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(54) **METHOD OF ELIMINATING OLED DISPLAY PANEL MURA**

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(57) **ABSTRACT**

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The present invention provides a method of eliminating OLED display panel Mura. First, a corresponding calculation formula is selected by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale, and the compensation gray scale which should be utilized is calculated, and then the OLED display panel is made to show the present compensation gray scale captured with the present calculation to determine whether the preset condition of ending the calculation of the compensation gray scale is achieved, and if the preset condition of ending the calculation of the compensation gray scale is not achieved, the iterative computation does not stop until the preset condition of ending the calculation of the compensation gray scale is achieved, which can rapidly and effectively eliminate the OLED display panel Mura to ensure the brightness uniformity of the OLED display panel.

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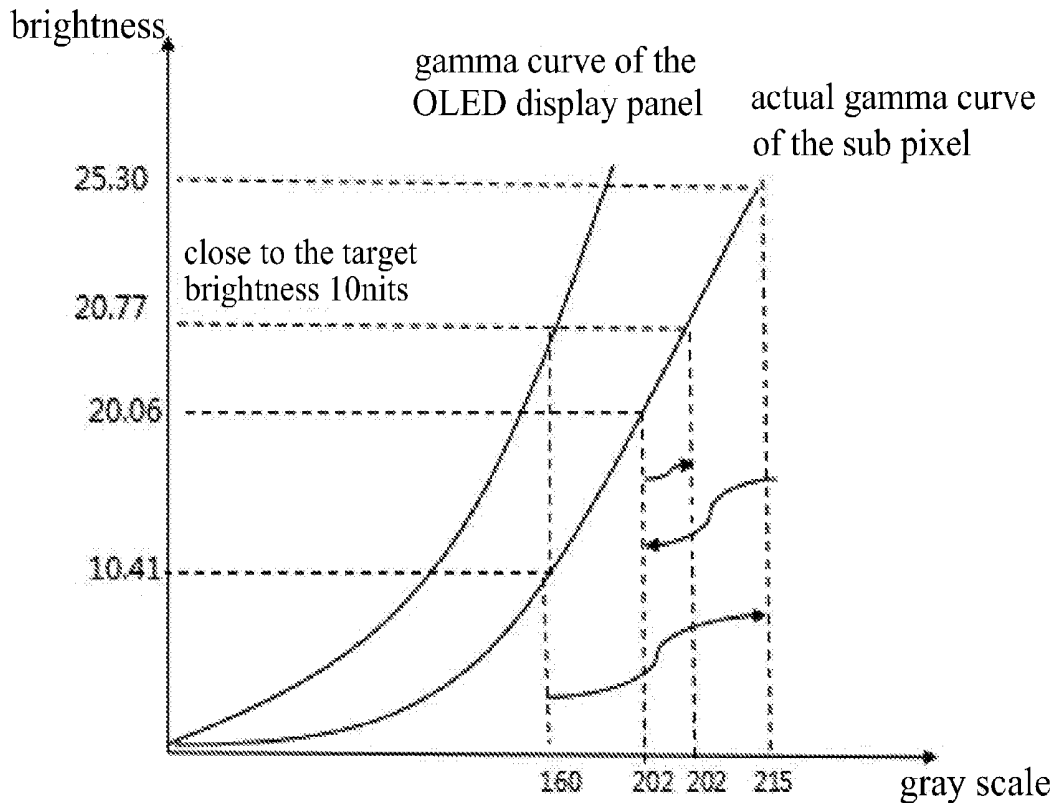
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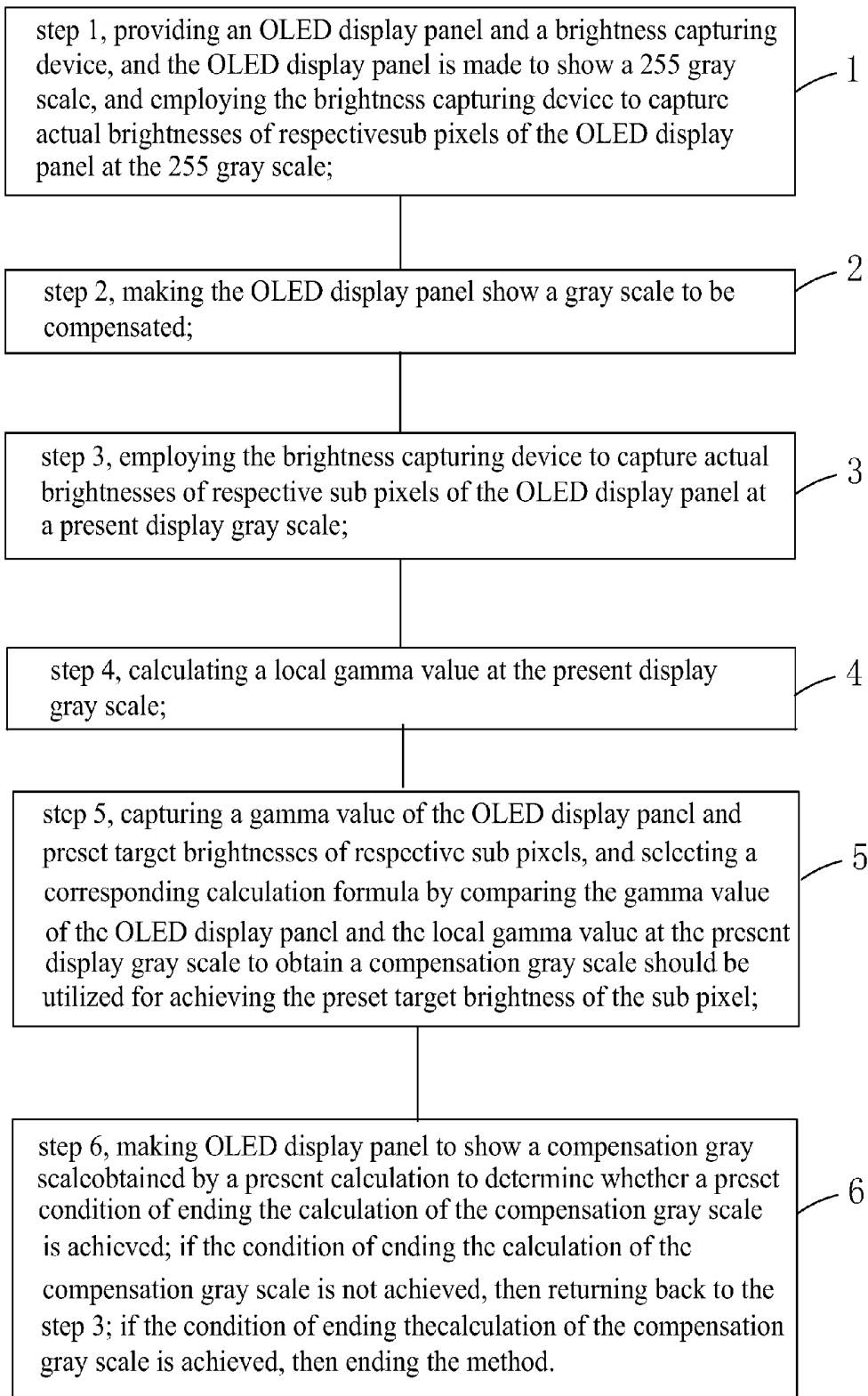


