accurately capture the effect of particles on the fluid flow in the outer layer. However, the particle is significantly larger than the wall-normal grid in the near-wall region, but slightly smaller than the axial and longitudinal grid resolutions. The point-particle model fails to capture the interactions in the near-wall region. In order to improve the near-wall predictions, particles are represented by Lagrangian material points which are used to perform interpolations from the grid to the Lagrangian points and to distribute the two-way coupling force to the Eulerian grid. Predictions using this approach is compared with the experimental data to evaluate its effectiveness.

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