Abstract Submitted
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Free flight simulations of a dragonfly-like flapping wing-body model by the immersed boundary-lattice Boltzmann method[1] TAKAJI INAMURO, KEISUKE MINAMI, KOSUKE SUZUKI, Dept. Aeronautics and Astronautics, Kyoto University — Free flights of the dragonfly-like flapping wing-body model are numerically investigated by using the immersed boundary-lattice Boltzmann method (IB-LBM). First, we simulate free flights of the model without the pitching rotation for various values of the phase lag angle ϕ between the forewing and the hindwing motions. We find that the wing-body model goes forward in spite of ϕ, and the model with ϕ =0° and 90° goes upward against gravity. The model with $\phi = 180°$ goes almost horizontally, and the model with $\phi = 270°$ goes downward. Secondly, we simulate free flights with the pitching rotation for various values of the phase lag angle ϕ. It is found that in spite of ϕ the wing-body model turns gradually in the nose-up direction and goes back and down as the pitching angle Θ_c increases. That is, the wing-body model cannot make a stable forward flight without control. Finally, we show a way to control the pitching motion by changing the lead-lag angle $\gamma(t)$. We propose a simple proportional controller of $\gamma(t)$ which makes stable flights within $\Theta_c = \pm 5°$ and works well even for a large disturbance.

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Takaji Inamuro
Dept. Aeronautics and Astronautics, Kyoto University

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