

Abstract Submitted  
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**Side-by-side intruders within a granular flow**<sup>1</sup> GABRIEL CABALLERO-ROBLEDO, ELI A. CUELLAR-GALAN, CINVESTAV Monterrey, CESAR L. CLEMENTE-LOPEZ, ITESM, Campus Monterrey, CARLOS MALAGA, FRANCISCO J. MANDUJANO SANCHEZ, Facultad de Ciencias, UNAM, MANUEL F. ACEVEDO-ESCALANTE, CINVESTAV Monterrey — Lift and drag forces on side-by-side intruders within a granular flow are studied using experiments, numerical simulations and a hydrodynamic model. Regimes of attractive and repulsive lift forces are found as a function of the separation of the intruders and flow velocity. The origin of such forces is investigated by correlating them to differences in the mean value and fluctuations of flow velocity in the regions around the intruders. Numerically, our three dimensional system is studied through Discrete Element Particle simulations adapted to use a Graphics Processing Unit (GPU). The hydrodynamic model that we apply to describe the system is kinetic theory extended for dense granular flow.

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