Stereoscopic display with radial parallax barrier

Ryosuke Ozaki, Hirotsugu Yamamoto** and Shiro Suyama**

***Dept. of Optical Science and Technology, Faculty of Engineering, Univ. of Tokushima, 2-1 minamijosanjima, Tokushima 770-8506 Japan**

****Center for Optical Reseach and Education, Utsunomiya University, 7-1-2, Yoto, Utsunomiya City, Tochigi, 321-0904, Japan**

Tel.: +81 88 656 9428, E-mail: raytok.183@gmail.com

In order to develop stereoscopic display that can be observed from all the surrounding viewpoints like the real object, stereoscopic image must be observed from all surrounding angles, resulting in circularly symmetric configuration including parallax barrier.

In this paper, we propose circularly symmetric configuration with radial parallax barrier and estimate basic characteristics of radial parallax barrier, by which possibility of stereoscopic vision is estimated.

Radial parallax barrier is shown in Fig. 1. Configuration of the experimental system is the same as one of conventional parallax barrier [1,2]. However, as the pitch of the barrier increases in the radial direction, two problems are concerned. First problem is that the perceived depth is inhibited by the barrier because of increasing barrier width. Second problem is that it is difficult to make adequate pixel configuration for right and left eyes because the barrier has not translational symmetry in spite of translational symmetry display.

Perceived depth by stereoscopic display placed horizontally was evaluated in order to estimate how high position the perpendicular stimulus images are perceived on the display. Experimental system is shown in Fig. 2. Perpendicular images with stepwise heights were designed, whose heights of the images on the display were 0 mm, 36.1 mm, 69.5 mm, 101.3 mm,129.7 mm and 156.9 mm. Figure 3 shows perceived depth dependence on designed depth. The stimulus images can be successfully perceived at the height up to approximately 100 mm, although the heights is smaller than designed one.

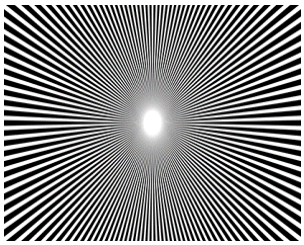

Fig.1. Radial parallax barrier with 260 line pairs / 360 degrees.

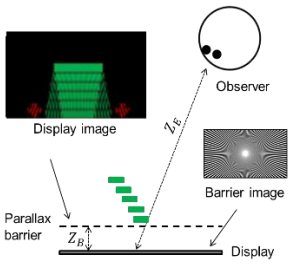

Fig.2. Experimental system for estimating possibility of the stereoscopic vision using radial parallax barrier.

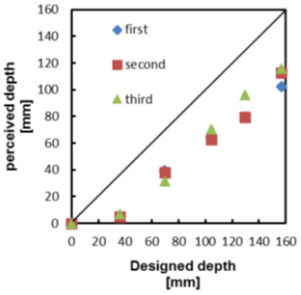

Fig. 3. Perceived depth vs. designed depth in which display is placed horizontally.

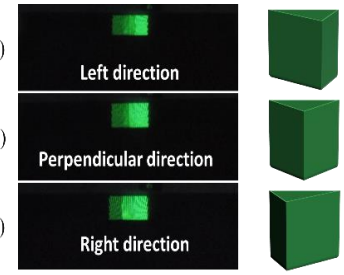

Fig. 4. Photographs from three directions in three-viewing auto-stereoscopic display.

In order to develop auto-stereoscopic display that can be observed from the surrounding viewpoints, images must be changed when observer change the viewpoints. Stimulus images of three-viewing auto-stereoscopic images were evaluated by viewing from three directions in order to confirm the stereoscopic vision possibility from surrounding viewpoints. Stimulus is an image like roof as shown in Fig. 4. Figures 4 (a), (b) and (c) are photographs from the left, center and right direction. The possibility of multi-viewing auto stereoscopic image in radial parallax barrier is confirmed.

In conclusion, radial parallax barrier is proposed and the potential for stereoscopic vision by radial parallax barrier is estimated. Even when display is placed horizontally, stimulus images can be observed with enough heights perpendicular to the display. Three-viewing auto-stereoscopic images from three directions can be confirmed. Thus, our proposed method is promising for multi-viewing auto-stereoscopic display by using radial parallax barrier.

References

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2. K.Sakamoto, et al.: Journal of the Institute of Image Information and Television Engineers, Vol. 59, No. 2, pp. 296-301 (2005).