

Design and evaluation of structured freeform optics for

uniform LED illumination

A. Dwivedi¹, G. S. Khan², A. Sharma¹

¹Department of Physics, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016, INDIA ²Centre for Sensors, INstrumentation and Cyber-physical Systems Engineering (SeNSE), Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016, INDIA

gufranskhan@sense.iitd.ac.in

Abstract

The advancement in solid-state light sources in terms of optical efficiency, color performance, emitting surface area, and long life-time makes them an ideal light source for illumination application, provided an appropriate light collection and distribution optics is designed. The conventional approach for the design of primary optics might end up with a solution involving multiple surfaces. Whereas the structured-freeform surfaces like TIR collimation optics can be monolithic but severely affect the uniform irradiance at the target. We present a method for the design of a structured freeform optical surface.

The method is based on point by point ray mapping with point source approximation for collimated optics. Depending on the non-uniformity of the light output from primary optics, the surface is fragmented into different zones to redirect ray at the target plane resulting uniform intensity distribution. The designed surface is suitable for use as a secondary optics as well as it can be integrated on the primary optics. The suitability for extended source is also analyzed by ray tracing using Zemax optical design tools. Figure 1 shows the surface cross-section and three dimensional model of the designed structured -freeform surface.



Figure 1: (Left) 2D coordinates of the structured-freeform surface locus. (Right) A solid 3D model of the designed structured -freeform element for uniform irradiance