

## **Effect of wing deformation on the aerodynamic performance of flapping wings: fluid-structure interaction approach**

### **ABSTRACT**

Wing stiffness is very crucial in augmenting aerodynamic forces in flapping wing flyers. In this work, the effect of wing deformation was studied using three-dimensional numerical analysis (two-way fluid structure interaction), coupling the flow solver (*FLUENT*) and the structural (*ABAQUS*) solver via the *MpCCI* platform. Three different degrees of bending stiffness corresponding to rigid, flexible, and highly flexible case wings were investigated. Moreover, the wings were tested for both low Reynolds number ( $R=9,000$ ) and high Reynolds number ( $R=40,000$ ), at a flapping frequency of 9 Hz corresponding to an angle of attack (AoA) ranging from  $\alpha=0$  to  $50^\circ$ . The results of mean aerodynamic lift and drag coefficients showed good agreement between numerical and experimental findings. Also, the time-averaged lift-to-drag ratio reveals that the highly flexible wing exhibited the best overall aerodynamic performance when compared to the rigid and flexible wing.

**Keyword:** Wing deformation; Aerodynamic performance; Flapping wings; Fluid-structure interaction approach