Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Effect of chordwise wing flexibility on the flapping flight of a butterfly-like 3D flapping wing-body model[1] KOSUKE SUZUKI, TAKAAKI AOKI, MASATO YOSHINO, Shinshu University — In our recent study [K. Suzuki, T. Aoki, and M. Yoshino, Phys. Rev. E 100, 013104 (2019)], we constructed a flexible wing with chordwise flexibility by connecting two rigid plates with a torsion spring, and investigated the effect of chordwise wing flexibility on the flapping flight of a simple butterfly-like flapping wing-body model by using an immersed boundary-lattice Boltzmann method. First, we investigated the effects of the spring stiffness on the aerodynamic performance when the body of the model is fixed. We found that the time-averaged lift and thrust forces and the required power increase with the spring stiffness. In addition, we found an appropriate range of the spring stiffness where the time averaged lift and thrust forces are larger than those of the rigid wings. Second, we simulated free flights when the body of the model can only move translationally. We found that the model with the flexible wings at an appropriate value of the spring stiffness can fly more effectively than the model with the rigid wings, which is consistent with the results when the body of the model is fixed.

[1]JSPS KAKENHI Grant No. JP16K18012

Kosuke Suzuki
Shinshu University

Date submitted: 28 Jul 2019 Electronic form version 1.4