Fig. 1

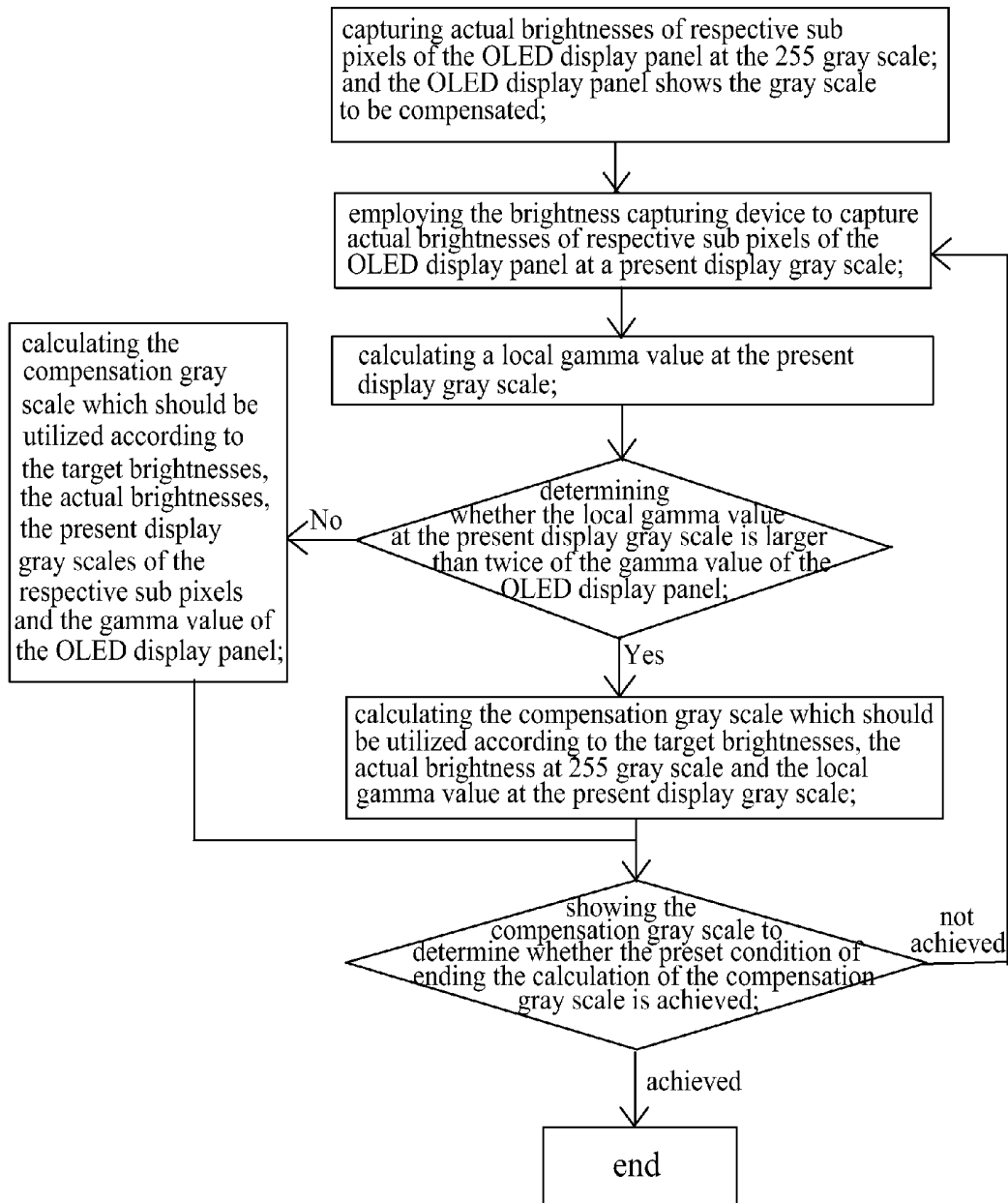


Fig. 2

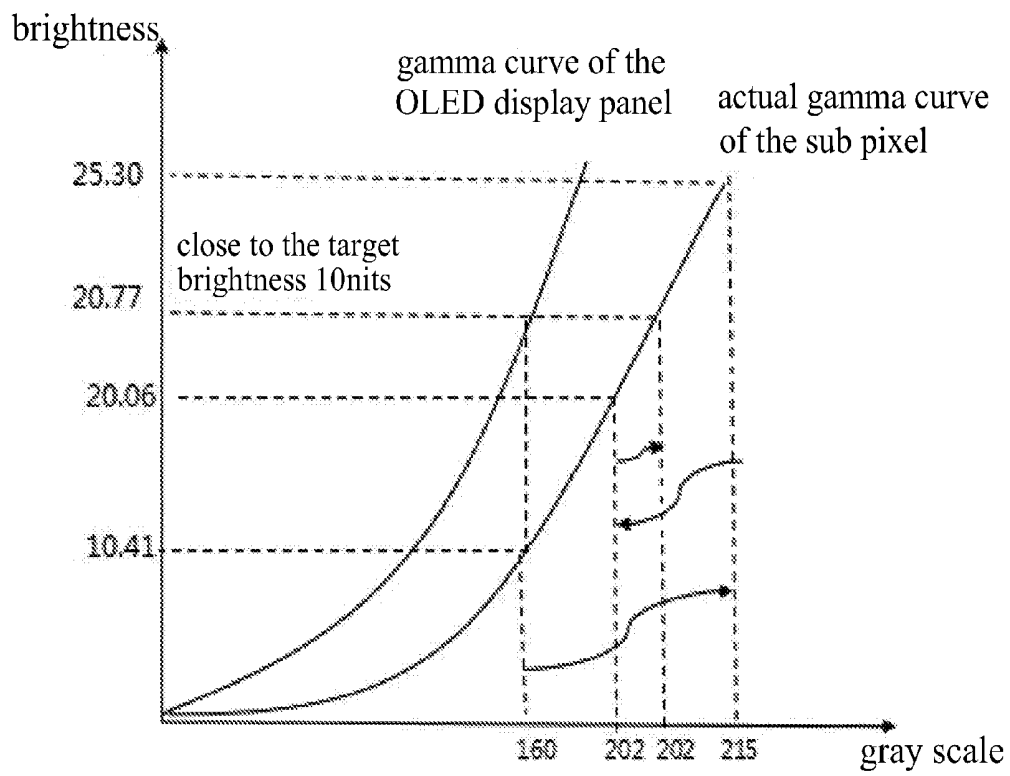


Fig. 3

## METHOD OF ELIMINATING OLED DISPLAY PANEL MURA

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a display technology field, and more particularly to a method of eliminating OLED display panel Mura.

### BACKGROUND OF THE INVENTION

**[0002]** The flat panel display elements possess many merits of thin frame, power saving, no radiation, etc. and have been widely used. The present flat panel display elements at present mainly comprise the Liquid Crystal Display (LCD) and the Organic Light Emitting Display (OLED).

**[0003]** An OLED possesses many outstanding properties of self-illumination, no requirement of backlight, high contrast, ultra-thin, wide view angle, fast response, applicability of flexible panel, wide range of working temperature, simpler structure and process. The OLED is considered as next generation flat panel display technology.

**[0004]** An OLED display generally comprises a substrate, an anode located on the substrate, an organic emitting layer located on the anodes, an electron transport layer located on the organic emitting layer, and a cathode located on the electron transport layer. As working, the Hole and the Electron from the cathode are injected to the organic emitting layer, these electrons and the holes are combined to generate excited electron-hole pairs, and the excited electron-hole pairs are converted from the excited state to the ground state for achieving illumination.

**[0005]** In the present production procedure of the flat panel display, the Mura (uneven brightness) often happens due to the reasons, such as the production processes, and a bright spot or a dark spot appears to lead to the display quality descend of the panel. Demura is a technology of eliminating the display Mura and making the image brightness uniform. The basic principle of the Demura technology is: making the panel show the gray scale image, and using the Charge Coupled Device (CCD) to capture the screen to capture the brightnesses of the respective pixel dots in the panel, and then adjusting the gray scale values or voltages of the pixel dots of the Mura area to make the over dark area become bright and to make the over bright area become dark to achieve the uniform display result.

