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Unsteady versus Quasi-Steady Aerodynamic Response of Finite Aspect Ratio Wings in Surging Flow DASHA GLOUTAK, JAYLON MCGHEE, JOHN FARNSWORTH, University of Colorado, Boulder — The time-varying forces and moments of finite aspect ratio wings in an unsteady streamwise flow are examined to better identify unsteady versus quasi-steady effects. Experimental data was collected for four NACA 0015 wings with semi-span aspect ratios of 1, 2, 3, and 4 in low Reynolds Number flows between 50,000 and 150,000. The surging flow amplitude was varied between 10 and 30 percent of the mean velocity for reduced frequencies between 0.005 and 0.1. Both low angles of attack and angles of attack near stall demonstrate pronounced hysteresis loops for particular reduced frequencies at large surging amplitudes. The static lift curves at these angles of attack also showed a large Reynolds Number dependence, indicating potential quasi-steady phenomena at work. The measured hysteresis loops are compared to results interpolated from the static data to highlight which regions of the examined parameter space exhibit unsteady vs. quasi-steady aerodynamic behavior. This material is based upon work supported by the Air Force Office of Scientific Research under award number FA9550-18-1-0311 and through the 2020 AFRL Summer Faculty Fellowship Program.

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