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Force Coefficients on Surging Rigid and Flexible Wings PETER MANCINI, ANYA JONES, University of Maryland, KENNETH GRANLUND, MICHAEL OL, Air Force Research Laboratory — This study considers an aspect ratio 4 rigid flat plate and an aspect ratio 4.5 flexible wing, undergoing rectilinear motion in a water tunnel over several chord lengths at a Reynolds number of 20,000. Varying incidence angle, Reynolds number, and acceleration profile led to an extensive parameter study for both wings. Acceleration regions were linear with time and varied with distances of 0.25 to 6.0 chord-lengths. Measurements include lift and drag histories along with flow visualization of leading and trailing edge vortices throughout the entire motion by fluorescent dye injection illuminated by a laser sheet. A non-circulatory bump in lift coefficient at the end of the acceleration region was observed for each rigid wing case. The rigid wing also experienced a significant decrease in lift shortly after the wing reached its terminal velocity. This dip was followed by a second peak in lift around 6 chords traveled for every case, although the magnitudes differed among the acceleration profiles. Conversely, the flexible wing exhibited little to no non-circulatory peak at the end of acceleration and did not experience this dip and rise in lift. This study explores the influence of planform and chordwise flexibility on leading edge vortex formation, retention, and shedding.

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