Method to Form Uniform Aerial Thermal Image
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1. Introduction

Three-dimensional aerial display can be realized by use of lens array [1] and reflective optical elements [2, 3]. Aerial display of light and heat using crossed-mirror array (CMA) and double-layered arrays of rectangular mirrors (WARM) has been proposed [4, 5]. These reflective optical elements form a thermal aerial image by converging infrared ray. After double reflections, the incident rays are converged into the image position because reflection surfaces are placed perpendicularly. Shape of thermal image is same of heat source. However, the intensity of the converged radiation varies depending on the distance between the WARM and the heat source. Therefore, when forming a large-size aerial thermal image, the temperature distribution of the formed aerial thermal image is not uniform.

In this paper, we propose a method to form uniform aerial thermal image. We conduct ray-tracing simulations to compare the intensity distributions obtained with the conventional method and the proposed method.

2. This Work

Proposed method is to form two aerial thermal images at the same position from the left side and the right side by using WARM on each side. The temperature distribution of the aerial thermal image become uniform by summing up the two aerial images formed from the both sides.

3. Simulation of Proposed Method

Light power intensity has been investigated with ray-tracing simulation software (Light Tools). The optical system for simulation is shown in Fig. 1. The WARM size is 282 mm × 282 mm. Its aperture size is 4 mm × 4 mm. Its thickness is 8 mm.

Results of ray-tracing simulations are shown in Fig. 2. When aerial thermal image is formed by only one WARM and one heat source, the power of aerial thermal image became lower as the distance between the WARM and the thermal aerial image became longer. When aerial thermal image is formed by the proposed method, the power of aerial thermal image was uniform. Thus, by using two WARMs in the both sides, we can form a uniform aerial thermal image.

4. Conclusion

We have proposed a method to form a uniform aerial thermal image. When two aerial thermal images that are formed from both sides are overlapped at the same position, the temperature distribution of the aerial thermal image becomes uniform.

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References