Abstract Submitted
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New repulsive lift force between objects due variations of wall slip[1] SHERVIN BAGHERI, AIDAN RINEHART, Linne Flow Centre, Dept. Engineering Mechanics, KTH Royal Institute of Technology, Stockholm, THOMAS SALEZ, Univ. Bordeaux, CNRS, LOMA, UMR 5798, F-33405, Talence, France, UGIS LACIS, Linne Flow Centre, Dept. Engineering Mechanics, KTH Royal Institute of Technology, Stockholm — Surfaces in nature are rarely perfectly smooth but have physical, chemical and other defects. We present a new hydrodynamic repulsive lift force that arises when surfaces with chemical contrasts or with varying textures come near contact. This lift force modifies the mobility of cells, colloids, bubbles, grains, and fibers traveling near walls and interfaces. Specifically, we demonstrate the spontaneous emergence of oscillations, transverse migration, spiral-like propulsive motion of a cylinder as it moves near a wall; these motions would not occur if the surfaces of the wall and the particle were perfectly homogenous. The physical mechanism behind the lift force is the breaking of the fluid pressure symmetry in the thin gap between two surfaces induced by a change of wall slip. Our study has implications for understanding how inhomogeneous biological interfaces interact with their environment; it also reveals a new method of patterning surfaces to reduce friction/wear or to influence self-assembly processes. Our work provides scaling estimates of the lift force induced by a change of wall slip for different configurations. This enables biologists, engineers, and physicists to predict the order of magnitude of the lift force, prior to performing experiments.

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