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Comparative study of solid and bristled wings in flapping flight of tiny insects[1] CHRISTOPHER TERRILL, ARVIND SANTHANAKRISHNAN, Oklahoma State University — Small insects such as thrips that are less than 1 mm in size fly at Reynolds numbers (Re) on the order of 10 and use wing-wing interaction during flapping. In this interaction, referred to as 'clap-and-fling', the wings come in close contact with each other at the end of upstroke and rotate about the trailing edge during start of downstroke. The wings of these tiny insects consist of an array of bristles as opposed to a solid membrane. The goal of this study is to examine the effects of bristled wings on aerodynamic force generation and flow structures compared to solid wings. We used an experimental model for the study in which two model wings were prescribed to move along a simplified 2D representation of clap-and-fling kinematics. Forces were measured through the use of strain gauges and 2D phase-locked particle image velocimetry (PIV) was used to visualize the flow generated from flapping. The PIV results show that circulation of the leading edge vortices (LEVs) is attenuated when bristled wings are used. However, improved drag reduction is observed in the bristled wings. Aerodynamic efficiency variation with Re will be discussed.

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