Simulation of Moiré Effect in Curved Displays

Vladimir Saveljev[1,2]
[1]Dept. of Inform. Display Engineering, Hanyang University, Seoul 133-791, Korea
[2]Imaging Media Research Center, KIST, Seoul 136-791, Korea
Tel.:82-2-958-5794, E-mail: saveljev.vv@gmail.com

Recently, the curved displays with a non-flat screens appeared in the market. It is expected that autostereoscopic 3D displays will be based on such non-flat display panels soon. With that, it should be noted that in the flat-panel autostereoscopic displays, the moiré effect may appear, because they are typically designed from two layers with an integer ratio of periods [1]. Therefore it becomes important to understand the moiré patterns in the circularly curved layers [2]. In this paper, the computer simulation of the moiré effect in a cylindrical bi-layer screen is presented.

For the observer located exactly at the center of the curvature, the moiré effect will be quite similar to that for the observer in front of a plain screen. In particular, the moiré patterns will have the same visible spatial frequency of the moiré patterns for any observation angle (when an observer turns the head around); it is constant in the cylindrical coordinates. In this case, the moiré patterns reduce the visual contrast.

However, when the observer is displaced from the center of the curvature, the patterns are reshaped and the angular dependence appears. Then, a change of the observer position would not only cause the displacement of the patterns similarly to the moiré mirror effect [3] in flat layers, but also the noticeable change of the angular dependence, which additionally disturbs the visual perception.

The result of simulation is shown in Fig. 1. The graphs are calculated numerically for the observer moved along the axis of the symmetry and crosswise (four displaced positions total). Each analyzed position is displaced from the center by one half of the screen width. The laterally displaced positions along the *x*-axis correspond to three observers watching TV screen next to each other near the center of the curvature. The longitudinally displaced positions along the *y*-axis describe additional chairs at different distances.

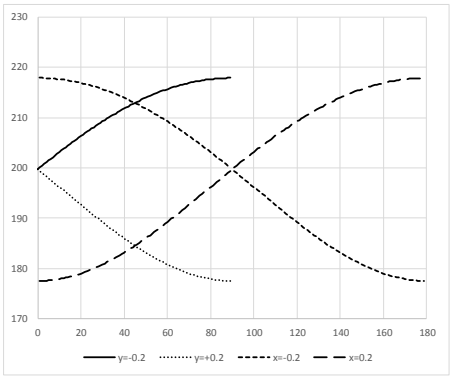

Fig. 1. Angular dependence of visible spatial frequency of the moiré patterns (arbitrary units) vs. observation angle (degrees) for 4 displaced observers

The simulation confirms the uniform appearance of the moiré patterns for the central observer. However the variation of the visible spatial frequency reaches 20% for the lateral observer and 10% for the longitudinal observer. The results of numerical simulation depend on the design parameters of a particular display panel (the size and the radius of curvature) and can be used in designing the curved autostereoscopic 3D displays.

References

1. G. Bell, R. Craig, T. Simmiss, *J. Soc. Inf. Disp.,* 15(11), 883 (2007).
2. 2. K. Patorski, M. Kujawinska, *Handbook of the Moiré Fringe Technique*, Elsevier (1993).
3. V. Saveljev and S.-K. Kim, *Opt. Express*, 20(3), 2163 (2012).