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Formation of vortex pairs with hinged rigid flaps at the nozzle exit PRASHANT DAS, RAGHURAMAN GOVARDHAN, JAYWANT ARAKERI, Indian Institute of Science — Biological flows related to aquatic propulsion using pulsed jets, or flow through the valves in a human heart, have received considerable attention in the last two decades. Both these flows are associated with starting jets that occur through biological tissue/membranes that are flexible. Motivated by these flows, we explore in the present work, the effect of passive flexibility of the nozzle exit on vortex generation from a starting jet. The starting jet is generated using a two-dimensional piston cylinder mechanism, the cross-section of the cylinder being rectangular with large aspect ratio. The fluid is pushed out of this cylinder or channel using a computer controlled piston. We introduce flexibility at the channel exit by hinging rigid flaps, which are initially parallel to the channel. The hinge used is such that it provides negligible stiffness or damping, thus allowing for the maximum opening of the flaps due to fluid forces. Using this system, we study both the flap kinematics and the vorticity dynamics downstream of the channel exit. Visualizations show large flap motions as the piston starts and this dramatically changes the vorticity distribution downstream of the flaps, with the formation of up to three different kinds of vortex pairs. This idealized configuration opens new opportunities to look at the effect of flexibility in such biological flows.

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