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Buckling transition of a flexible fiber at a surface stagnation point LAURA GUGLIELMINI, Stanford University, NICOLAS AUTRUSSON, Institut Superieur de l'Aeronautique e de l'Espace, AMIT KUSHWAHA, ERIC SHAQFEH, Stanford University, HOWARD STONE, Princeton University — The interplay of viscous and elastic stresses is relevant to a number of flow problems involving slender elastic fibers. These range from the swimming of microorganisms to the transport of pulp fibers in processing flow as well as from nanotube and nanocarpet applications to semi-flexible polymer behavior. In this work, we discuss the response of an elastic fiber tethered to a plane wall and subjected to a stagnation point flow. Using a combination of stability analysis and numerical simulations, (with the latter based on a discretized beam model), we show that, for a critical value of the ratio between viscous and elastic forces, the filament is susceptible to a buckling instability at a bifurcation point which may be subcritical. Further, we discuss the effect of thermal fluctuations on the buckling transition, thus demonstrating the dynamic effect of small fluctuations on a filament whose persistence length is much longer than its contour length.

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