Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Unsteady flow structure response to acceleration of non-slender swept wings[1] HAN TU, Syracuse University, MATTHEW MARZANEK, DAVID RIVAL, Queen's University, MELISSA GREEN, Syracuse University — Previous experiments studying steady translation and axially accelerating translation of a triangular planform wing have shown that at high angles of attack, an axial gust or acceleration can induce flow reattachment. Finite-time Lyapunov exponent (FTLE) analysis reveals spanwise differences of the flow structure around a 45° sweep delta wing. Flow reattachment onsets inboard while the flow remains separated from the leading edge further outboard. Under certain axial acceleration magnitudes, a long whip-like nFTLE ridge lifting off the wing surface can be observed. The root of the whip-like structure moves toward the trailing edge and it closely follows a local chordwise pressure peak. It can be inferred that the nFTLE ridges' roots across the span form a line that moves along with the high pressure zone in response to the axial gust. Following this region downstream along the chord is a region of low pressure, consistent with lift being re-established on the wing as the flow reattaches. Vertical accelerations will be studied and combined with axial acceleration cases to obtain further insight of flow structure evolution in highly unsteady environments for non-slender delta wings.

[1]This work was supported by the Office of Naval Research under ONR Award No. N00014-16-1-2732.

Han Tu
Syracuse Unversity

Date submitted: 01 Aug 2019 Electronic form version 1.4