# Horizontally Scanning Holographic Displays

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Holography is an ideal three-dimensional (3D) display technique, because it provides 3D images that satisfy all phsysiological factors of human 3D perception (vergence, binocular disparity, motion parallax, and accommodation). However, its electronic implementation is quite difficult because ultra-high resolution spatial light modulators (SLMs) are required to display hologram patterns. When a pixel pitch and a resolution of the SLM are respectively denoted by $p$ and $N\times M$ and the wavelength of light is denoted by $\lambda$, the viewing zone angle is given by $2\sin^{-1}(\lambda/2p)$ and the screen size is given by $Np\times Mp$. The most advanced SLM developed for the super high-vision televisions (resolution: 7680×4,320, pixel pitch: 4.8 $\mu$m) can provide limited viewing zone angle of 7.6° and screen size of 1.7 in.

We have been developing holographic display techniques to enlarge the viewing zone angle and the screen size by use of microelectromechanical systems (MEMS) SLMs. Because MEMS-SLMs can generate hologram patterns at a high frame rate, the time-multiplexing technique is utilized to enlarge the viewing zone angle and the screen size. Three types of holographic displays have been developed; the screen scanning system [1], the viewing-zone scanning system [2], and the 360-degree scanning system [3].

Figure 1 shows the color reconstructed images generated by the screen scanning system, which has a screen size of 6.2 in. and a viewing zone angle of 11°. Figure 2 shows those generated by the viewing-zone scanning system, which has a screen size of 2.0 in and a viewing zone angle of 40°. Figure 3 shows those generated by the 360-degree scanning system having a circular screen with a diameter of 100 mm. The three systems used the digital mircromirror device (DMD) as the MEMS-SLM.

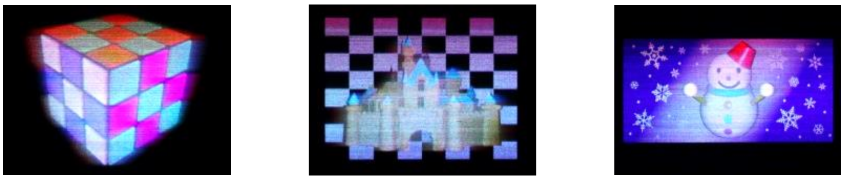

**Fig. 1. Reconstructed images generated by screen scanning system**

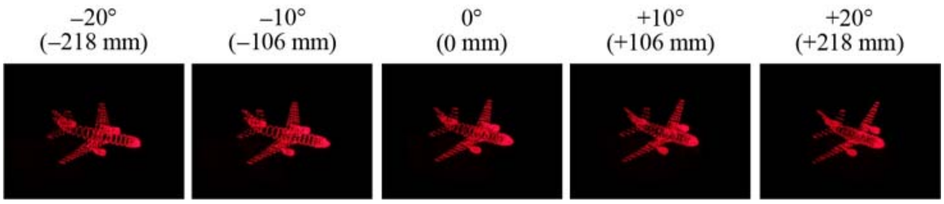


**Fig. 2. Reconstructed images generated by viewing-zone scanning system**

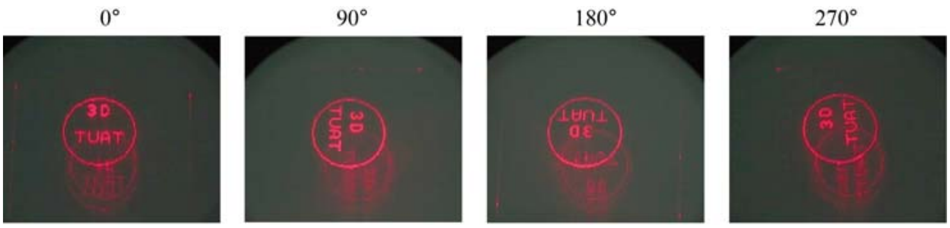


**Fig. 3. Reconstructed images generated by 360-degree scanning system**

## References

1. Y. Takaki and N. Okada, Appl. Opt. **48**, 3255 (2009).
2. Y. Takaki and K. Fujii, Opt. Express **22**, 24713 (2014).
3. T. Inoue and Y. Takaki, Opt. Express **23**, 6533 (2015).