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Single camera volumetric velocimetry in aortic sinus with a percutaneous valve CHRIS CLIFFORD, BRIAN THUROW, Auburn University, PREM MIDHA, IKECHUKWU OKAFOR, VRISHANK RAGHAV, AJIT YOGANATHAN, Georgia Institute of Technology — Cardiac flows have long been understood to be highly three dimensional, yet traditional in vitro techniques used to capture these complexities are costly and cumbersome. Thus, two dimensional techniques are primarily used for heart valve flow diagnostics. The recent introduction of plenoptic camera technology allows for traditional cameras to capture both spatial and angular information from a light field through the addition of a microlens array in front of the image sensor. When combined with traditional particle image velocimetry (PIV) techniques, volumetric velocity data may be acquired with a single camera using off-the-shelf optics. Particle volume pairs are reconstructed from raw plenoptic images using a filtered refocusing scheme, followed by three-dimensional cross-correlation. This technique was applied to the sinus region (known for having highly three-dimensional flow structures) of an in vitro aortic model with a percutaneous valve. Phase-locked plenoptic PIV data was acquired at two cardiac outputs (2 and 5 L/min) and 7 phases of the cardiac cycle. The volumetric PIV data was compared to standard 2D-2C PIV. Flow features such as recirculation and stagnation were observed in the sinus region in both cases.

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