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Title:Light extraction by directional sources within optically dense media

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Abstract:Light extraction efficiency (LEE) from a light-emitting diode is commonly referenced against an isotropic radiator within a dense dielectric medium. However, this description is not necessarily accurate for photonic devices with directional source elements. We therefore derive exact solutions for the LEE of a directive radiating source next to a planar dielectric boundary, accounting for any Fresnel reflections at the interface. These results can be used to validate numerical simulations and to quantify the baseline LEE for different source models. Four variations are explored, including the isotropic radiator, parallel and perpendicular orientations of the Hertzian dipole, and Lambertian scattering. Due to index matching, Fresnel reflections are generally negligible for materials with large escape cones, but reduce LEE by 20 % or more when critical angle is below 25°; . © 2012 Optical Society of America.

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Main heading:Light emitting diodes

Controlled terms:Radiators

Uncontrolled terms:Critical angles - Dielectric boundary - Dielectric medium - Exact solution - Fresnel reflections - Hertzian dipole - Index matching - Isotropic radiators - Lambertian scattering - Light extraction - Light-extraction efficiency - Optically dense media - Perpendicular orientation - Radiating sources - Source elements - Source models

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