Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Evolution of three-dimensional flow structures over the rotating wing[1] ABBISHEK GURURAJ, MAHYAR MOAVEN, ZU PUAYEN TAN, BRIAN THUROW, VRISHANK RAGHAV, Auburn University — The development of the leading-edge vortex (LEV) and associated flow structures over surfaces undergoing unsteady maneuvers like rotation and/or pitching is advantageous in some cases while detrimental in others. As such, the comprehensive understanding of these flow phenomenon is paramount. In this study, a novel single-camera plenoptic 3D velocimetry technique in the rotating frame of reference is employed to characterize the three-dimensional flow over a rotating wing. Unlike past fixed-frame 3D velocimetry, this approach allows prolonged flow measurement across multiple complete rotations. Preliminary analysis show that multiple vortices are shed from the leading-edge and the LEV developed stronger and closer to the wing surface than secondary vortices, consistent with observations in the literature on rotating wings. It was also observed that after some time has elapsed after the start of rotation, the convection speed of LEV became higher towards the root relative to the tip in the measurement volume considered. To further understand the dynamics of these flow structures, the components of the vorticity equation in the rotating frame of reference will be quantified to assess their contributions to the evolution of flow structures over the rotating wing.

[1]The authors acknowledge the support from the Army Research Office under the Grant Number: W911NF-19-1-0052.

Abbishek Gururaj
Auburn University

Date submitted: 10 Aug 2020 Electronic form version 1.4