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Experimental Investigation of Unsteady Stall Characteristics in Flapping Flight NATHAN LUNSFORD, JAMEY JACOB, Oklahoma State University — This study examines the effects of wing rigidity on the aerodynamics of flapping wings, particularly in regard to unsteady separation. A flapping wing model was constructed and tested using a variety of diagnostics including force balance, PIV, and flow visualization. Three different wing flexibilities relative to each other were used: flexible, semi-flexible, and rigid. The setups were tested at a range of Reynolds numbers and flapping frequencies in addition to static measurements. The more flexible wings show more peaks and instability in the unsteady lift results at higher frequencies, possibly resulting from movement in the flexible trailing edge. At lower frequencies, the lift and drag curves correlate with each other in a sinusoidal pattern. This pattern's peaks align with the theoretical values from the frequency. It is seen that the flexible wing has lower energy content at lower frequencies and higher content at higher frequencies. This is a result of energy content being distributed from the dominant flapping frequency to higher modes on the wing as flexibility increases, which could be used to excite natural frequencies found in the wing.

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