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Flow structure and aerodynamic performance of a hovering bristled wing in low Re SEUNGHUN LEE, MOHSEN LAHOOTI, DAEGYOUM KIM, KAIST — Previous studies on a bristled wing have mainly focused on simple kinematics of the wing such as translation or rotation. The aerodynamic performance of a bristled wing in a quasi-steady phase is known to be comparable to that of a smooth wing without a gap because shear layers in the gaps of the bristled wing are sufficiently developed to block the gaps. However, we point out that, in the starting transient phase where the shear layers are not fully developed, the force generation of a bristled wing is not as efficient as that of a quasi-steady state. The performance in the transient phase is important to understand the aerodynamics of a bristled wing in an unsteady motion. In the hovering motion, due to repeated stroke reversals, the formation and development of shear layers inside the gaps is repeated in each stroke. In this study, a bristled wing in hovering is numerically investigated in the low Reynolds number of $O(10)$. We especially focus on the development of shear layers during a stroke reversal and its effect on the overall propulsive performance. Although the aerodynamic force generation is slightly reduced due to the gap vortices, the asymmetric behavior of vortices in a gap between bristles during a stroke reversal makes the bristled wing show higher lift to drag ratio than a smooth wing.

Seunghun Lee
KAIST

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