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**Influence of the accuracy in index of refraction matching on fluid flow measurements** VIBHAV DURGESH, MANOOOCHEHR KOOCHESFAHANI, YIYING TONG, Michigan State University — Fluid flow imaging through curved surfaces suffers from optical distortion caused by the mismatch in the refractive indices of the fluid and the solid surface, leading to errors in velocity measurements and the resulting estimates of wall shear stress. Examples include imaging of flow through porous media and in-vitro studies of biological flow problems. A common approach for minimizing optical distortions is to adjust the refractive index of the fluid to closely match that of the solid. In this study we investigate how the accuracy in the index of refractive matching influences the image distortion and, in particular, the measurement accuracy of wall shear stress, a critical property in biofluid dynamics. A ray-tracing approach is used to simulate the optical distortion and is validated against experiments in a simple geometry, i.e. imaging of a liquid flow inside a cylindrical tube. Ray-tracing is implemented through an in-house code for simple geometries and the results are compared with simulations using a more complete (free) software that is already available online and can deal with complex geometries. Results show that a slight mismatch in the indices of refraction, as small as one part in a thousand, can lead to a significant error in the estimate of wall shear stress.

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