**[0006]** As applying Demura technology in the practical production, not only good display result is requested but also the time needs to be short, which requires great and practical Demura algorithm. The Demura algorithm used in prior art is to estimate the gray scale value after correction according to the Gamma value and the target brightness. As the method of eliminating Mura of liquid crystal display disclosed in the patent CN201310695713.X, which the specific steps are: first capturing the actual brightness values of the respective sub pixels, and correcting the actual brightness values of the respective sub pixels according to the brightness correction coefficients, and then, calculating and obtaining the gray scale values after correction corresponding to all the sub pixels of the inputted image according to the brightness values and gamma values of the respective sub pixels, and the specific calculation formulas is  $X1=L1/Y$ , wherein L1 is the brightness value after correction, and X1 is the gray scale value after correction, and Y represents the Gamma index

**[0007]** In the OLED display panel, the difference of the gamma curve of the respective pixel dots, and particularly in the Mura area is larger. The expected compensation result cannot be realized with single calculation according to the unified gamma value or gamma curve. Therefore, the present Demura algorithm is not suitable for the OLED display panel.

### SUMMARY OF THE INVENTION

**[0008]** An objective of the present invention is to provide a method of eliminating OLED display panel Mura, which can rapidly and effectively eliminate the OLED display panel Mura to ensure the brightness uniformity of the OLED display panel and to raise the display quality of the OLED display panel.

