

The development of 42" 2D/3D switchable display

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Abstract

Stereoscopic/autostereoscopic systems have been developed in order to express true 3D images, but have never had great success in the practical use. In order to apply 3D display to promising applications such as advertisements and games, we've developed a 42" 2D/3D switchable display. It has characteristics that don't require special glasses for 3D images, use multi-view technology for improving 3D viewing characteristics, and has a 2D/3D switching function to express dynamic 3D contents as well as conventional 2D contents.

1. Introduction

Many kinds of researches on 3D display have been going on for a long time. There are many trials to be put to practical use, however it has been limited to some applications such as simulation. We've looked for other applications for the 3D display and finally targeted on the information (ex. advertisement) display. The information display should have the accuracy of the information and a large sized screen for many people who want to obtain information. And it should make users have interest and curiosity. The 2D/3D switching function can give us freedom in use of contents and help us deliver information effectively. In this paper, we'd like to introduce the 42" 2D/3D switchable display.

2. Results

2.1 Main characteristics of the 3D display to be put to practical use

It needs some characteristics for the 3D display to be used widely.

This is explained below.

1. No use of special glasses.
2. Large screen size.
3. Multi-view technology for multiple people to see.
4. 2D/3D switchable function.

It must be an autostereoscopic system that don't need special glasses to see 3D images. And it is the first step to use 3D display simply and easily.

Table1. The comparison of function and performance according to the type of the autostereoscopic 3D systems.

Items	Parallax barrier type	Lenticular type
No use special glasses	○	○
Multi-view tech.	○	○
2D/3D switching function	○	*△
3D luminance	△	○

* In the lenticular type, it is hard to apply the 2D/3D switching function to the large sized display under current manufacturing process

According to the results of evaluation for the 3D image quality by the size of display by using our proto-type (2.83", 19", 42"), the depth reality of the 3D image becomes higher in proportion to the size. [1].

Multi-view technology has to be applied to the 3D display in order to make multiple people see the 3D images simultaneously near the best position where the perspective views can be separated properly. [2].

Most users would feel visual fatigue if they see 3D images with large depth for a long stretch of time. It needs the proper configuration to minimize visual fatigue, which must display conventional 2D images for some time and subsequently true 3D images. [3]. Thus, it should have 2D/3D switching function to express 2D images as well as true 3D images.

2.2 2D/3D switching function

2D/3D switchable display is composed of main LCD, switching LCD, BLU(Back Light Unit) and control part. The Control part is connected with switching LCD and BLU. When the 3D display is switched from the 2D mode to 3D mode, the control part changes its brightness according to the contents because people can see the images more comfortably. In case of 3D mode, it is displayed a multiplexed image (stereo image) derived from 15 perspective views on the main LCD and parallax barrier pattern on the switching LCD. In case of 2D mode, it is displayed a conventional 2D image on the main LCD and transparent or full white on the switching LCD. At this moment, emitting light of the BLU is reduced by control part.

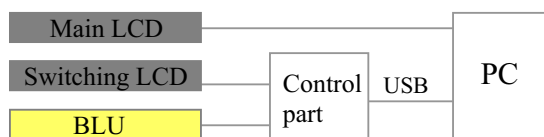


Fig 1. Schematic diagram for switching 2D and 3D mode

2.3 42" 2D/3D switchable display

We have developed the 42" 2D/3D switchable display in such as Fig 2. It consists of main LCD, 42" S-IPS panel with FHD(Full High Definition, 1920×1080) resolution, and switching LCD to display parallax barrier pattern. It can display the same image quality as the conventional LCD in 2D mode, and dynamic 3D images by using parallax barrier method as well. The 15 view multiplexing method enables multiple people to enjoy 3D images simultaneously around 3~5 [m] apart from 3D display without lowering of 3D image quality. Table 2 and Fig. 3 shows there is no

difference of the electro-optical characteristics in 2D mode compared to conventional LCD's. Thus it is possible to utilize various 2D contents. In the 3D mode, the optimum viewing distance from the screen is 4 meters and the luminance decreases from 450 to 200 [cd/m²]. It is the thing that have to improve so as to manufacture 2D/3D switchable display. Fig. 4 shows viewing angle for 3D images to be seen comfortably without image flipping in the 3D mode. In other words, users can see 3D images comfortably in the range of 40 [cm] horizontal.

