TELECENTRIC DIGITAL HOLOGRAPHIC MICROSCOPY BASED ON MODIFIED LATERAL-SHEARING INTERFEROMETER

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A new single-shot digital holographic microscopy (SS-DHM) with the modified lateral-shearing interferometer (MLSI) based on the computational telecentric imaging technique is proposed. The proposed system is composed of three-step processes such as optical recording, digital compensation and numerical reconstruction. In the optical recording process, using the MLSI [1], where a tube lens is intentionally set to be located at the slightly shorter distance than its focal length from the objective lens, the object beam with an additional quadratic phase factor (QPF) due to the tube lens is optically recorded in the hologram. This optical QPF can be then balanced out from the recorded hologram in the digital compensation process since the digital version of this QPF can be computationally generated based on the known distance difference between the focal length and actual location of the tube lens. Furthermore, from this phase-compensated hologram, the object image can be numerically reconstructed in 3-D. With these combined processes of optical recoding and digital compensation of the QPF, the proposed system can be made to be virtually operated in the computational telecentricity, which then enables implementing a simple-structured MLSI-based single-shot DHM system.

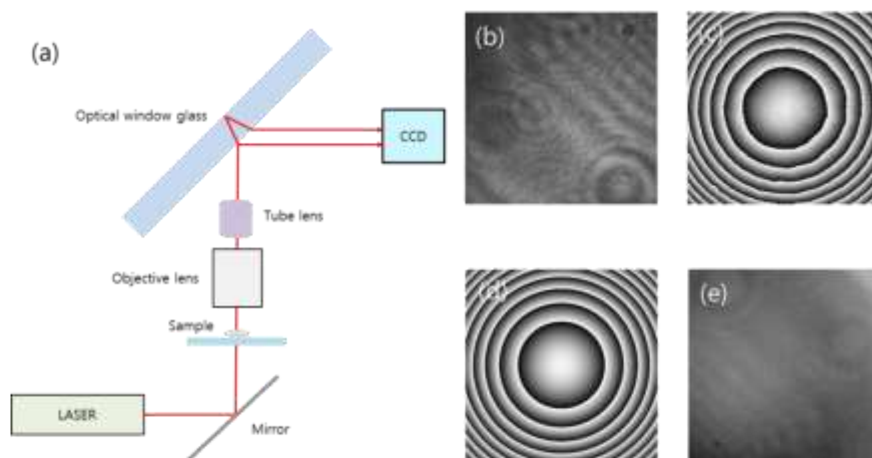

Figure 1: (a) Optical setup of the proposed system, (b) Recorded hologram, (c) Optical CPF of the recorded hologram, (d) Computer-generated CPF, (e) Compensated hologram

[1] K.B. Seo, B.M. Kim, E.S. Kim. "Digital holographic microscopy based on a modified lateral shearing interferometer for three-dimensional visual inspection of nanoscale defects on transparent objects." *Nanoscale Res. Lett.* **9**(1), 1-14 (2014).

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