Effect of wing mass in free flight by a butterfly-like 3D flapping wing-body model[1] KOSUKE SUZUKI, Institute of Engineering, Academic Assembly, Shinshu University, IORI OKADA, Graduate School of Science and Technology, Shinshu University, MASATO YOSHINO, Institute of Engineering, Academic Assembly, Shinshu University — The effect of wing mass in free flight of a flapping wing is investigated by numerical simulations based on an immersed boundary-lattice Boltzmann method. We consider a butterfly-like 3D flapping wing-model consisting of two square wings with uniform mass density connected by a rod-shaped body. We simulate free flights of the wing-body model with various mass ratios of the wing to the whole of the model. As a result, it is found that the lift and thrust forces decrease as the mass ratio increases, since the body with a large mass ratio experiences large vertical and horizontal oscillations in one period and consequently the wing tip speed relatively decreases. In addition, we find the critical mass ratio between upward flight and downward flight for various Reynolds numbers.

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