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Optical Design and Modeling of Micro Light-Emitting Diodes for Display Applications

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Abstract : Recently, there has been a lot of interest in µ-LED technology because of its exceptional qualities, including auto emission, high visibility, low consumption of power, rapid response and longevity. Light-emitting diodes (LED) using III-nitride, such as lighting sources, visible light communication (VLC) devices, and high-power devices, are finding increasing use as miniaturization technology advances. The use of micro-LED displays in place of traditional display technologies like liquid crystal displays (LCDs) and organic light-emitting diodes (OLEDs) is one of the most prominent recent advances, which may even represent the next generation of displays. The development of fully integrated, multifunctional devices and the incorporation of extra capabilities into micro-LED displays, such as sensing, light detection, and solar cells, are the pillars of advanced technology. Due to the wide range of applications for micro-LED technology, the effectiveness and dependability of these devices in numerous harsh conditions are becoming increasingly important. Enough research has been conducted to overcome the under-effectiveness of micro-LED devices. In this paper, different Micro LED design structures are proposed in order to achieve optimized optical properties. In order to attain improved external quantum efficiency (EQE), devices' light extraction efficiency (LEE) has also been boosted.

Keywords : finite difference time domain, light out coupling efficiency, far field intensity, power density, quantum efficiency, flat panel displays
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