Probing wavefront in digital holographic display system by the use of transport of intensity equation

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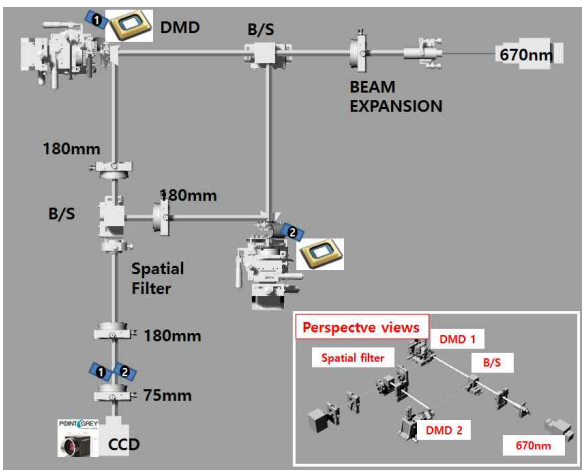
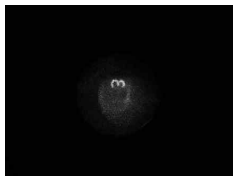
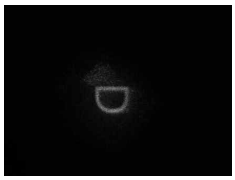
Recently, holographic display systems that can provide horizontally continuous views along a circular direction have been shown [1-2]. However, to increase the size of the reconstructed holograms, it is necessary to adopt additional techniques such as a spatial multiplexing and temporal multiplexing of spatial light modulator(SLM). In addition, to provide large size holograms, spatially-tiled configuration of spatial light modulator is one of the widely-known methods. To estimate the property of the holographic display system, it is necessary to adopt a phase extraction method. Here, we will adopt transport of intensity equation (TIE) as a quantitative phase imaging technique to estimate the phase profile of reconstructed computer generated holograms (CGHs).
The schematic diagram of holographic display system is shown in Fig. 1(a). In our holographic display system, 660nm laser is used as a light source, and two DMDs, each of which has the pixel number of 1024 X 768, are used as spatial light modulators to extend the size of the reconstructed holograms. A 4-f optics configuration composed of two lenses with the focal length of 180mm and a spatial filter are used to remove unwanted signals inevitably caused by an arrayed-mirror structure of the DMDs. And the reimaged DMDs can be positioned in front of the lens with the focal length of 75 mm. Consequently, the reconstructed holograms in a viewing window can be captured by the charge coupled device (CCD). The captured reconstructed holograms are shown in Figs. 1(b) and (c). By using the TIE relationship, the phase profile of the reconstructed holograms can be given, and the images of the extracted phase profile are shown in Figs. 1(d) and (e).



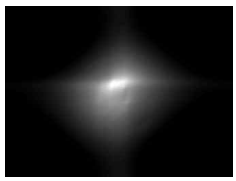
(a)



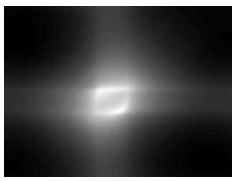
(b)



(c)



(d)



(e)

Fig. 1 (a) Experimental setup, (b) and (c) are reconstructed hologram, and (d) and (e) are the extracted phase profile of (b) and (c).

Acknowledgment

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References

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2. Y. Sando, D. Barada, and T. Yatagai, Opt. Lett. 39(19), 5555 (2014).