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Falling and Rising of Solid Particles in Thermally Stratified Fluid

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Abstract : Ubiquitous nature of particle settling is governed by the presence of the surrounding fluid medium. Thermally stratified fluid alters the settling phenomenon of particles as well as their interactions. Direct numerical simulation (DNS) is carried out with an open-source library Immersed Boundary Adaptive Mesh Refinement (IBAMR) to quantify the fundamental mechanism based on Distributed Lagrangian Multiplier (DLM). The presence of background density gradient due to thermal stratification replaces the drafting-kissing-tumbling in a homogeneous fluid to drafting-kissing-separation behavior. Simulations are performed with a varying range of particle-fluid density ratios, and it is shown that the stratification effect on particle interactions varies with density ratio. It is observed that the combined role of buoyancy and inertia govern the physical mechanism of particle-particle interaction.

Keywords : direct numerical simulation, distributed lagrangian multiplier, rigidity constraint, sedimentation, stratification
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