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A numerical study of a long flexible fiber in shear flow: dynamics and rheology PAWEL ZUK, ANTONIO PERAZZO, JANINE NUNES, HOWARD STONE, Princeton University — Long slender particles can span the whole spectrum of stiffness: from very flexible particles such as globular proteins to extremely rigid particles, e.g. carbon nanotubes or β-amyloid fibers. The behavior of rigid particles is well understood, however there are only few recent experimental reports about long fibers of moderate flexibility. We present a numerical study of a single long flexible fiber in a shear flow. The fiber is simulated as a bead-spring model including hydrodynamic interactions in the Rotne-Prager-Yamakawa approximation. We analyze fiber shape, motion and stress induced in the fluid under the shear flow. We find that all of these properties appear to be related to the characteristic length scale of the kinks formed in the fibers. We present a scaling law for the kink size as a function of shear rate and the fiber parameters and justify it using elastic theory. The study suggests that local properties of a single fiber may condition the behavior of concentrated suspensions.

Pawel Zuk
Princeton University

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