

Abstract Submitted
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Effects of shape on the thrust performance and vortical structure of flapping plates¹ XI-YUN LU, GAO-JIN LI, University of Science and Technology of China — Three-dimensional unsteady hydrodynamics of flapping plates with different shapes are numerically investigated using the lattice Boltzmann and immersed boundary method. The plate shape is quantitatively described by the area moments. The thrust exhibits a monotonous increase with the area moments. Two typical regimes are identified. One is un-linear relation between the thrust and the area moment for lower area moment and the other is linear relation for larger area moment. Moreover, the vortical structures in the wake are usually composed of two rows of vortex rings formed by the vortices shed from the leading and trailing edges as well as the two tip sides. As the strength of the vortices changes with the plate shape, the topology of the vortical structures is closely related to the plate shape. Further, the intrinsic relationship between the hydrodynamics and the vortical structures in the wake is analyzed using some unconventional force expressions and simplified vortex ring models.

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