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Plenoptic PIV: Towards simple, robust 3D flow measurements[1]
BRIAN THUROW, TIM FAHRINGER, Auburn University — In this work, we report on the recent development of plenoptic PIV for the measurement of 3D flow fields. Plenoptic PIV uses a plenoptic camera to record the 4D light-field generated by a volume of particles seeded into a flow field. Plenoptic cameras are primarily known for their ability to computational refocus or change the perspective of an image after it has been acquired. In this work, we use tomographic algorithms to reconstruct a 3D volume of the particle field and apply a cross-correlation algorithm to a pair of particle volumes to determine the 3D/3C velocity field. The primary advantage of plenoptic PIV over multi-camera techniques is that it only uses a single camera, which greatly reduces the cost and simplifies a typical experimental arrangement. In addition, plenoptic PIV is capable of making measurements over dimensions on the order of 100 mm x 100 mm x 100 mm. The spatial resolution and accuracy of the technique are presented along with examples of 3D velocity data acquired in turbulent boundary layers and supersonic jets.

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