View image simulation with Monte Carlo method in multi-view display

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A multi-view system separates view images into different directions with a display panel and a periodic optical structure [1-3]. To verify the optical characteristics with simulations, we often utilize ray tracing simulators such as LightTools (Synopsys, ver. 8.1.0) which is based on Monte Carlo algorithm. This ray tracing simulator, which provides simulation results with millions of light rays, has been a great option for testing system specifications including lens profile, aberrations, and crosstalk [4]. However, it was difficult to reflect the pixel structure and to make whole pixels in the ray tracing program because of the lack of computer capacity. Therefore it has been hard to perform the view image simulations with the Monte Carlo method.

In this work, we developed view image simulation with the Monte Carlo method in subpixel scale in multi-view display. We generated a base image in subpixel scale and manufactured a mask pattern including base image. By loading a mask pattern at the display part, the view images can be obtained at viewpoints. Figure 1(a) shows the pentile subpixel structure of a 3-view multi-view display [3], and Fig. 1(b) shows low resolution subpixel structure. Due to lack of memory, we used the subpixel structure with the lower resolution for the simulation. Figures 1(c) and 1(d) show the target view images and the generated mask pattern, respectively. The subpixel structures are described in the mask pattern. Figures 1(e) and 1(f) show the obtained view images with the Monte Carlo method at different viewpoints.
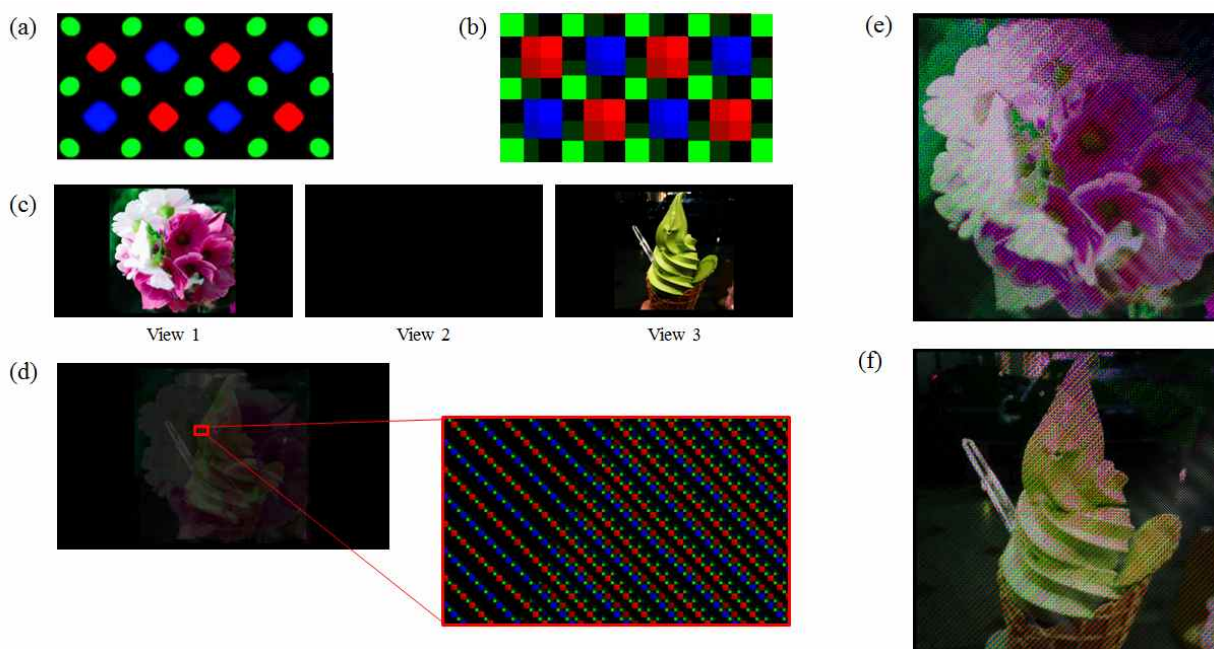
Fig. 1. Monte Carlo view image simulation in 3-view multi-view display system: (a) pentile subpixel structure, (b) low resolution pentile subpixel structure, (c) target view images, (d) generated mask pattern including base image, (e) and (f) result view images with the Monte Carlo method.

References

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