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Application of Plenoptic Camera 3D PIV in a Rotating Frame of Reference¹ MAHYAR MOAVEN, ABBISHEK GURURAJ, ZU PUAYEN TAN, BRIAN THUROW, VRISHANK RAGHAV, Department of Aerospace Engineering, Auburn University — A major limitation to the thorough understanding of a rotating flow's aerodynamic characteristics is the difficulty in measuring data within the rotating frame of reference. Rotating 3D Velocimetry (R3DV) is a concept designed to acquire volumetric flow field measurements over a rotor, within the rotating frame of reference, using a single camera. A submerged wing rotates in conjunction with a mirror that reflects light traveling through flow over the wing to a stationary plenoptic camera. The plenoptic camera's added array of microlenses between the aperture and image sensor gives it the ability to capture the incident angle of light rays, allowing for 3D reconstruction of volumes. Traditionally, plenoptic camera calibration has been explored for a stationary field of view. In current development is a method to incorporate rotation into the calibration such that images from all azimuth angles can be calibrated by interpolation, thereby eliminating the need to calibrate each distinct angle. Other challenges include achieving sufficient depth resolution and obtaining an adequate depth of field at a distant focal plane. Preliminary results demonstrating the efficacy of the R3DV method will be presented along with explanations of how the aforementioned problems will be overcome.

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