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Squirming At Finite Reynolds Number NICHOLAS CHISHOLM, ZIYI ZHU, ADITYA KHAIR, Dept. of Chemical Engineering, Carnegie Mellon University — The dynamics of swimming microorganisms at zero Reynolds number ($Re = 0$) has been the subject of extensive theoretical and experimental investigation over the past decade, and the study of locomotion at high Reynolds number ($Re \gg 1$), where inertial forces are dominant, has a venerable history. In this talk, we consider swimming between these limits, i.e. at finite Reynolds numbers, using the popular "squirmer" model of self-propulsion, wherein locomotion is achieved through surface distortions. We first utilize matched asymptotic expansions to derive an analytical expression for the swimming velocity of a squirmer through $O(Re^2)$, which highlights that inertia affects so-called "pusher" and "puller" swimmers in fundamentally different manners. (The equivalent of Whitehead's paradox for a self-propelled object is elucidated in the process.) Next, we employ numerical methods to compute the swimming velocity of pushers and pullers for higher Reynolds numbers. Finally, we demonstrate that inertia causes squirmers (which are non-chiral) to drift across the streamlines of an imposed shear flow.

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