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Lift & drag correlations for a particle in wall-bounded linear shear flows at finite Re FADY NAJJAR, University of Illinois at Urbana-Champaign, LANYING ZENG, UIUC, S. BALACHANDAR, University of Florida, PAUL FISCHER, Argonne National Laboratory — The lift and drag forces acting on a finite-sized rigid spherical particle are studied computationally using a high-order parallel spectral element method (Nek5000).We consider a wall-bounded linear shear flow in which the particle is embedded and the particle Reynolds number ranges from 2 to 250. The particle location is systematically changed from nearly sitting on the wall to far away from the wall. A drag correlation is proposed as a function of particle Reynolds number and separation distance from the wall. At very small separation distances, the lift force is observed to be positive and significantly larger at the entire Reynolds number range considered. However, at larger separation distances, the lift force becomes negative at some critical Reynolds number. At the largest separation distance considered, the lift coefficient shows a fairly good agreement with the numerical results of Kurose & Komori (1999) in an unbounded linear shear flow. For particle on the wall, the lift coefficient shows a power law dependence on the particle Reynolds number in the finite Reynolds number regime. The numerical results compare very well with low Re theoretical results and a composite correlation that is accurate over the entire Re range is proposed.

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