**[0009]** For realizing the aforesaid objective, the present invention provides a method of compensating AMOLED power supply voltage drop, comprising steps of:

**[0010]** step 1, providing an OLED display panel and a brightness capturing device, and the OLED display panel is made to show a 255 gray scale, and employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at the 255 gray scale;

**[0011]** step 2, making the OLED display panel show a gray scale to be compensated;

**[0012]** step 3, employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at a present display gray scale;

**[0013]** step 4, calculating a local gamma value at the present display gray scale, and a calculation formula is:

$$Gamma_i = \frac{\log\left(\frac{L_i}{L_{255}}\right)}{\log\left(\frac{Gray_i}{255}\right)}$$

**[0014]** wherein i is an integer larger than or equal to 0, and i+1 is a number of a present iterative computation, and Gamma<sub>i</sub> is the local gamma value at the present display gray scale, and L<sub>i</sub> is the actual brightness of the sub pixel at the present display gray scale, and L<sub>255</sub> is the actual brightness of the sub pixel at the 255 gray scale, and the Gray<sub>i</sub> is the present display gray scale;

**[0015]** step 5, capturing a gamma value of the OLED display panel and preset target brightnesses of respective sub pixels, and selecting a corresponding calculation formula by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to obtain a compensation gray scale should be utilized for achieving the preset target brightness of the sub pixel, and a specific calculation formula and an application condition are:

**[0016]** if the local gamma value at the present display gray scale is larger than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula (1);

$$Gray_{i+1} = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{Gamma_i}} \times 255; \quad (1)$$

[0017] wherein  $L_{goal}$  is a target brightness of the sub pixel, and  $Gray_{i+1}$  is the compensation gray scale;

[0018] if the local gamma value at the present display gray scale is smaller than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula (2);

$$Gray_{i+1} = \left( \frac{L_{goal}}{L_i} \right)^{\frac{1}{\gamma}} \times Gray_i; \quad (2)$$

[0019] wherein  $\gamma$  is the gamma value of the OLED display panel;

[0020] step 6, making OLED display panel to show a compensation gray scale obtained by a present calculation to determine whether a preset condition of ending the calculation of the compensation gray scale is achieved;

[0021] if the condition of ending the calculation of the compensation gray scale is not achieved, then returning back to the step 3;

[0022] if the condition of ending the calculation of the compensation gray scale is achieved, then ending the method.

[0023] The brightness capturing device is a brightness meter.

[0024] The brightness capturing device is a CCD.

[0025] In the step 3, a picture of a display image of the OLED display panel at the present display gray scale with the CCD to obtain actual brightnesses of the respective sub pixels of the OLED display panel at the present gray scale.

[0026] In the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset allowable deviation brightness.

[0027] In the step 6, the condition of ending the calculation of the compensation gray scale is: the number of the present iterative computation reaches a preset number of a maximum iterative computation.

[0028] The preset number of the maximum iterative computation is three.

[0029] In the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset error brightness or a number of the present iterative computation reaches a preset number of a maximum iterative computation.

[0030] In the step 5, the preset target brightnesses of the respective sub pixels are captured with a corresponding gamma curve of the gamma value of the OLED display panel.

[0031] The present invention further provides a method of eliminating OLED display panel Mura, comprising steps of:

[0032] step 1, providing an OLED display panel and a brightness capturing device, and the OLED display panel is made to show a 255 gray scale, and employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at the 255 gray scale;

[0033] step 2, making the OLED display panel show a gray scale to be compensated;

[0034] step 3, employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at a present display gray scale;

[0035] step 4, calculating a local gamma value at the present display gray scale, and a calculation formula is:

$$Gamma_i = \frac{\log\left(\frac{L_i}{L_{255}}\right)}{\log\left(\frac{Gray_i}{255}\right)}$$

[0036] wherein  $i$  is an integer larger than or equal to 0, and  $i+1$  is a number of a present iterative computation, and  $Gamma_i$  is the local gamma value at the present display gray scale, and  $L_i$  is the actual brightness of the sub pixel at the present display gray scale, and  $L_{255}$  is the actual brightness of the sub pixel at the 255 gray scale, and the  $Gray_i$  is the present display gray scale;

[0037] step 5, capturing a gamma value of the OLED display panel and preset target brightnesses of respective sub pixels, and selecting a corresponding calculation formula by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to obtain a compensation gray scale should be utilized for achieving the preset target brightness of the sub pixel, and a specific calculation formula and an application condition are:

[0038] if the local gamma value at the present display gray scale is larger than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$Gray_{i+1} = \left( \frac{L_{goal}}{L_{255}} \right)^{\frac{1}{Gamma_i}} \times 255;$$

[0039] wherein  $L_{goal}$  is a target brightness of the sub pixel, and  $Gray_{i+1}$  is the compensation gray scale;

[0040] if the local gamma value at the present display gray scale is smaller than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$Gray_{i+1} = \left( \frac{L_{goal}}{L_i} \right)^{\frac{1}{\gamma}} \times Gray_i;$$

[0041] wherein  $\gamma$  is the gamma value of the OLED display panel;

[0042] step 6, making OLED display panel to show a compensation gray scale obtained by a present calculation to determine whether a preset condition of ending the calculation of the compensation gray scale is achieved;

[0043] if the condition of ending the calculation of the compensation gray scale is not achieved, then returning back to the step 3;

[0044] if the condition of ending the calculation of the compensation gray scale is achieved, then ending the method;

[0045] wherein the brightness capturing device is a CCD;

[0046] wherein in the step 5, the preset target brightnesses of the respective sub pixels are captured with a corresponding gamma curve of the gamma value of the OLED display panel.

