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Buckling and migration of semi-flexible filaments BRATO CHAKRABARTI, Univ of California - San Diego, YANAN LIU, OLIVIA DU ROURE, ANKE LINDNER, PMMH-ESPCI, DAVID SAINTILLAN, Univ of California - San Diego — The dynamics of polymeric fluids exhibit rich and sometimes counter-intuitive behaviors, which can be traced back to the complex conformations of polymer molecules in shear flow. The tumbling of rigid bodies in shear flow at low Reynolds number has been understood since the pioneering work of Jeffery. The effect of polymer chain flexibility, however, has non-trivial consequences in this classical problem. Here we study the dynamics of actin filaments, which are semi-flexible filaments usually found in the cell cytoplasm, in an externally applied simple shear flow. We model these inextensible filaments using Euler-Bernoulli beam and use nonlocal slender body theory (SBT) in the presence of Brownian fluctuations to probe their dynamics, and compare our numerical simulations to microfluidic experiments. We systematically explore the parameter space by varying the length of the polymer and changing the shear rate. A series of conformational transitions is observed with increasing shear rate, from quasi-periodic tumbling to nontrivial buckling regimes due to the destabilizing effect of compressive viscous forces, and physical mechanisms are proposed for these transitions.

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