Non-mechanical Table-top Holographic Display System using Circular Array Light Source and Random Pinhole Plate

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1. Introduction

Three-dimensional (3D) holographic display system which is issued on next generation displays, and its realization is a challenging task. Recently, electronics and telecommunications research institute (ETRI) and our team proposed the 360-degree table-top holographic display system, which is one of the next generation 3D holographic display systems through the Giga-Korea Project. This system consists of 4-f off-axis system, a mirage mirror, digital micro-mirror devices (DMDs) which sequentially load computer generated holograms (CGHs) at 360 degrees, and a mechanical motor synchronized with the DMDs [1]. Also, the non-mechanical table-top system without motors is being researched for safer and more practical system.

In this paper, we calculated CGHs for pinhole architecture using iterative Fourier transform algorithm (IFTA) for the non-mechanical table-top system as mentioned above [2, 3]. The proposed system can be produced wide viewing zone at 360-degree horizontally and 45-degree vertically.

2. System principles

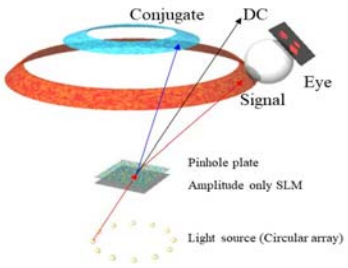

Fig. 1. Schematic diagram of non-mechanical system

The schematic diagram of the proposed system is shown in Fig. 1. The pinhole plate is placed on the amplitude only SLM and a light wave is incident from a circularly arranged light source. In this system, conjugate and DC noise caused by amplitude only SLM propagate to other regions, and signal wave propagates to the position of the observer. The conjugate and DC noise propagate to areas where the observer is not located, so the observer can receive intact signals without a 4-f off-axis system and mechanical rotating parts. The architecture of the pinhole plate is a structure in which one pinhole corresponds to one pixel, and the pinhole is located at a random position within one pixel of the active region.

3. Simulation results

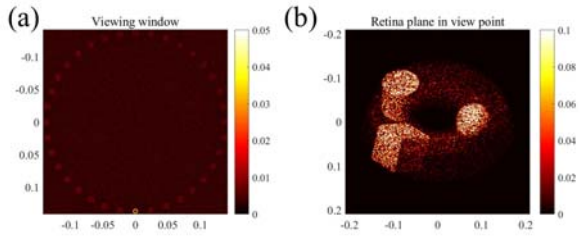

Fig. 2. Simulation results, (a) A viewing window and (b) observation results of proposed system

Figure 2 shows the simulation results of the 36-point prototype system. Observers can see different images in 36 regions of interest (ROIs), and there may be background noise there, but they can be reduced by increasing of the number of iterations. Furthermore, inevitable speckle noise also occurs because random pinhole plate operating as the random phase. As a result, by expanding the viewpoint and each ROI, a natural and continuous viewing window can be formed.

3. Conclusions

In this paper, we propose a non-mechanical table-top holographic display system by modeling pinhole plate and calculating CGHs based on IFTA. We will implement electromagnetic analysis and prototype for the next system as a future works.

Acknowledgements

This work was supported by GigaKOREA Project (GK19D0100, Development of Telecommunications Terminal with Digital Holographic Tabletop Display).

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