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Rotation of a submerged finite cylinder moving down a soft incline BAUDOUIN SAINTYVES, University of Chicago, BHARGAV RALLABANDI, University of California Riverside, THEO JULES, ENS Lyon, THOMAS SALEZ, Universite de Bordeaux, JESSE AULT, Brown University, CLARISSA SCHONECKER, Max Planck Institute for Polymer Research, HOWARD STONE, Princeton University, L. MAHADEVAN, Harvard University — A submerged finite cylinder moving under its own weight along a soft incline lifts off and slides at a steady velocity while also spinning. Here, we experimentally quantify the steady spinning of the cylinder and show theoretically that it is due to a combination of an elastohydrodynamic torque generated by flow in the variable gap, and the viscous friction on the edges of the finite-length cylinder. The relative influence of the latter depends on the aspect ratio of the cylinder, the angle of the incline, and the deformability of the substrate, which we express in terms of a single scaled compliance parameter. By independently varying these quantities, we show that our experimental results are consistent with a transition from an edge-effect dominated regime for short cylinders to a gap-dominated elastohydrodynamic regime when the cylinder is very long. This work is a step in explaining the motion of free particles in situations where elasticity and hydrodynamics are intimately coupled, such as cells in a microfluidic channel or in a blood vessel. *B. Saintyves, B. Rallabandi, T. Jules, J. Ault, T. Salez, C. Schonecker, H.A. Stone and L. Mahadevan, Soft Matter 16 (16), 4000-4007.*

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