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Development of 3D Plenoptic PIV to Study Flow over Rotating Wings¹ MAHYAR MOAVEN, ABBISHEK GURURAJ, ZU PUAYEN TAN, BRIAN THUROW, VRISHANK RAGHAV, Auburn University — While the leading-edge vortex (LEV) is of great interest in rotor aerodynamics, research in this phenomenon has been hampered by difficulties in indefinitely following the 3D flow-field evolution, thereby necessitating measurements in the rotating frame of reference. Rotating 3D Velocimetry (R3DV) is a technique designed to fill this void using a plenoptic camera. The primary distinction between a conventional and plenoptic camera is an additional microlens array in front of the image sensor of the latter that splits incoming light rays based on incidence angle, allowing for reconstruction of 3D volumes from a single camera. Here, a volume of flow over a rotating wing is imaged with a stationary plenoptic camera via a hub-mounted rotating mirror locked to the rotors view. Quiescent flow measurements were also recorded in the absence of the wing to account for calculated velocity vectors being skewed by the non-inertial frame of reference. Implementation of a previously established plenoptic calibration method for stationary volumes has been adapted to incorporate systematic volume rotation. An overview of the methodology will be presented along with resulting visualization of the leading-edge vortex development over a rotating wing.

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