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An immersed boundary method for fluid-structure interactions in a nematic liquid crystal SAVERIO SPAGNOLIE, University of Wisconsin-Madison — The nematic phase of a liquid crystal is characterized by a spontaneous local molecular alignment leading to an anisotropic (direction-dependent) response to deformations. A body moving through such a phase can induce complex viscous and elastic structures in the flow, and the fluid's anisotropic response can generate surprising forces on the immersed body. Bacteria swimming in a liquid crystal, for instance, have been observed to align with the orientation of the underlying director field. The complexity of such problems generally makes mathematical analysis intractable, and the computation of solutions can still be very challenging. In this talk an immersed boundary method for computing fluid-structure interactions in a nematic liquid crystal will be discussed. The Ericksen-Leslie equations, or a more general Landau-de Gennes model, are solved on a fixed, regular grid. Immersed boundaries communicate forces onto the fluid as in Peskin's original method, but now also torques on the nematic director field through molecular anchoring boundary conditions. Sample applications will also be discussed, including the locomotion of undulatory bodies in anisotropic fluids.

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