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Simultaneous 3D Strain and Flow Fields Measurement of a Model Artery under Unsteady Flows[1] MOSTAFA TOLOUI, JIAN SHENG, University of Minnesota, AEM — Fluid-Structure Interaction imposes challenges in both aero-elasticity and biomedical studies. A simultaneous solid deformation and fluid flow measurement technique based on digital in-line holographic particle tracking velocimetry (PTV) has been developed. It allows us to measure concurrently 3D strain field of a deforming structure and the unsteady flow near it. To facilitate the measurement, both wall and flow are seeded with tracer particles distinguished by size. The motion of these tracers provides the 3D deformation of the wall and the 3D velocity distribution of the flow separately. A fully index matched facility including transparent artery and NaI solution is constructed to enable observations near the wall or through the complex geometry. An arterial model with the inner diameter of 9.5 mm and the thickness of 0.9 mm is manufactured from the cross-linked transparent PDMS at the mixing ratio of 1:10 and doped with mono-dispersed 19 μm polystyrene particles. A cinematic holographic PTV system is used to trace the 3D particle motion in the model and flow simultaneously. Preliminary study is performed within a sample volume of 15 $\times$ 15 $\times$ 75 mm with the spatial resolution of 7.4 μm in lateral and 10 μm in depth. Uncertainty and accuracy analysis will be reported.

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