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Designing self-propelling micro-swimmers using responsive gels[1]
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We use computational modeling to design a synthetic micro-swimmer that not only self-propels but also navigates in highly viscous environments. Our simple swimmer consists of a cubic gel body with two rectangular stiff flaps attached to its opposite sides and a stimuli-sensitive flexible flap at the body front. The responsive gel undergoes periodic expansion and contraction that can be induced by certain external stimuli such as temperature, light, magnetic or electric fields. The periodic changes in the volume of the body lead to asymmetric beating motion of the propulsion flaps which propel the micro-swimmer through the inertialess fluid. We study the effect of body elasticity on the locomotion of our swimmer and show how the elasticity of the body can be harnessed to induce forward and backward swimming motion. We also demonstrate that our swimmer can successfully turn in the desired direction following the bending of the responsive steering flap. In this scenario, the steering flap bends and creates flow asymmetry which results in the swimmer rotation.

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