**[0047]** The benefits of the present invention are: the present invention provides a method of eliminating OLED display panel Mura. First, a corresponding calculation formula is selected by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale, and the compensation gray scale which should be utilized is calculated according to the target brightnesses, the actual brightnesses, the present display gray scales of the respective sub pixels and the gamma value of the OLED display panel, or the compensation gray scale which should be utilized is calculated according to the target brightnesses, the actual brightness at 255 gray scale and the local gamma value at the present display gray scale, and then the OLED display panel is made to show the present compensation gray scale captured with the present calculation to determine whether the preset condition of ending the calculation of the compensation gray scale is achieved, and if the preset condition of ending the calculation of the compensation gray scale is not achieved, the actual brightness of the sub pixel at the compensation gray scale is captured to calculate again to capture the local gamma value at the present display gray scale and to compare and select the corresponding calculation formula for obtaining the compensation gray scale which should be utilized next time, and the iterative computation does not stop until the preset condition of ending the calculation of the compensation gray scale is achieved. In comparison with prior art, the present invention can make the brightness of the sub pixel closer to the target brightness of the sub pixel with the compensation gray scale obtained by the multiple times of the iterative computation, which can rapidly and effectively eliminate the OLED display panel Mura to ensure the brightness uniformity of the OLED display panel and to raise the display quality of the OLED display panel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0048]** In order to better understand the characteristics and technical aspect of the invention, please refer to the following detailed description of the present invention is concerned with the diagrams, however, provide reference to the accompanying drawings and description only and is not intended to be limiting of the invention.

**[0049]** In drawings,

**[0050]** FIG. 1 is a flowchart of a method of eliminating OLED display panel Mura according to the present invention;

**[0051]** FIG. 2 is an operational logic diagram of a method of eliminating OLED display panel Mura according to the present invention;

**[0052]** FIG. 3 is a diagram that the obtained compensation brightness gets close to the target brightness with the iterative computation according to the method of eliminating OLED display panel Mura according to the present invention.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

**[0053]** For better explaining the technical solution and the effect of the present invention, the present invention will be further described in detail with the accompanying drawings and the specific embodiments.

**[0054]** Please refer to FIG. 1 in conjunction with FIG. 2. The present invention provides a method of eliminating OLED display panel Mura, comprising steps of:

**[0055]** step 1, providing an OLED display panel and a brightness capturing device, and the OLED display panel is made to show a 255 gray scale, and employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at the 255 gray scale;

**[0056]** Specifically, the brightness capturing device can be a brightness meter or a CCD.

**[0057]** step 2, making the OLED display panel show a gray scale to be compensated.

**[0058]** step 3, employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at a present display gray scale.

**[0059]** Specifically, the CCD is illustrated, in the step 3, a picture of a display image of the OLED display panel at the present gray scale with the CCD to obtain actual brightnesses of the respective sub pixels of the OLED display panel at the present gray scale, and only one captured picture is required for capturing the actual brightnesses of the respective sub pixels each time. The operation can be simplified and thus the operation rate of compensating gray scale can speed up.

**[0060]** step 4, calculating a local gamma value at the present display gray scale, and a calculation formula is:

$$Gamma_i = \frac{\log\left(\frac{L_i}{L_{255}}\right)}{\log\left(\frac{Gray_i}{255}\right)}$$

**[0061]** wherein  $i$  is an integer larger than or equal to 0, and  $i+1$  is a number of a present iterative computation, and  $Gamma_i$  is the local gamma value at the present display gray scale, and  $L_i$  is the actual brightness of the sub pixel at the present display gray scale, and  $L_{255}$  is the actual brightness of the sub pixel at the 255 gray scale, and the  $Gray_i$  is the present display gray scale;

**[0062]** step 5, capturing a gamma value of the OLED display panel and preset target brightnesses of respective sub pixels, and selecting a corresponding calculation formula by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to obtain a compensation gray scale should be utilized for achieving the preset target brightness of the sub pixel, and a specific calculation formula and an application condition are:

**[0063]** if the local gamma value at the present display gray scale is larger than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula (1);

$$Gray_{i+1} = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{Gamma_i}} \times 255; \quad (1)$$

**[0064]** wherein  $L_{goal}$  is a target brightness of the sub pixel, and  $Gray_{i+1}$  is the compensation gray scale;

**[0065]** if the local gamma value at the present display gray scale is smaller than twice of the gamma value of the OLED

display panel, then the compensation gray scale should be utilized is calculated according to the following formula (2);

$$Gray_{i+1} = \left( \frac{L_{goal}}{L_i} \right)^{\frac{1}{\gamma}} \times Gray_i; \quad (2)$$

**[0066]** wherein  $\gamma$  is the gamma value of the OLED display panel.

**[0067]** Particularly, the formula (1) or formula (2) is selected by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to calculate the compensation gray scale which should be utilized. As the difference of the local gamma value at the present display gray scale and the gamma value of the OLED display panel is smaller, the formula (2) is selected to calculate the compensation gray scale which should be utilized for enhancing the compensation result to prevent that the fluctuation of the gamma value of the sub pixel influences the compensation result, and as difference of the local gamma value at the present display gray scale and the gamma value of the OLED display panel is larger, the local gamma value at the present display gray scale obtained with the calculation of the iterative computation in real time is utilized to calculate the compensation gray scale which should be utilized to avoid that the difference of the local gamma value at the present display gray scale and the gamma value of the OLED display panel becomes too large (larger than twice of the gamma value of the OLED display panel) and results in the divergence of the actual brightness of the sub pixel in the iterative process and the situation of getting away from the target brightness farer and farer. With the combination usage of the two calculation methods, it allows that as the gamma value of the sub pixel fluctuates at various gray scales, it still can prevent that the vibration appears to the actual brightness of the sub pixel in the compensation process.

