

外在環境光源於反射式顯示器色彩品質評估之研究

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摘要

隨著資訊時代的來臨，消費性電子產品不斷朝向可攜式化、輕薄短小化、省電、低功率輸出的方向前進。過去的穿透式顯示器(Transmissive type LCDs)由於擁有固定的背光，因此對色彩表現對環境光源較不敏感，但是在強光下(如太陽光)，其色彩飽和度會明顯下降，除此之外，此種顯示器也會因為要開背光而耗損較多的電能；為了解決穿透式顯示器的問題，反射式顯示器(Reflective type LCDs)利用環境光節省了背光的電能，也縮小了顯示器的體積和重量，但也因此對環境光源較為敏感，色彩表現會因為光源的不同而有所差異。

過去常用色座標(Chromaticity diagram)以及相關色溫(Correlated color temperature, CCT)來表示光源的差異，但是卻沒有一個指標性的標準來評估光源之於反射式顯示器的好壞。因此本論文以色彩學的觀點重新出發，將演色性(Color Rendering Index, CRI)的觀念帶進顯示器的領域，用以取代過去用以評估光源的指標。更進一步探討光源頻譜之於顯示器濾色片(Color filter)的匹配程度與色彩表現優劣的關係。最後，本文期望能利用演色性，找出對於反射式顯示器色彩表現最佳的頻譜之光源組合，尤其是目前當紅擁有高飽和度的LED(其窄頻的特性也相對容易與濾色片的匹配程度下降，因此造成了嚴重的色差)。

From Luminance to Illuminance: Color Rendering in Viewpoint of Reflective Display

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Abstract

As the popularization of multimedia, the market of liquid crystal display (LCD) for portable applications is increasing worldwide due to their remarkable merits of thin, light, and low power consumption. Color rendering performances of the reflective type displays are acutely affected by the spectral power distribution (SPD) of the ambient light, which exhibits huge variations under different environmental conditions. Unlike the conventional transmission-type LCD whose color performance is determined by the fixed backlighting “luminance”, color shift was resulted from the “illuminance” for a reflective type LCD.

In this thesis, the dependence of color performance on spectra of various lighting sources was discussed, especially for the light emitting diodes (LEDs). LED has the character of high color saturation, but the narrowband spectra can still induce high level of mismatch. In addition, the mismatch would lead to high color difference between two various lighting sources even with the same chromaticity diagram or correlated color temperature (CCT). In addition, the concept color rendering index (CRI) was used to evaluate the lighting sources of the reflective type LCDs.

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