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**The propulsion of filaments with natural curls** NOOR KHOURI, MOHAMMAD JAWED, Massachusetts Institute of Technology, FANG DA, EITAN GRINSPUN, Columbia University, PEDRO REIS, Massachusetts Institute of Technology — We consider a macroscopic analogue model for the locomotion of prokaryotic bacteria with a single flagellum and study the dynamics of a flexible helical filament that is rotated in a viscous fluid, at low Reynolds numbers. The scaling from the original micron-scale onto the desktop-scale is made possible by the prominence of geometry in the deformation process. Our filaments are custom fabricated with different geometric and material properties (with an emphasis on varying their intrinsic curvature), clamped at one end and rotated in a bath of glycerin. Geometrically nonlinear configurations of the filament can result from the coupling of the elastic forces of the filament and the viscous drag. Using digital imaging, we reconstruct the 3D deformed configurations of the rotating filament and quantify its dynamics. Our precision model experiments are combined with numerical tools ported from the computer graphics community. We couple the results from the experiments and simulations to quantify the effect of the control parameters on the propulsive force exerted by the rotating filament and rationalize the underlying mechanical instabilities.

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