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Lift and drag forces on a particle rolling/sliding on a wall in a shear flow at finite Re HYUNGOO LEE, S. BALACHANDAR, University of Florida — Recent research [1] has shown that both the shear and wall-induced lift contributions on a particle sharply increase as the gap between the wall and the particle is decreased. Explicit expressions that are valid over a range of finite Re were obtained for the drag and lift forces in the limiting cases of a stationary particle in wall-bounded linear flow and of a particle translating parallel to a wall in a quiescent ambient. Here we consider the more general case of a translating particle in a wall-bounded linear shear flow where both the shear and wall effects superpose. We have considered a modest Reynolds number range of 1 to 100. Direct numerical simulations using immersed boundary method were systematically performed to figure out characteristics of hydrodynamic forces on a finite-sized moving particle whose location is nearly sitting on the wall. We present composite correlation for the drag and lift forces which are in agreement with all the available low Reynolds number theories. The effect of particle rolling or sliding on the wall is also considered and thereby the Magnus lift contribution is also considered in this work. [1] L. Zeng, Ph.D. thesis, University of Illinois at Urbana-Champaign, 2007.

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