

A Novel Driving Algorithm for Reducing Dynamic False Contour in PDPs

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Abstract

We propose a simple and efficient driving algorithm to reduce Dynamic False Contour(DFC) in Plasma Display Panels(PDPs) by using both accumulation and combination of light emission periods. Although the accumulative way of light emission in sustain period is regarded as more effective than combinational way to reduce DFC, it takes much addressing time to express high gray-scale. Therefore, we combine accumulative and combinational light emission methods to reduce DFC.

In the proposed method, one TV field (16.7ms) is composed of four combinational subfields for expressing small gray scales and fifteen accumulative subfields for large gray scales. In addition, we use some Graphic Signal Processing(GSP) algorithm to get more natural images by reducing DFC.

1. Introduction

Plasma display panels(PDPs) are known to be best suited to a large screen display for wall-hanging TVs, but they still have some technical challenges such as Dynamic False Contour (DFC).

The Address Display Separated (ADS) driving method widely adopted in PDPs uses 8 sub-fields or

more sub-fields to express 256-level-gray scale. It causes a serious degradation in image quality for the moving picture. This phenomenon occurs when the gray level of a pixel changes with TV frames as shown in Figure 1, where the gray level changes from 127th to 128th gray, the human's retina feels a different gray from 128th gray.

To solve the DFC problem, a variety of driving methods and algorithms have been proposed including a free coding method [1], a scattering method [2], a time-compressed driving method [3], a flicker free coding method [4] and a multi-level subfield driving method [5] and so on. However, it is so difficult to completely eliminate the problem that it still remains.

One of the popular methods is to divide a large-weighted subfield into several smaller-weighted subfields. For example, a driving method named "CLEAR" developed by Pioneer Corporation is able to theoretically eliminate the DFC problem by accumulating the light emission of subfields [6].

However, this technique can hardly express high gray-scale levels, because practically too many subfields are needed to express high gray-scale levels. That is, 255 subfields are necessary to express 256-gray-levels.

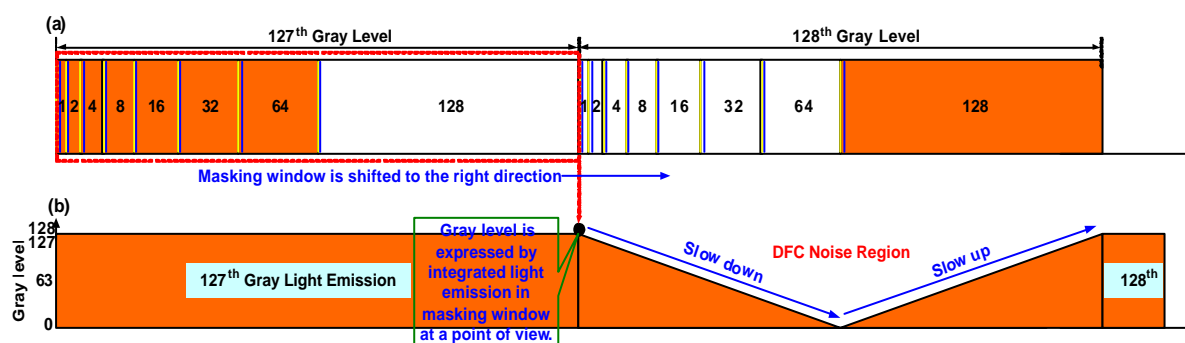


Figure 1. (a) Conventional ADS driving method and (b) integration of a light emission in time division. Human's retina feels DFC noise region, although gray level of a pixel changes only 1 gray from 127th to 128th gray.

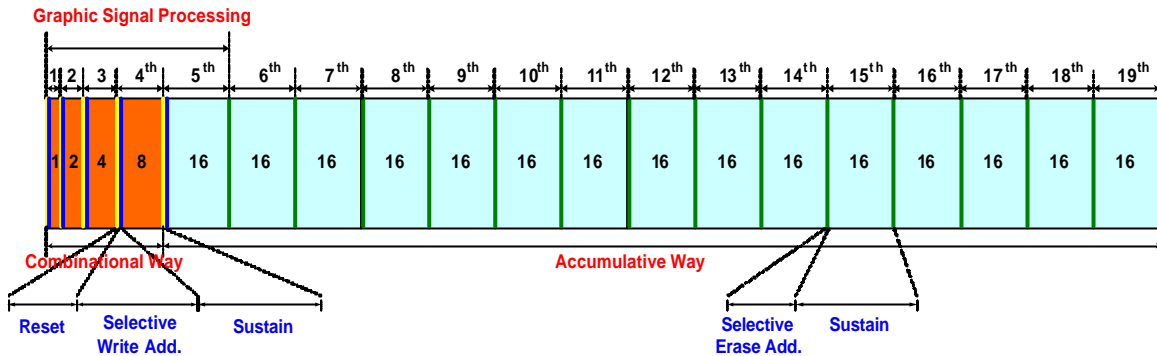


Figure 2. Proposed subfield configuration. One TV field is composed of 19 subfields by using a combinational way and an accumulative way.

