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DNS with Discrete Element Modeling of Suspended Sediment Particles in an Open Channel Flow[1] PEDRAM PAKSEREHT, SOURABH APTE, Oregon State University, JUSTIN FINN, University of Liverpool, UK —
Interactions of glass particles in water in a turbulent open channel flow over a smooth bed with gravity perpendicular to the mean flow is examined using direct numerical simulation (DNS) together with Lagrangian Discrete-Element-Model (DEM) for particles. The turbulent Reynolds number (Re_τ) is 710 corresponding to the experimental observations of Righetti & Romano (JFM, 2004). Particles of size 200 microns with volume loading on the order of 10^{-3} are simulated using four-way coupling with standard models for drag, added mass, lift, pressure, and inter-particle collision forces. The presence of particles affect the outer as well as inner region of the wall layer where particle inertia and concentration are higher. The DNS-DEM is able to capture the fluid-particle interactions in the outer layer accurately. However, in the inner layer, an increase in mean as well as rms fluid velocity, as observed in the experiments, is not predicted by the DNS-DEM model. It is conjectured that particles slide and roll on the bottom wall, creating slip-like condition. Predictions using different models for drag and lift forces, as well as strong torque coupling are explored and compared with experimental data.

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