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Forces and moments on a rigid rolling sphere in wall-bounded linear shear flows FADY NAJJAR, Univeristy of Illinois at Urbana-Champaign, LANYING ZENG, UIUC, LIN ZHANG, UIUC, S. BALACHANDAR, University of Florida, PAUL FISCHER, Argonne National Laboratory — Understanding drag and lift forces as well as moments exerted on a finite-sized particle in the wall vicinity is a problem of key interest in various engineering applications including aerosol transport, and lift-off of sand particles on sea/ocean shores.Simulations based on high-order parallel spectral element method (Nek5000) are being pursued to investigate the flow past a finite-sized particle. The particle is located in the vicinity of a solid wall and embedded in a linear shear flow. A range of particle location away from the wall has been considered, ranging from almost touching the wall to farther away. We consider a range of Reynolds (Re) numbers varying from 10 to 200, where Re is defined based particle diameter and local velocity at particle center. The lift and drag forces as well as the moments are calculated and show a substantial increase in the lift coefficient (C_L) as the particle moves closer to the wall and in the limit the particle sits on the wall. The contributions of the viscous and pressure terms to the lift coefficient, C_L, will be presented along with comparison to experimental measurements. We then consider the case of rolling particle on a wall for varying speeds to understand the lift and moments mechanisms generated. Results obtained from these simulations will be compared with experiments as well as low Re theory.

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