Converging light, thermal and sound wave by 2 types crossed mirror array

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1. Introduction

We have studied aerial image for aerial digital signage. This signage is composed of light, sound wave and thermal. Because the signs are aerial and have no physical hardware at the image positions, we can walk through the signs. This indicates that our signage position is everywhere you want, for example, signs can be placed right in front of a walker's face. This signage can be perceived by ears and by skin as well as by eye. This means that this type of signage have high sense of realism.

Aerial image can be realized by use of dihedral corner reflectors [1]. We have designed and fabricated a crossed-mirror array (CMA) for LED lamps in order to realize aerial image of a large LED panel [2, 3]. CMA can converge any sort of wave that can be reflected by aperture wall of CMA, for example far infrared and sound wave [4, 5]. CMA needs 2 types of aperture for converging sound wave and light at same time, because wavelength of sound wave is much longer than light. Sound CMA is formed by comb-shaped clear acrylic plate. Far infrared is absorbed by acrylic plate. This absorption might be problem in converging far infrared and sound wave simultaneously.

The purpose of this study is converging visible light, far-infrared light and sound wave at same time by using 2 types of CMA. We have investigated sound volume, temperature and light distributions.

2. Converging by CMA

CMA can form aerial image by reflection. After double reflections, the incident rays are converging into the image position because each reflection surfaces are placed perpendicularly and act as dihedral roof mirrors. Every light emitted from a light source converges to the position of the plane symmetry of the light source about the CMA plane. This convergence can be achieved not only in light but also in any waves. Thus, CMA can converge any sort of wave that can be reflected by aperture wall of CMA.

3. EXPERIMENTS

We have converged light, thermal and sound by two types CMA and investigating light and sound distribution. Thermal light source was halogen heater (300W). Sound source was parametric speaker. Using sound was sin wave of 8 kHz. Incident angle was 45 degrees. Distance 0 means designed converging position. Designed converging position was 100 cm from conventional CMA.

Sound, thermal and light distributions on the distance are shown in Fig. 2. Distribution on the distance has maximum values of sound, thermal and light intensity at designed converging position. This means that sound, thermal and light are converged simultaneously at designed converging position. Some far-infrared is passes through the aperture of sound CMA. Thermal is formed by this far-infrared.

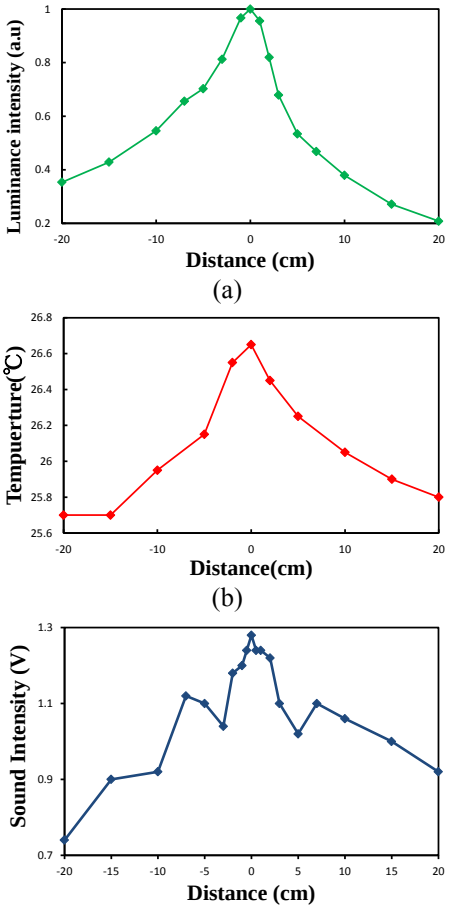

Fig. 1. Dependences of (a) light (b) thermal and (c) sound upon the distance.

4. Conclusion

In this study, we have successfully converged visible light, far infrared light and sound wave at same time by using 2 types CMA. This means that light, thermal and sound aerial image can form by 2 types CMA.

References

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