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How swimming near a curved body could improve bio-inspired propulsion[1] RUIJIE ZHU, JUNSHI WANG, HAIBO DONG, HILARY BART-SMITH, DANIEL QUINN, Univ of Virginia, BIO-INSPIRED ENGINEERING RESEARCH LAB TEAM, FLOW SIMULATION RESEARCH GROUP TEAM, FLUID-STRUCTURE INTERACTION LAB TEAM — A simplified model is proposed to study the advantages of fish schooling. Our model predicts that fish can gain thrust and efficiency by swimming close to each other. Sinusoidal pitching motion is prescribed to a rigid airfoil to mimic a flapping caudal fin, and a rigid cylinder is placed nearby to mimic the curved body of another fish. Using Theodorsen's theory for a pitching airfoil, we estimate the thrust and power coefficient of the airfoil at various positions relative to the cylinder. We also explore the effect of the airfoil's pitching frequency, pitching amplitude, and size relative to the cylinder. Various combinations of those parameters are simulated using an immersed boundary method. Analytical and computational results are compared to evaluate the effectiveness of our fish schooling model. Our results offer new insights into the fluid physics of multi-body interactions and the hydrodynamics of fish schooling.

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