**[0068]** Specifically, in the first iterative computation,  $i=0$ , and the calculation formula corresponding to the local gamma value is:

$$Gamma_0 = \frac{\log\left(\frac{L_0}{L_{255}}\right)}{\log\left(\frac{Gray_0}{255}\right)},$$

and the calculation formula of compensating gray scale is:

$$Gray_1 = \left( \frac{L_{goal}}{L_{255}} \right)^{\frac{1}{Gamma_0}} \times 255 \text{ or } Gray_1 = \left( \frac{L_{goal}}{L_0} \right)^{\frac{1}{\gamma}} \times Gray_0,$$

wherein  $Gray_0$  is the gray scale to be compensated, and  $L_0$  is the actual brightness of the sub pixel at the gray scale to be compensated; in the second iterative computation,  $i=1$ , and the calculation formula corresponding to the local gamma value is:

$$Gamma_1 = \frac{\log\left(\frac{L_1}{L_{255}}\right)}{\log\left(\frac{Gray_1}{255}\right)},$$

and the calculation formula of compensating gray scale is:

$$Gray_2 = \left( \frac{L_{goal}}{L_{255}} \right)^{\frac{1}{Gamma_1}} \times 255 \text{ or } Gray_2 = \left( \frac{L_{goal}}{L_1} \right)^{\frac{1}{\gamma}} \times Gray_1;$$

in the third iterative computation,  $i=2$ , and the calculation formula corresponding to the local gamma value is:

$$Gamma_2 = \frac{\log\left(\frac{L_2}{L_{255}}\right)}{\log\left(\frac{Gray_2}{255}\right)},$$

and the calculation formula of compensating gray scale is:

$$Gray_3 = \left( \frac{L_{goal}}{L_{255}} \right)^{\frac{1}{Gamma_2}} \times 255 \text{ or } Gray_3 = \left( \frac{L_{goal}}{L_2} \right)^{\frac{1}{\gamma}} \times Gray_2;$$

and so on until the calculation of the compensation gray scale is ended, i.e. the result of the previous calculation is employed to be the parameter of the next calculation to be inputted into the next calculation to form the iterative computation.

**[0069]** step 6, making OLED display panel to show a compensation gray scale obtained by a present calculation to determine whether a preset condition of ending the calculation of the compensation gray scale is achieved;

**[0070]** if the condition of ending the calculation of the compensation gray scale is not achieved, then returning back to the step 2;

**[0071]** if the condition of ending the calculation of the compensation gray scale is achieved, then ending the method.

**[0072]** Specifically, in the step 6, the condition of ending the calculation of the compensation gray scale can be: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset allowable deviation brightness, i.e. the OLED display panel showing the present gray scale has already reached the expected display result.

**[0073]** In the step 6, the condition of ending the calculation of the compensation gray scale also can be: the number of the present iterative computation reaches a preset number of a maximum iterative computation;

**[0074]** In the step 6, the condition of ending the calculation of the compensation gray scale also can be: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset error brightness or a number of the present iterative computation reaches a preset number of a maximum iterative computation, and either one condition is reached, the calculation of the compensation gray scale can be ended.

**[0075]** Preferably, the preset number of the maximum iterative computation is three.

**[0076]** Here, more detail description is conducted to the present invention with one specific iterative computation process. As shown in FIG. 3, supposing that the target brightness  $L_{goal}$  of some sub pixel in the OLED display panel is 20 nits at 160 gray scale, and the actual brightness captured by the brightness capturing device is 10.41 nits, and the actual brightness of the 255 gray scale is 55.76 nits, and the gamma value of the OLED display panel is 2.2, wherein the target brightness is captured with a corresponding gamma curve of the gamma value 2.2 of the OLED display panel, and the actual gamma value of the sub pixel is different from the gamma value of the OLED display panel, and supposing that the actual gamma value at 128 gray scale is 3.0, and the actual gamma value at the 224 gray scale is 4.8, and the actual gamma value between the 128 gray scale and the 224 gray scale is similar with the linear change (the actual gamma value of the sub pixel is not required in the specific calculation, it is merely for the description of contrast), and then the corresponding gamma curves of the two do not coincide, either, and one compensation gray scale is obtained with the first iterative computation by utilizing the calculation formula of the present invention according to the aforesaid known conditions:

$$\text{Gamma}_0 = \frac{\log\left(\frac{L_0}{L_{255}}\right)}{\log\left(\frac{\text{Gray}_0}{255}\right)} = \frac{\log\left(\frac{10.41}{55.74}\right)}{\log\left(\frac{160}{255}\right)} = 3.60 < 2 \times 2.2$$

**[0077]** then the formula (2) is selected to calculate the compensation gray scale should be utilized:

$$\text{Gray}_1 = \left(\frac{L_{goal}}{L_i}\right)^{\frac{1}{\gamma}} \times \text{Gray}_0 = \left(\frac{20}{10.41}\right)^{\frac{1}{2.2}} \times 160 \approx 215;$$

**[0078]** It can be obtained according to the actual gamma value of the sub pixel, the actual brightness of the sub pixel at 215 gray scale is 25.30 nits (the data is on the actual gamma curve of the sub pixel);

**[0079]** Specifically, the actual gamma value is used to obtain the actual brightness of the sub pixel for explaining the effect of the present invention here, but in practical operation, the OLED display panel is made to show the compensation gray scale 215 obtained by a present calculation because the actual gamma value of the sub pixel is unknown, and the actual brightness of the sub pixel at the 215 gray scale captured by the brightness capturing device, such as the CCD camera, is 25.30 nits.

**[0080]** Then, one more compensation gray scale is obtained with the second iterative computation:

$$\text{Gamma}_1 = \frac{\log\left(\frac{L_1}{L_{255}}\right)}{\log\left(\frac{\text{Gray}_1}{255}\right)} = \frac{\log\left(\frac{25.30}{55.74}\right)}{\log\left(\frac{215}{255}\right)} = 4.63 > 2 \times 2.2;$$

**[0081]** then the formula (1) is selected to calculate the compensation gray scale should be utilized:

$$\text{Gray}_2 = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{\text{Gamma}_1}} \times 255 = \left(\frac{20}{55.76}\right)^{\frac{1}{4.63}} \times 255 \approx 204$$

**[0082]** The OLED display panel is made to show the compensation gray scale 204 obtained by the present calculation, and the actual brightness of the sub pixel captured by the brightness capturing device at the gray scale is 20.77 nits, i.e. the actual brightness of the sub pixel at gray scale 204 on the actual gamma curve of the sub pixel is 20.77 nits; in contrast of the first iterative computation, the compensation gray scale obtained with the second iterative computation makes the actual brightness corresponded with the sub pixel gets closer to the target brightness.

