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Propulsion by Helical Strips in Circular Channels

EBRU DEMIR, SERHAT YESILYURT, Sabanci University, Istanbul, Turkey — Progress in manufacturing techniques avails the production of artificial micro swimmers (AMS) in various shapes and sizes. There are numerous studies on the generation of efficient locomotion by means of helical tails with circular cross-sections. This work focuses on locomotion with helical strips in circular channels. A CFD model is used to analyze the effects of geometric parameters and the radius of the channel on swimming velocity of infinite helical-strips in circular channels. Results show that there is an optimum wavelength that depends on thickness to channel radius ratio, suggesting that these parameters need to be optimized simultaneously. With constant angular velocity, thinner strips swim faster, whereas under constant torque application, thicker strips (in radial direction) prevail. As width approaches the wavelength, velocity decreases under both conditions, unless a magnetically coated tail is simulated, for which width has an optimum value. Increasing channel radius to helix amplitude ratio increases the velocity up to a maximum and after a slight drop, saturation occurs as bulk swimming conditions are approached.

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