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Volumetric velocimetry downstream of a percutaneous heart valve VRISHANK RAGHAV, CHRISTOPHER CLIFFORD, Auburn University, PREM MIDHA, IKECHUKWU OKAFOR, Georgia Institute of Technology, BRIAN THUROW, Auburn University, AJIT YOGANATHAN, Georgia Institute of Technology, AUBURN UNIVERSITY COLLABORATION, GEORGIA INSTITUTE OF TECHNOLOGY COLLABORATION — Transcatheter aortic valve replacement has emerged as a safe and effective treatment for severe, symptomatic aortic stenosis in intermediate or greater surgical risk patients. However, despite excellent short-term outcomes, improved imaging and awareness has led to the identification of leaflet thrombosis on the aortic side of the prosthesis. Upon implantation, the transcatheter heart valve (THV) becomes enclosed in the native aortic valve leaflet tissue dividing the native sinus into two regions – a smaller anatomical sinus and a neo-sinus. To understand the causes for thrombosis, plenoptic Particle Image Velocimetry (PIV) is used to investigate the pulsatile three-dimensional flow in the sinus and neo-sinus region of the THV. Experiments are conducted on both a real and a transparent THV model in a pulsatile flow loop capable of replicating physiological hemodynamics. Comparisons with planar PIV results demonstrate the feasibility of using Plenoptic PIV to study heart valve fluid dynamics. Large three-dimensional regions of low velocity magnitude and low viscous shear stress were observed near the heart valve which could increase particle residence time potentially leading to formation of clots the THV leaflet.

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