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Hydrodynamic performance of a self-propelled ray with oscillatory locomotion[1] YOUNG DAL JEONG, JAE HWA LEE, UNIST — Mylobatoid rays have dorsoventrally flattened diamond-shaped bodies with expanded pectoral fins, and they swim by oscillating their large pectoral fins. This oscillatory locomotion utilizes the lift-based propulsion, which is specialized for efficient propulsion. Inspired by the high efficient rays, we perform numerical simulations of a self-propelled oscillating ray in a viscous quiescent flow. To consider the fluid-structure interaction between the oscillating ray and surrounding fluid, the penalty immersed boundary method is adapted. From references for the biological ray kinematics, the oscillatory locomotion in the vertical and spanwise directions is actively given at the leading edge, although the chordwise moving motion is freely movable by the fluid-flexible body interaction. Moreover, three-dimensional motion of the rest part is passively determined, and the propulsion performance is influenced by the elastic properties. The effects of the elastic properties on the cruising speed and the input power are investigated systematically.

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