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Swimming in a suspension of rod-like molecules JUAN SHI, THOMAS POWERS, Brown University — In nature, it is common for microorganisms to swim in fluids with microstructure, such as mucus. Motivated by this fact, there have been many recent theoretical, computational, and experimental studies of idealized swimmers in a dilute solution of flexible polymers. Here we study this problem from a different point of view by considering swimmers in a dilute solution of rigid rod-like polymers. We study the prescribed swimming problem of Taylor's sheet in a dilute suspension of non-Brownian rods. Using a simple continuum constitutive law for the suspension that describes the stress in terms of velocity gradient and local rod orientation, we calculate swimming speed to second order in the amplitude of the wave. Due to stresses induced by the presence of the rods, the first-order flow field differs from that of the Newtonian case. We find that the swimming speed increases linearly with rod concentration: the presence of the rods always makes the swimmer go faster. We also consider the problem of a finite swimmer by studying a two-dimensional circular squirmer. The squirmer is defined as a circle with a prescribed tangential slip velocity that leads to propulsion. By varying the prescribed slip boundary condition, we study both pushers and pullers.

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