

Maxwellian-view Display Using Computer Generated Hologram

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1. Introduction

The Maxwellian view [1] is a powerful technique to provide visual information to people with refractive error, low vision, and eye diseases. Because images are displayed with rays converging at the center of the pupil of eyes, retinal images are formed independently to the refractive power of the crystalline lens. Conventional Maxwellian-view displays are based on geometrical optics; a lens is used for generating the converging rays. Therefore, some mechanical system is required to move the ray convergence point according to the eye movement. This study proposes the Maxwellian-view display based on computer-generated holography to allow the electronic movement of the ray convergence point.

2. Holographic Maxwellian-view Display

Figure 1 shows the basic idea of the holographic Maxwellian-view display. The spatial light modulator (SLM) generates wavefront which produces reconstructed images at any distance and converges at the center of the pupil. Because the inclination and the radius of curvature of the wavefront can be easily controlled using the computer-generated holography technique, the light convergence point can be electronically moved in both the lateral and longitudinal directions, as shown in Fig. 2. In this figure, a lens is attached to the SLM to shorten the system length.

The proposed technique was experimentally verified. Figure 3 shows the movement of the light convergence point; a section paper was placed at the eye position. The light spot could be moved in a rage of plus/minus 10 mm, which almost covers the typical pupil movement area.

Figure 4 shows retinal images generated by the proposed technique, which were captured by a video camera placed at the pupil position. Although the focus of the camera was changed from 300 mm to 1,000 mm from the pupil, the reconstructed images were observed unchanged. The paper strips showing the distances from the pupil were placed for reference.

3. Conclusions

A holographic Maxwellian-view display which supports the movement of the eye pupil is proposed. The experimental verification was shown.

Acknowledgements

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References

- [1] G. Westheimer, "The Maxwellian view", *Vision Res.* 6, 669-682 (1966).

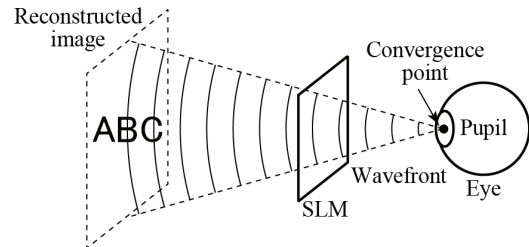


Fig. 1 Holographic Maxwellian-view display.

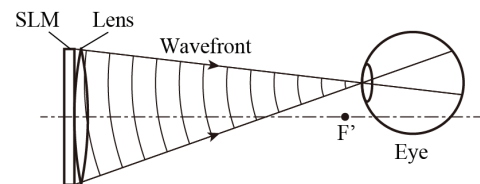


Fig. 2 Movement of light convergence point.

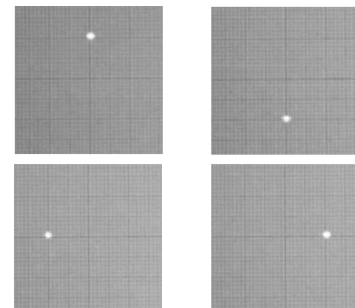


Fig. 3 Experimental results of movement of light convergence point.

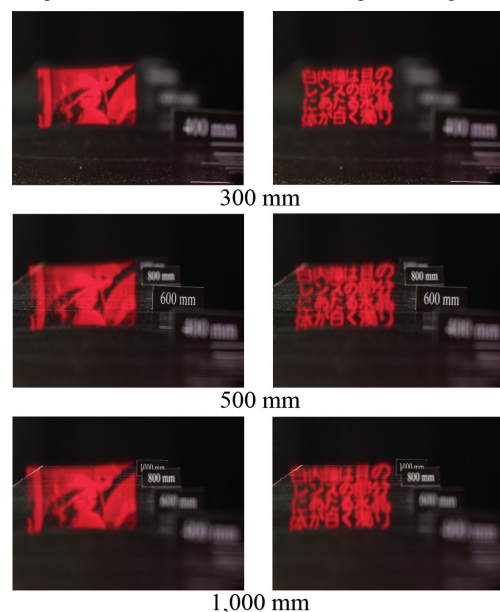


Fig. 4 Retinal images generated by holographic Maxwellian-view display.