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Flapping locomotion of a flexible wing with heaving motion[1]
SUNGHYUK IM, HYUNG JIN SUNG, KAIST — The flapping locomotion of a freely heaving flexible wing was experimentally explored in a merry-go-round equipment. Two rectangular wings were attached at the both ends of a horizontal support bar submerged in a dodecagonal water tank. The center of the support bar was connected to the vertically flapping axis which is freely rotating. This experimental apparatus generated a pure heaving motion in the vertical direction to the flapping wings in the frequency range of 0 to 5 Hz. The propulsion due to the heaving wing was expressed by a horizontally rotating speed of the support bar. The heaving motion and the rotating speed were retained with a laser displacement sensor and a rotary encoder. The rotating speed according to the heaving frequency was measured with different experimental parameters. Compared to a rigid wing, the flexible wing in the heaving motion showed a better propulsive performance in some conditions. The effects of the flexibility, the aspect ratio, and the thickness of the heaving wing on the propulsive performance were examined.

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