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Three-dimensional Particle Image Velocimetry of Optically Opaque Flows using Ultrasound Contrast Agents HENNING GELSHORN, UC San Diego, ANA MEDINA, UCIII Madrid, DANIEL LOTZ, DAVID J. FISHER, UC San Diego, JAVIER RODRIGUEZ-RODRIGUEZ, UCIII Madrid, JUAN C. DEL ALAMO, THILO HOELSCHER, UC San Diego — Currently, phase contrast magnetic resonance imaging is the only technique that provides time-resolved volumetric velocity maps of optically opaque systems such as blood flow in our vessels. However, this technique is expensive, time consuming and has low resolution. This project constitutes the first step towards the introduction of 3D echo-PIV, a novel ultrasound imaging technique that provides volumetric maps of three-component blood flow velocity almost in real time. 3D echo-PIV is non-invasive, fast, mobile and inexpensive, and therefore has the potential to become a commonly-used modality in the clinical setting. This new modality performs particle image velocimetry on 3D, time-lapse sequences of ultrasound bright-mode frames obtained during contrast agent infusion by tracking the sound backscattered by the contrast agent microbubbles. The present study applies 3D echo-PIV to tubular silicone phantoms in an arterial flow simulator and compares these measurements to the results from computer simulations obtained with commercial codes that have been extensively validated. We vary systematically geometrical parameters and flow rates to model different physiological hemodynamic patterns.

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