**[0083]** Thereafter, another compensation gray scale is obtained with the third iterative computation:

$$\text{Gamma}_2 = \frac{\log\left(\frac{L_2}{L_{255}}\right)}{\log\left(\frac{\text{Gray}_2}{255}\right)} = \frac{\log\left(\frac{20.77}{55.74}\right)}{\log\left(\frac{204}{255}\right)} = 4.43 > 4.4;$$

**[0084]** then the formula (1) is selected to calculate the compensation gray scale should be utilized:

$$\text{Gray}_3 = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{\text{Gamma}_2}} \times 255 = \left(\frac{20}{55.76}\right)^{\frac{1}{4.43}} \times 255 \approx 202;$$

**[0085]** The OLED display panel is made to show the compensation gray scale 202 obtained by the present calculation, and the actual brightness of the sub pixel captured by the brightness capturing device at the gray scale is 20.06 nits, i.e. the actual brightness of the sub pixel at gray scale 202 on the actual gamma curve of the sub pixel is 20.06 nits; in contrast of the second iterative computation, the compensation gray scale obtained with the third iterative computation makes the actual brightness corresponded with the sub pixel gets closer to the target brightness.

**[0086]** As shown in FIG. 3, after each iterative computation, the brightness of the sub pixel will get closer to the target brightness and thus to achieve the uniform display result. Accordingly, after the iterative computations of multiple times, the actual brightness of the sub pixel can get closer and closer to the target brightness to effectively overcome the issue of poor compensation result due to the actual gamma value abnormality in the Mura area in prior art, which can effectively eliminate the OLED display panel Mura to ensure the brightness uniformity of the OLED display panel and to raise the display quality of the OLED display panel.

**[0087]** In conclusion, the present invention provides a method of eliminating OLED display panel Mura. First, a corresponding calculation formula is selected by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale, and the compensation gray scale which should be utilized is calculated according to the target brightnesses, the actual brightnesses, the present display gray scales of the respective sub pixels and the gamma value of the OLED display panel, or the compensation gray scale which should be utilized is

calculated according to the target brightnesses, the actual brightness at 255 gray scale and the local gamma value at the present display gray scale, and then the OLED display panel is made to show the present compensation gray scale captured with the present calculation to determine whether the preset condition of ending the calculation of the compensation gray scale is achieved, and if the preset condition of ending the calculation of the compensation gray scale is not achieved, the actual brightness of the sub pixel at the compensation gray scale is captured to calculate again to capture the local gamma value at the present display gray scale and to compare and select the corresponding calculation formula for obtaining the compensation gray scale which should be utilized next time, and the iterative computation does not stop until the preset condition of ending the calculation of the compensation gray scale is achieved. In comparison with prior art, the present invention can make the brightness of the sub pixel closer than the target brightness with the compensation gray scale obtained by the multiple times of the iterative computation, which can rapidly and effectively eliminate the OLED display panel Mura to ensure the brightness uniformity of the OLED display panel and to raise the display quality of the OLED display panel.

**[0088]** Above are only specific embodiments of the present invention, the scope of the present invention is not limited to this, and to any persons who are skilled in the art, change or replacement which is easily derived should be covered by the protected scope of the invention. Thus, the protected scope of the invention should go by the subject claims.

What is claimed is:

1. A method of eliminating OLED display panel Mura, comprising steps of:

- step 1, providing an OLED display panel and a brightness capturing device, and the OLED display panel is made to show a 255 gray scale, and employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at the 255 gray scale;
- step 2, making the OLED display panel show a gray scale to be compensated;
- step 3, employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at a present display gray scale;
- step 4, calculating a local gamma value at the present display gray scale, and a calculation formula is:

$$\text{Gamma}_i = \frac{\log\left(\frac{L_i}{L_{255}}\right)}{\log\left(\frac{\text{Gray}_i}{255}\right)}$$

wherein  $i$  is an integer larger than or equal to 0, and  $i+1$  is a number of a present iterative computation, and  $\text{Gamma}_i$  is the local gamma value at the present display gray scale, and  $L_i$  is the actual brightness of the sub pixel at the present display gray scale, and  $L_{255}$  is the actual brightness of the sub pixel at the 255 gray scale, and the  $\text{Gray}_i$  is the present display gray scale;

step 5, capturing a gamma value of the OLED display panel and preset target brightnesses of respective sub pixels, and selecting a corresponding calculation for-

mula by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to obtain a compensation gray scale should be utilized for achieving the preset target brightness of the sub pixel, and a specific calculation formula and an application condition are:

if the local gamma value at the present display gray scale is larger than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$\text{Gray}_{i+1} = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{\text{Gamma}_i}} \times 255;$$

wherein  $L_{goal}$  is a target brightness of the sub pixel, and  $\text{Gray}_{i+1}$  is the compensation gray scale;

if the local gamma value at the present display gray scale is smaller than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$\text{Gray}_{i+1} = \left(\frac{L_{goal}}{L_i}\right)^{\frac{1}{\gamma}} \times \text{Gray}_i;$$

wherein  $\gamma$  is the gamma value of the OLED display panel;

step 6, making OLED display panel to show a compensation gray scale obtained by a present calculation to determine whether a preset condition of ending the calculation of the compensation gray scale is achieved; if the condition of ending the calculation of the compensation gray scale is not achieved, then returning back to the step 3;

if the condition of ending the calculation of the compensation gray scale is achieved, then ending the method.

