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Simultaneous measurement of morphological shape and 3D motion of objects using digital holographic microscopy KYUNG WON SEO, SANG JOON LEE, Pohang University of Science and Technology — The phase-imaging technique using off-axis holography and the volumetric measurement of particle fields using in-line holography have been investigated separately. In the present study, we combine the advantages of these two techniques. A high-speed off-axis holographic system is established to simultaneously measure the morphology and the 3D motion of particles in a microtube flow with high spatial and temporal resolutions. The off-axis holography setup with transmission-type configuration is based on the principle of Mach–Zehnder interferometry. Off-axis holograms were numerically reconstructed in amplitude and phase, after frequency-domain filtering by adopting the angular spectrum method. The amplitude information of the reconstructed image indicates the 3D positions of the suspended particles, and phase information provides the object morphology or physical thickness. As a result, the 3D trajectories, instantaneous velocity, and the 3D shape of particles are extracted through a position detection and particle tracking velocimetry (PTV) algorithm and quantitative phase map. This holographic microscopy technique demonstrates the feasibility of the simultaneous measurement of the 3D dynamic behavior and temporal shape of objects.

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