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Bending of elastic fibers in shear flow[1] MARIA L. EKIEL-JEZEWSKA, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland, PAWEL J. ZUK, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland and Princeton University, Princeton, USA, AGNIESZKA M. SLOWICKA, Institute of Fundamental Technological Research, Polish Academy of Sciences, Pawinskiego 5b, Warsaw, Poland, HOWARD A. STONE, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, New Jersey 08544, USA — We investigate numerically the dynamics of an elastic fiber in a shear flow at low Reynolds number. The results are based on numerical simulations in the bead-spring model with hydrodynamic interactions evaluated in the Rotne-Prager-Yamakawa approximation and a precise multipole expansion corrected for lubrication forces. The fiber is initially straight and oriented in the flow direction. Typical time scales of the bending process and fiber shapes and their maximum curvatures are analyzed. We find universal scalings and identify three different dynamical modes in the phase space of the fiber bending stiffness A and aspect ratio n. A comparison with the elastica model is also performed, assuming as a new theoretical input the existence of a hydrodynamic force acting on the fiber tip.

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