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The Influence of Second Harmonic Phase and Amplitude Variation in Cyclically Pitching Wings ETHAN CULLER, JOHN FARNSWORTH, Univ of Colorado - Boulder — From wind tunnel testing of a cyber-physical wing model, it has been found that the pitch trajectory for stall flutter is described by an array of higher harmonic frequencies with decaying energy content. These frequencies distort the stall flutter motion from that of a pure sinusoidal oscillation in pitch and can have a significant effect on the resulting force production. In order to understand how these higher harmonic frequencies contribute to the overall pitching moment characteristics of a wing in stall flutter, a rigid finite span wing model, with aspect ratio four, was pitched in the wind tunnel. The prescribed motion of the pitch cycle was varied by changing the amplitude ratio and phase of the second harmonic of the oscillation frequency. The second harmonic represents the second highest energy mode in the pitching cycle spectra. Pitching moment and planar particle image velocimetry data was collected. From these pitching trajectories, a significant dependence of pitching moment on both the phase and amplitude of the prescribed waveforms was found. Specifically, for the same amplitude ratio, variations in the phase produced changes of approximately 30 percent in the phase averaged pitching moment.

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