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Channel shape modifications to focus particles: A theoretical analysis LAURA GUGLIELMINI, HOWARD STONE, SEAS - Harvard University — Microfluidics techniques that provide focusing of particles suspended in a stream of fluid have several applications such as cell sorting, detection, media exchange, particle removal, etc. For example, focusing can typically be achieved by the use of a stream (or sheath) or surrounding fluid, by dielectrophoresis, or by acoustic methods. In contrast, recent experimental work has shown how micro-structures can be introduced along the walls of a channel so that the suspended particles focus along a symmetry axis; the response is due to the hydrodynamic features (the pressure field) of the flow [1]. We present a model for these low-Reynolds-number flows based on an asymptotic lubrication analysis that accounts for the periodic perturbations at the boundary. We evaluate the resulting forces on suspended, large particles and discuss how the appropriate design of such obstacles at the walls can allow particles to deviate from streamlines and follow a required path.
[1] Choi et al. Small 4, 634-641 (2008).

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