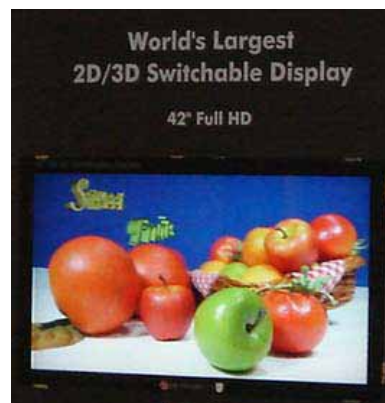


Fig 2. 42" 2D/3D switchable display which was exhibited in CES 2006.

Table 2. Specifications of 42" 2D/3D switchable display

Items	2D mode	3D mode
1. Size [inch]	42	
2. Resolution	1920×1080	More than SVGA
3. Luminance [nit]	450	200
4. Contrast Ratio	800:1	-
5. Viewing angle[°] (L/R/U/D)	89/89/89/89	-
6. Color gamut [%]	72	-
7. 2D/3D switching	Possible	
8. 3D method	Parallax barrier	
9. Multi view technology	-	15 view
10. Optimum position[m]	-	4

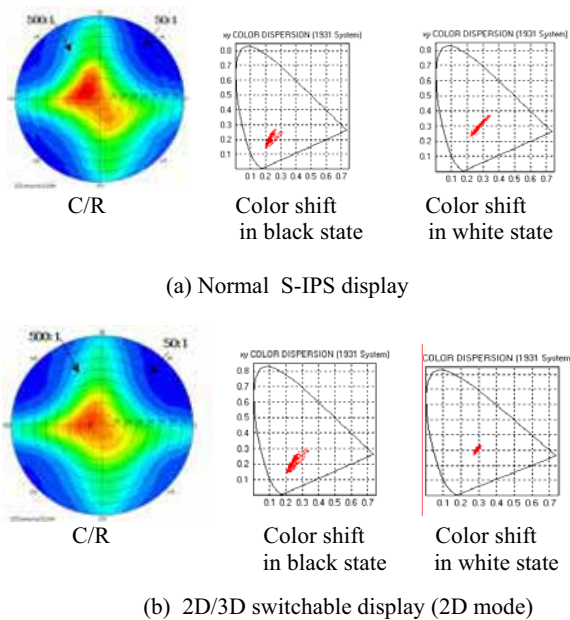


Fig 3. Electro-optical characteristics such as contrast ratio and color shift with respect to the all directions in the 2D mode compared to conventional LCD, i. e. (a) normal S-IPS (b) 2D/3D switchable display (2D mode).

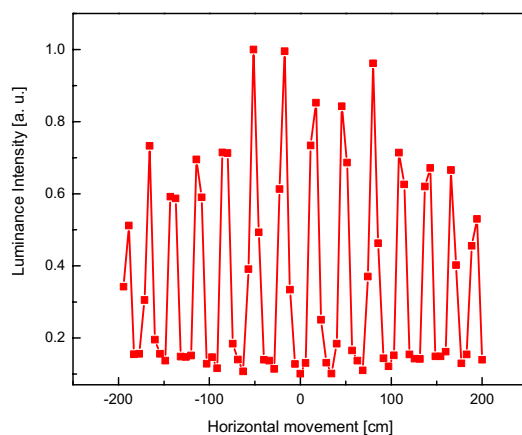


Fig 4. Viewing characteristics in the 3D mode. Luminance intensity with respect to horizontal movement is measured at the optimum position.

3. Conclusion

It is the first autostereoscopic system that has 2D/3D switching function, large sized screen over 40 inches. We expect that it will be applied to an information display, a booming display field as well as games and simulations. The large sized 2D/3D switchable display will be a new premium product which can display dynamic 3D images as well as high quality 2D images in the near future.

4. References

- [1] H. Ujike, IDW'05, 1727
- [2] T. Dekker, IMID '05, 31
- [3] Sumio Yano, Displays 23(2002), 191-201