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Lift force enhancement and fluid-structure interactions on a self-excited flapping wing model[1] OSCAR CURET, SHARON SWARTZ, KENNETH BREUER, Brown University — We present data from a mechanical model that we have used to explore a physical mechanism that may have aided transition from gliding to flapping flight over fifty million years ago. The model is composed of a cantilevered flat plate with a hinged trailing flap and is tested in a low-speed wind tunnel. For slow wind speeds the model is stationary, but above a critical wind speed the wing starts to oscillate due to an aeroelastic instability. A positive angle of attack on the wing results in a positive lift force. However, this lift force is significantly enhanced once the wing starts to oscillate. We used particle image velocimetry (PIV) to understand the unsteady aerodynamics of the self-excited flapping wing, and to identify and characterize the mechanisms that generate the enhanced lift force. We also discuss the implications of our results on the evolution of powered biological flight.

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