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Theory for propulsion and transport in an anisotropic fluid
THOMAS POWERS, MADISON KRIEGER, Brown University, SAVERIO SPAGNOLIE, University of Wisconsin, Madison — Swimming microorganisms are typically found in complex fluids, which are full of polymers. When these polymers align, the fluid becomes anisotropic. We seek to understand how anisotropy affects swimming when the stroke is prescribed. We model the anisotropic fluid with a nematic liquid crystal. The swimmer is a two-dimensional sheet deforming via propagating transverse or longitudinal waves. We find that the nature of anchoring conditions for the nematic degrees of freedom plays a critical role in determining the swimming speed. Furthermore, we study the fluid transport induced by the swimmers motion by calculating the flux of fluid in the laboratory frame. Finally, we elucidate the various limits of the nematic theory, such as the six-fold symmetric hexatic case and Ericksen's transversely isotropic fluid.

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