Optimization of optical design for developing an LED lens module

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Abstract

In this study, a procedure for optimization of an LED lens module design based on 3 LED light sources was divided into two phases. For preliminary optimization of the dimensions of the LED lens module in Stage I, an optical analysis with orthogonal arrays and TracePro (an optical design package) combined with analysis of variance was conducted to investigate relationships between the multiple optical quality characteristics (viewing angle and average illuminance) and dimension parameters and find the initial optimal parameter combination of the LED lens module. In Stage II, the initial optimal parameter combination determined in Stage I was employed to develop an orthogonal array L25(56) for optical simulation. The experimental data of the orthogonal array were used to train and test the back-propagation neural network to develop an optical quality predictor, which was integrated into the genetic algorithms and the particle swarm optimization in order to find the optimal parameter combination that conformed to optical quality. From the experimental results, the proposed optimization procedure contributes to a precise viewing angle to achieve the goal of optical quality and improved the average illuminance in development of the product. The procedure to optimize the optical design developed in this study can be applied to design all types of LED lens modules and improve the optical design and technology of the LED lens industry.