DIGITAL HOLOGRAPHIC MICROSCOPY USING SINGLE-ARM OFF-AXIS INTERFEROMETER BASED ON A CONCEPT OF SUB-DIVIDED TWO-BEAM INTERFERENCE

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Digital holographic microscopy (DHM) using a single-arm off-axis interferometer (SA-OAI) system operating on a concept of sub-divided two-beam interference (STBI) is proposed. In this system, a pair of pellicle beam splitter and optical mirror is employed to generate two sheared off-axis beams from the object beam by controlling the tilting angle of the optical mirror. Based on the STBI concept, each sheared object beam is divided into two areas with and without object data, which are called half-object and half-reference beams, respectively [1]. These sub-divided object and reference beams then make interference patterns just like the conventional two-arm holographic interferometer. Thus, in the proposed SA-OAI system, zero-order terms, virtual and duplicated image problems occurring in most single-arm lateral-shearing interferometers can be solved, which then allow extraction of the hologram data only related to the target object and its three-dimensional (3-D) reconstruction in the digital reconstruction process. To confirm the feasibility of the proposed system, operational performances are analyzed with the ray-optics, and experiments with test objects are carried out, and the results are compared with those of the conventional system.

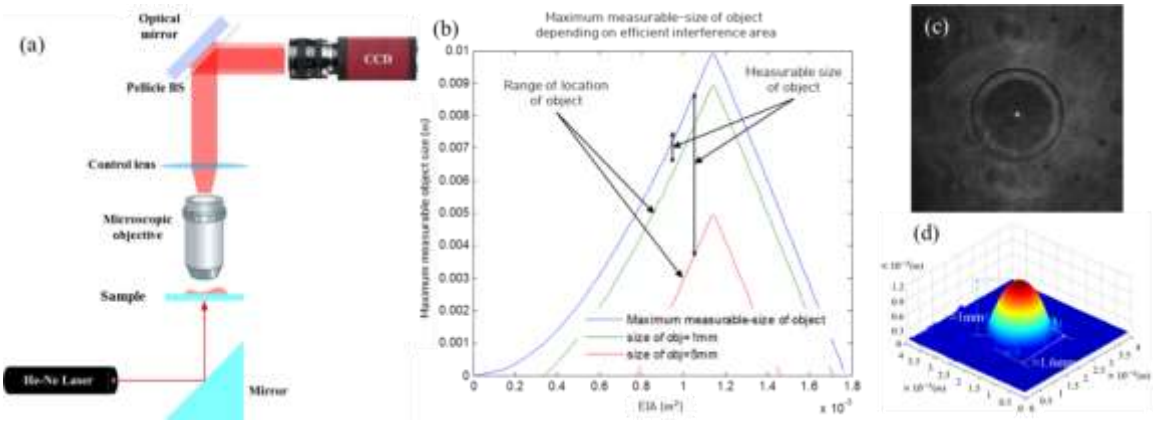

Figure 1: (a) Optical setup of the proposed SA-OAI system, (b) Maximum measurable-size of the object depending on the effective interference area (EIA), (c) Recorded holographic interference pattern, and (d) Reconstructed 3-D shape of the object

[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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