Looking through diffusive glass by digital amplitude/phase correction

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1. Introduction

Many researchers have investigated optical imaging through diffusive media or scattering media. Wide variety of techniques to reconstruct complex amplitude of an object trough diffusive glass or thin scattering media has been reported [1-5]. Among them, digital holography enables reconstruction of intensity and phase images of objects through a diffusive glass plate [6]. In Ref. 6, object light and light from diffusive glass are treated as independent wave. We proposed reconstruction of phase and intensity information of an object behind diffusive glass by digital holography [7,8]. Our method measured transmittance and phase of diffusive glass in advance. By a known complex amplitude of diffusive glass, complex amplitude of an object through diffusive glass is reconstructed by digital correction of the transmittance and phase change of diffusive glass. The object intensity and phase at an arbitrary distance can be reconstructed by optical back propagation. In this paper, we investigated reconstruction of complex amplitude of an object through diffusive glass by changing the distance between an object and diffusive glass / between ad diffusive glass and a camera.

2. Looking through diffusive glass by digital holography and correction of complex amplitude

The experimental setup of such apparatus was described in an earlier report [7,8]. A He-Ne laser light source produces a 632.8 nm wavelength was used in our experiments. The procedure of the reconstruction of the intensity and phase of the object is as follows (Fig. 1). (1) First, the complex amplitude of the diffusive glass is acquired by phase-shifting digital holography. The complex amplitude of the diffusive glass on the camera surface is acquired. (2) We reconstruct the complex amplitude on the diffusive glass by the calculation with optical back propagation. (3) Then, an object is inserted and the complex amplitude of the object through the diffusive glass is acquired by phase-shifting digital holography. The complex amplitude of the object through the diffusive glass on the camera surface is acquired. (4) The complex amplitude both the object and diffusive glass on the diffusive glass is obtained by optical back propagation. (5) Thereafter, the complex amplitude of the diffusive glass is divided by the complex amplitude of the diffusive glass and the object to reconstruct the complex amplitude of the object in the diffusive glass (6) Furthermore, the complex amplitude of the reconstructed object is propagated back to the object plane, and the complex amplitude on the object plane is reconstructed. The object intensity and phase at an arbitrary distance are reconstructed by optical back propagation.

In the experiments, test target was used as an object to be reconstructed. From experimental results, reconstruction of the intensity and phase of the object through the diffusive glass was demonstrated.

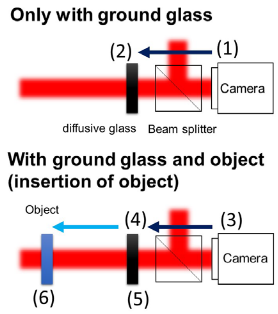

Fig. 1 Reconstruction of complex amplitude of an object through diffusive glass.

3. Conclusions

Digital holography was used to reconstruct the intensity and phase of an object through diffusive glass. We investigated reconstruction of phase and intensity information of USAF test target behind a diffusive glass.

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