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Time: 2:30 ~ 2:45

Room : A020

Design of a Large-scale Fiber Optic Daylighting System Using Parabolic Trough and Linear Fresnel lens

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Daylighting is essential to improve indoor environments and to reduce electric lighting power consumption in the multi-floor office buildings. Traditional fiber-based daylighting systems were implemented only for small-scale. To distribute sunlight into the entire building, a large number of optical fibers are needed. We propose a daylighting system, which illuminates the interior of the multi-floor building. This study focuses on the uniform distribution of sunlight through optical fibers. To this end, two efficient approaches for the fiber-based daylighting system are presented. The first approach consists of a parabolic trough, and the second approach contains a linear Fresnel lens. Sunlight is captured through the concentrator and distributed through the optical fibers. At the capturing stage, collimated illumination is achieved through the collimating reflector and the collimating lens for the parabolic trough and the linear Fresnel lens, respectively. Since it is difficult to achieve high concentration, the trough compound parabolic concentrator is used to insert maximum light into the optical fibers for both approaches. To distribute daylight at the destination, a combination of lenses is used at the end side of the fiber bundle. Furthermore, we find that the hybrid system of combining sunlight and light emitting diode light achieves the required illumination levels at all times. Optical simulation tools were used to design and simulate the efficiency of the system. Simulation results have shown that the efficiency, which is estimated based on the average illuminance at the interior and illumination quality, of the system is better than that of traditional lighting systems.