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Trajectories of Artificial Microswimmers with Helical Tails Inside Circular Channels. SERHAT YESILYURT, HAKAN CALDAG, Sabanci University — Trajectories are obtained for millimeter-scale artificial microswimmers inside circular channels filled with glycerol. Rotating magnetic field is applied to propel 3D-printed swimmers with helical tails and permanent magnetic heads. Experiments are recorded with a high-speed camera and processed with contrast-based image processing tools to extract 3D trajectories and orientations of the swimmers. Swimmers pushed by the tail exhibit a helical trajectory at all times while straight trajectories are observed when the length to diameter ratio is very high for pulled ones. Long tails are pointed towards the channel's centerline and short ones are pointed towards the wall. Weak Poiseuille flow is found to alter the swimming speed and suppress the step-out behavior. Flow from tail side increases the instability of swimmers. Experimental observations are validated with snapshot and dynamic models that use CFD to obtain average and time-dependent velocities and trajectories of the swimmer. Lastly, modulation of the rotating magnetic field tilts the swimmer in desired directions or halts the swimmer propulsion without stopping the rotation of the swimmer.

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