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Laminar-turbulent transition of channel flows: the effect of neutrally buoyant finite-size particles[1] MICHELINE ABBAS, VINCENT LOISEL, OLIVIER MASBERNAT, University of Toulouse - Laboratoire de Genie Chimique, ERIC CLIMENT, University of Toulouse - Institut de Mecanique des Fluides de Toulouse — Numerical simulations were performed on channel flows laden with resolved finite-size neutrally buoyant particles at moderate volumetric concentration. In the case of fluctuating flows close to laminar-turbulent transition, the particle volume fraction is homogeneously distributed in the channel except an accumulation layer in the near-wall region (particle migration is driven by inertia). Particles increase the level of perturbations close to the wall leading to significant enhancement of both the velocity fluctuations and the wall friction coefficient. Additionally, particles break down the large-scale flow structures into smaller, more numerous and sustained eddies. When the flow Reynolds number is decreased, flow relaminarization occurs at critical Reynolds number Re_{cS} (based on the effective suspension viscosity) significantly below the critical Reynolds number Re_c of single-phase flow transition. In the case of laminar flows, the suspension segregates into pure fluid and particle laden wall layers due to cross-stream migration. An instability is observed characterized by the formation of dune-like patterns at the separation between pure fluid and concentrated suspension. Increasing the Reynolds number yields transition to turbulence at a threshold above Re_{cS}.

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