Characterization of Color Vision by Spectroscopy and Nanotechnology: Application to Media Photonics

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Abstract

Color vision is a complex phenomenon in optics and photonics (O&P). Display and visualization devices are interfaces between digital information and human perception, whereby the information is transported by light. These interfaces should be optimised for the capabilities of human vision and visual perception. However, the devices used today also present us with a number of technological challenges. The aim is to use the capabilities of the human visual system to meet these challenges. The display technology in the focus of this research is Quantum Dot (QD)-enhanced Liquid Crystal Display (LCD). The LCD technology has been revitalized by the integration of QDs into the backlight. This unique application of quantum physics enables an astonishing increase in performance in terms of displayable color gamut and color saturation while improving display brightness and energy efficiency.

This thesis discusses and correlates two main topics, human color perception and QD-enhanced LCDs. The research focuses on the question of how the used QDs change the possibilities of color rendering in LCDs with focus on the visual perception of the spectrum produced by these nanoparticles. In order to answer this question, various topics have been set as a framework for the research work. Defined experimental tasks with different display devices as well as the characterization of these original systems were conducted. For this purpose, different optical measuring instruments and software applications were used. Within the scope of a user study, color matching experiments were conducted to develop a deeper understanding of the color vision of the individual observer, especially with regard to intra-individual and inter-individual variability. The collected data was summarized and evaluated to enable an analysis of the QD-enhanced LCD technology and its perspectives in the field of media photonics, as well as an assessment of the expected improvements for media-related applications and scientific research applications.

Publications

CONFERENCE PAPERS

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