2. Driving Method for Suppressing DFC

We adopt an accumulation method to eliminate the DFC, and also include a combination method to express high-gray scale in a binary-weighted-light-emission scheme. Figure 2 shows basic subfield configuration for reducing DFC. One TV field is composed of 19 subfields and 1st to 4th subfields are used to express small gray levels including 0-gray to 31-gray in a combinational way, and the other subfields express 16-gray level respectively that are used in an accumulative way(32, 64, ..., 240). For example, 69-gray-level can be expressed using 1st and 3rd subfields for 5-gray-level in combinational subfields, and the remaining 64-gray-level is represented by 5th to 8th subfields successively.

In the driving method, each of 1st to 5th subfields (combinational subfields) consists of reset period, selective-write-addressing period and sustain period. On the other hand, all accumulative subfields (6th to 19th subfields) have no reset period but one selective-erase addressing period and one sustain period. Note that when an accumulative subfield is addressed to emit light, the previous subfield always emits light. That's why a reset period does not have to be included to discharge all cells for selective erase.

In addition, the proposed driving method provides longer light emission time compared to prior methods as summarized in Table 1. Longer light emission time is very desirable, because the longer the light emission time, the higher the luminance and contrast ratio[7].

Table 1. Comparison of light emission time between driving methods to express 256-gray-level.

methods		time	Address time	Emission light time
NTSC	ADS	single	11.52ms	5.18 ms
		dual	5.76 ms	10.94 ms
	CLEAR	single	74.59 ms	X
		dual	37.29 ms	X
	Proposed method	single	11.23 ms	5.47 ms
		dual	5.6 ms	11.1 ms
HDTV	ADS	single	25.92ms	X
		dual	12.96 ms	3.74 ms
	CLEAR	single	167.83 ms	X
		dual	83.91 ms	X
	Proposed method	single	25.27 ms	X
		dual	12.63 ms	4.07 ms

3. Graphic Signal Processing

In the proposed driving method, the DFC might occur when a gray scale of an image is expressed with combinational subfields. To suppress this possibility, we include some GSP algorithm to our driving method.

The GSP algorithm compares display data of each pixel between a previous and a current frame. If the data differs by 8 or more gray levels than the previous frame data, the image data is modified by GSP algorithm. The flow chart in Figure 3 illustrates the detail.

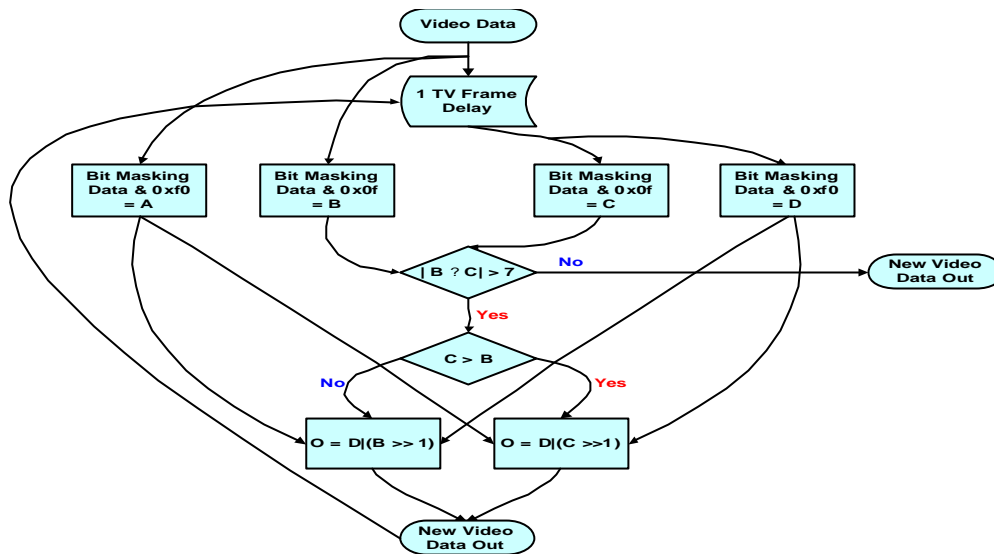


Figure 3. Graphic signal processing algorithm.

4. Simulation Results

Figure 4 shows simulated results of the conventional ADS driving method and the proposed driving method. Figure 4 (a) is the original image, and Figure 4 (b) and 4(c) show the images obtained from the conventional ADS and the proposed driving method respectively. The DFC in Figure 4 (c) is greatly reduced compared to Figure 4 (b). The worst case error rate of the distorted data in the conventional ADS driving method is 49.6 percent, but it is reduced to only 2.73 percent in a proposed method.



(a)



(b)

5. Conclusions

The accumulative subfields method is desirable in respect of the DFC, but it has a practical limitation in high-gray scale expression. So, we propose a novel driving algorithm to reduce the DFC phenomenon by combining both an accumulative and a combinational gray scale expression method. There is some possibility that the DFC might occur in the proposed driving method due to the introduced combinational subfields. So, we also develop a GSP algorithm to suppress the possibility. The simulation results show that the DFC cannot be eliminated perfectly, but greatly reduced. The worst case error rate of the distorted data in the conventional ADS driving method is 49.6 percent, but it is reduced to only 2.73 percent in a proposed method.



(c)



(d)

Figure 4, Simulation results. (a) Original image, (b) Image from DFC possibility, (c) Image from conventional ADS driving method, (d) Image from proposed driving method .

6. References

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