The method to reconstruct RGBW LED dimming value for ensuring linearity for brightness of LED lighting

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In this paper we reconstruct the non-linear characteristic of the forward current and the brightness of the RGBW LEDs to the linear characteristic. The forward current value is found to be matched with the same interval in brightness. And it is possible to find a corresponding PWM dimming value. This will provide a means to precisely control the color of the full-color illumination with a RGBW LEDs.

The configuration for measuring and reconstructing the brightness of RGBW LED lighting shows in Fig.1. In Fig.1, the Color control module has a function for combining and controlling the color of RGBW LEDs. The RGBW LED modulation module generates the PWM modulation signal corresponding to the RGBW LED current and voltage of each individual RGBW. The RGBW LED lighting module is driven by the PWM signal transmitted from the RGBW LED modulation module. The Measurement module measures the brightness of the LED luminaire. The Database(a) module stores the measured data with the PWM value. The Color reconstruction module reconstructs the PWM value corresponding to the brightness changing at the same interval. The Database(b) module stores the reconstructed brightness and the PWM value. By the above process, RGBW LEDs will have the linearity.

Correlation of the forward current and the brightness of the RGBW LED lighting is shown in Fig.2(a). In general, the brightness of the LED has non-linear characteristics in the forward current. Therefore, a formal PWM modulation method is not possible to overcome the non-linear characteristics. It is necessary to reconstruct a non-linear characteristics to a linear characteristics. In particular, the non-linear characteristics appears prominently in the A section and the E section. As shown in Fig.2(b), A non-linear characteristics can go close gradually in a linear characteristics. Figure 2(c) shows the correlation relationship to find the PWM value(current value) corresponding to the equal spacing of the brightness.

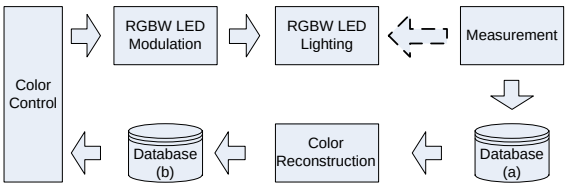

Fig.1 Brightness measurement of RGBW LED and Linear full-color configuration

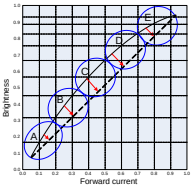

Fig.2(a) Real correlation between forward current and brightness of RGBW LED

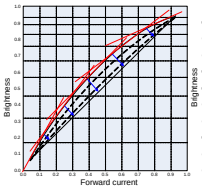

Fig.2(b) Ideal correlation between forward current and brightness of RGBW LED

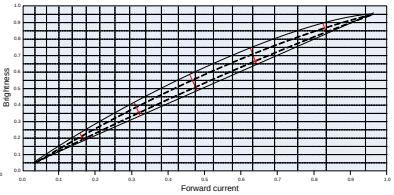

Fig.2(c) Reconstructive correlation between forward current and proportional brightness of RGBW LED

Through this study we have made it possible to control the accurate color by PWM modulation. This reduces the color of the distortion, and can find the accurate color for human emotions.

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