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Locomotion by tangential deformation in a polymeric fluid LAILAI ZHU, Linne FLOW Centre, KTH Mechanics, Stockholm, Sweden, ERIC LAUGA, University of California San Diego, LUCA BRANDT, Linne FLOW Centre, KTH Mechanics, Stockholm, Sweden — Many biological cells such as bacteria often encounter viscous environments with suspended microstructures or macromolecules. The physics of micro-propulsion in such a non-Newtonian viscoelastic fluid has only recently started to be addressed. Here we present results of three-dimensional numerical simulations for the steady locomotion of a self-propelled body in a model polymeric (Giesekus) fluid at low Reynolds number. The microswimmer is driven by a purely tangential distortion on the outer surface reproduced as non-homogenous boundary condition on a rigid body. The swimming speed and efficiency for different values of the Weissenberg number and the viscosity ratio are reported. The swimming speed is lower in a visco-elastic fluid and is asymptotically recovering for large We approaching values for Newtonian swimmer. Interestingly, the efficiency is seen to significantly increase as the viscosity of the polymeric fluid is increased. Further analysis reveals that polymeric stresses break the Newtonian front-back symmetry in the flow profile around the body. Speed and efficiency for pusher and puller squirmers will be reported together with analysis of the velocity fields. Time-dependent boundary conditions shall also be considered.

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