Full-color large-scale computer-generated hologram based on RGB color filters

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ABSTRACT

Large-scale full-parallax computer-generated holograms (CGH), which we have created for the last decade, could reconstruct only monochromatic 3D images. This is because these CGHs are a sort of 'thin hologram'. Our CGHs are fabricated using laser lithography and made of a photomask, i.e. the fringe pattern is made of a metal thin film coated on a glass substrate. Thus, the fringe pattern has a two-dimensional structure. However, the CGHs can be reconstructed using reflection illumination because of high reflectivity of the metal film.

Unlike volume holograms, our CGHs cause much color smear because of color aberration of thin holograms. To reconstruct full-color images from our large-scale CGHs, we have proposed a technique employing RGB color filters used for LCD panels. In this technique, the metal fringe pattern is divided into RGB blocks where the fringe pattern is calculated at the wavelength corresponding to RGB primary colors. RGB color filters are precisely attached to the metal fringe pattern. As a result, viewers can see a full-color image by combining RGB monochromatic images reconstructed by RGB blocks.

Unfortunately, the spectral property of RGB color filters is so broad that we have to use a RGB multi-chip white LED for illumination, which provides narrower spectrum than that by a halogen light or single-chip white LED using phosphor. Thus, we also propose a technique of transferring the CGH to a volume hologram in order to improve the reconstructed color image. Several full-color CGHs created by the techniques will be on display.

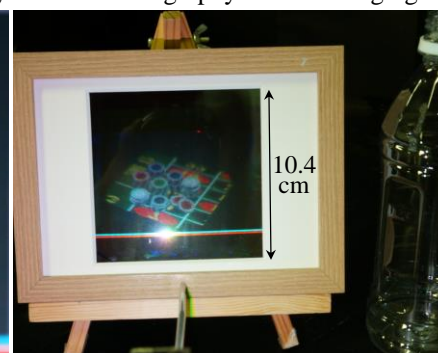**Keywords:** Large-scale CGH, high-definition CGH, full-color image, RGB color filters

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Color Cube, 5.2 cm × 5.2 cm   Casino Chips, 10.4 cm × 10.4 cm