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Measurements of 3-D Flows with a Digital Holographic Microscope[1] E. MALKIEL, J. SHENG, J. KATZ, Johns Hopkins University — Rising interests in micro-scale dynamics, such as turbulence in a near wall region or flow around a microorganism require measurements at compatible scales. A Digital Holographic Microscope (DHM) records magnified in-line holographic images and the 3D volumes are reconstructed numerically. This method offers inherent advantages over both conventional microscopy and lens-less in-line holography. DHM extends the depth of field of a conventional microscope by two orders of magnitude, to about 1000 time the target object diameter. It also reduces the depth-of-focus to less than ten particle diameters, two orders of magnitude lower than lens-less holography. For example, using segmentation and volume averages, one can detect displacements of 2μm particles in the depth direction at a resolution of about 10 μm. A single digital hologram can detect 5000 – 10,000 particles. Examples of implementation of this method include near-wall velocity measurements of the channel flow at $0<y^+<60$ (Re_h=60,000), as well as swimming behavior of a nauplius. Errors and techniques for determining velocity field and particle distributions are discussed.

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