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Simulation of prolate swimming jellyfish with jet-based locomotion[1] SUNG GOON PARK, BOYOUNG KIM, JIN LEE, KAIST, WEI-XI HUANG, Tsinghua university, HYUNG JIN SUNG, KAIST — The hydrodynamic patterns in the wake of swimming jellyfish are based on the bell morphology. Jellyfish with a prolate bell morphology form a clear jet structure in the wake. A three-dimensional computational model was used to analyze the hydrodynamic patterns. The Froude propulsion efficiency, defined by the ratio of the value of the energy required to deform the elastic bell to the value of the average center velocity multiplied by the thrust, was compared with different forms of the elastic bell deformation. The immersed boundary method was adopted to consider the interaction between the swimming jellyfish and surrounding fluid. Due to the effect of the momentum transferred to the surrounding fluid by the bell deformation, the rotational fluid mass was formed, called vortices. The vortex structures in the wake of prolate swimming jellyfish were elucidated in detail in both quantitative and qualitative ways. A dimensionless temporal parameter was employed to investigate the vortex formation process quantitatively. The starting/stopping vortex structures were generated during the contraction/relaxation phase. During the early stage of the contraction, the vortex structures were mainly generated by the stroke, then the ejected fluid was entrained into the vortex structures.

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