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Swimming micro-robot powered by stimuli-sensitive gel HASSAN MASOUD, ALEXANDER ALEXEEV, George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology — Using three-dimensional computer simulations, we design a simple maneuverable micro-swimmer that can self-propel and navigate in highly viscous (low Reynolds-number) environments. Our simple swimmer consists of a cubic gel body which periodically changes volume in response to external stimuli, two rigid rectangular flaps attached to the opposite sides of the gel body, and a flexible steering flap at the front end of the swimmer. The stimuli-sensitive body undergoes periodic expansions (swelling) and contractions (deswelling) leading to a time-irreversible beating motion of the propulsive flaps that propel the micro-swimmer. Thus, the responsive gel body acts as an "engine" actuating the motion of the swimmer. We examine how the swimming speed depends on the gel and flap properties. We also probe how the swimmer trajectory can be changed using a responsive steering flap whose curvature is controlled by an external stimulus. We show that the turning occurs due to steering flap bending and periodic beating. Furthermore, our simulations reveal that the turning direction can be regulated by changing the intensity of external stimulus.

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