2. The method of eliminating OLED display panel Mura according to claim 1, wherein the brightness capturing device is a brightness meter.

3. The method of eliminating OLED display panel Mura according to claim 1, wherein the brightness capturing device is a CCD.

4. The method of eliminating OLED display panel Mura according to claim 3, wherein in the step 3, a picture of a display image of the OLED display panel at the present display gray scale with the CCD to obtain actual brightnesses of the respective sub pixels of the OLED display panel at the present gray scale.

5. The method of eliminating OLED display panel Mura according to claim 1, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset allowable deviation brightness.

6. The method of eliminating OLED display panel Mura according to claim 1, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: the number of the present iterative computation reaches a preset number of a maximum iterative computation.

7. The method of eliminating OLED display panel Mura according to claim 6, wherein the preset number of the maximum iterative computation is three.

8. The method of eliminating OLED display panel Mura according to claim 1, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset error brightness or a number of the present iterative computation reaches a preset number of a maximum iterative computation.

9. The method of eliminating OLED display panel Mura according to claim 1, wherein in the step 5, the preset target brightnesses of the respective sub pixels are captured with a corresponding gamma curve of the gamma value of the OLED display panel.

10. A method of eliminating OLED display panel Mura, comprising steps of:

- step 1, providing an OLED display panel and a brightness capturing device, and the OLED display panel is made to show a 255 gray scale, and employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at the 255 gray scale;
- step 2, making the OLED display panel show a gray scale to be compensated;
- step 3, employing the brightness capturing device to capture actual brightnesses of respective sub pixels of the OLED display panel at a present display gray scale;
- step 4, calculating a local gamma value at the present display gray scale, and a calculation formula is:

$$\text{Gamma}_i = \frac{\log\left(\frac{L_i}{L_{255}}\right)}{\log\left(\frac{\text{Gray}_i}{255}\right)}$$

wherein  $i$  is an integer larger than or equal to 0, and  $i+1$  is a number of a present iterative computation, and  $\text{Gamma}_i$  is the local gamma value at the present display gray scale, and  $L_i$  is the actual brightness of the sub pixel at the present display gray scale, and  $L_{255}$  is the actual brightness of the sub pixel at the 255 gray scale, and the  $\text{Gray}_i$  is the present display gray scale;

step 5, capturing a gamma value of the OLED display panel and preset target brightnesses of respective sub pixels, and selecting a corresponding calculation formula by comparing the gamma value of the OLED display panel and the local gamma value at the present display gray scale to obtain a compensation gray scale should be utilized for achieving the preset target brightness of the sub pixel, and a specific calculation formula and an application condition are:

if the local gamma value at the present display gray scale is larger than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$\text{Gray}_{i+1} = \left(\frac{L_{goal}}{L_{255}}\right)^{\frac{1}{\text{Gamma}_i}} \times 255;$$

wherein  $L_{goal}$  is a target brightness of the sub pixel, and  $\text{Gray}_{i+1}$  is the compensation gray scale;

if the local gamma value at the present display gray scale is smaller than twice of the gamma value of the OLED display panel, then the compensation gray scale should be utilized is calculated according to the following formula;

$$\text{Gray}_{i+1} = \left(\frac{L_{goal}}{L_i}\right)^{\frac{1}{\gamma}} \times \text{Gray}_i;$$

wherein  $\gamma$  is the gamma value of the OLED display panel; step 6, making OLED display panel to show a compensation gray scale obtained by a present calculation to determine whether a preset condition of ending the calculation of the compensation gray scale is achieved; if the condition of ending the calculation of the compensation gray scale is not achieved, then returning back to the step 3; if the condition of ending the calculation of the compensation gray scale is achieved, then ending the method; wherein the brightness capturing device is a CCD; wherein in the step 5, the preset target brightnesses of the respective sub pixels are captured with a corresponding gamma curve of the gamma value of the OLED display panel.

11. The method of eliminating OLED display panel Mura according to claim 10, wherein in the step 3, a picture of a display image of the OLED display panel at the present display gray scale with the CCD to obtain actual brightnesses of the respective sub pixels of the OLED display panel at the present gray scale.

12. The method of eliminating OLED display panel Mura according to claim 10, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset allowable deviation brightness.

13. The method of eliminating OLED display panel Mura according to claim 10, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: the number of the present iterative computation reaches a preset number of a maximum iterative computation.

14. The method of eliminating OLED display panel Mura according to claim 13, wherein the preset number of the maximum iterative computation is three.

15. The method of eliminating OLED display panel Mura according to claim 10, wherein in the step 6, the condition of ending the calculation of the compensation gray scale is: a difference value of the actual brightness and the target brightness of the sub pixel is smaller than a preset error brightness or a number of the present iterative computation reaches a preset number of a maximum iterative computation.

\* \* \* \* \*

专利名称(译)	消除OLED显示面板的方法		
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申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
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IPC分类号	G09G3/3208 G09G3/20		
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优先权	201610200089.5 2016-03-31 CN		
其他公开文献	US10121408		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

摘要(译)

本发明提供了一种消除OLED显示面板Mura的方法。首先，通过比较OLED显示面板的伽玛值和当前显示灰度的局部伽马值来选择相应的计算公式，并计算应该利用的补偿灰度，然后制作OLED显示面板显示当前计算所捕获的当前补偿灰度，以确定是否达到了结束补偿灰度计算的预设条件，如果未达到结束补偿灰度计算的预设条件，则迭代计算不会停止，直达到结束补偿灰度计算的预设条件，这可以快速有效地消除OLED显示面板Mura，以确保OLED显示面板的亮度均匀性。

