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Technique for Characterization of 3D Unsteady Fluid-Structure Interactions via a Single Plenoptic Camera BRIAN THUROW, ZU TAN, BIPIN TIWARI, VRISHANK RAGHAV, Auburn University — Due to flexible boundaries, many flows are unsteady, three-dimensional and subjected to fluid-structure interactions (FSI). Conventional studies of FSI nominally treat the flow and boundary surface measurements separately, resulting in a loss of true FSI physics, especially for aperiodic flows. More recently, simultaneous multi-camera approaches using tomographic-PIV/3D-PTV and Digital Image Correlation (DIC) have been explored. However, this approach is cumbersome to arrange in confined spaces, and challenging to align with each camera's shallow depth-of-field. Here, we propose an alternative method of simultaneous FSI measurement using a single plenoptic camera. Equipped with a microlens array, plenoptic cameras capture a volume's light-field in 4D, which enables single-camera 3D measurements. In this study, a newly developed *kHz*-rate plenoptic camera is applied to characterize the FSI of a flexible 50x 30 x 30mm^3 tube model. Macroscopic painted dots were used to track surface motion, while micron-sized particles were used as the flow tracer. A pulsatile flow was applied to intermittently collapse the tube, during which the dots and seeds were simultaneously imaged. In post-processing, dots and seeds are separated by diameters and/or shape, after which their 3D trajectories are tracked separately via a plenoptic-PTV algorithm. Preliminary proof-of-concept results are presented, along with further analyses to optimize particles/dots sizes and densities.

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