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Catenaries in viscous fluid

JAMES HANNA, BRATO CHAKRABARTI[1], Virginia Polytechnic Institute and State University — Slender structures live in fluid flows across many scales, from towed instruments to plant blades to microfluidic valves. The present work details a simple model of a flexible structure in a uniform flow. We present analytical solutions for the translating, axially flowing equilibria of strings subjected to a uniform body force and linear drag forces. This is an extension of the classical catenaries to a five-parameter family of solutions, represented as trajectories in angle-curvature "phase space." Limiting cases include neutrally buoyant towed cables and freely sedimenting flexible filaments.

[1]now at University of California, San Diego

James Hanna
Virginia Polytechnic Institute and State University

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