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Daylight Factor Estimation Based on Data Sampling Using Distance Weighting

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Abstract

Many of the architectural design which incorporates natural light through the window design based on assumptions and empirical review that is not measurable. The entry of natural light into the space affects the level of energy efficiency to the use of artificial lighting. The large number of lumens from the light source that will fall on the surface of the room on every square feet (sq ft) would affect the value of illumination in the room. This study was conducted to determine the size of the lighting distribution of sunlight in the room. The method used is the direct measurement in the study area, collecting measurement data and map the numbers into a formula the density distribution of incoming light by using a mathematical equation to further simulate the density distribution of daylight that enters the room apartments and distribute the value of illumination with daylight factor. Simulation of light distribution daytime (daylight) used a simple method, which can result shows the distribution of light from the highest intensity to the lowest intensity. The results showed that the value of the existing distribution are useful to conduct a study follow-up study on the distribution of light in the room. Illumination distribution is expected to be useful for the design of spatial structure for architects.

Keywords: natural lighting, illumination distribution, daylight factor.

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1. Introduction

Natural lighting or daylighting is a source of light for the full spectrum of human vision adaptation. Consideration of the daylighting of a building can increase productivity in space. Something important, daylight provides tremendous psychological benefits to the residents of the building, it should be of prime concern because it can reduce the burden of artificial lighting requirements [1].

The extent and distribution of natural light in a room depends on three factors: Geometry of space, placement and orientation of windows and other openings and the characteristics of the internal surface. Design in form factor to accommodate daylight illumination requirements for activities in space and aims aesthetics of lighting design [2]. Natural light or daylight is a natural lighting coming from the whole ball bright sky, cloudy, wherein the heavens role as disseminator (diffuser) for the sunlight reaching it. Measurement values can be expressed with natural lighting Daylight Factor (DF). The amount of light can be measured by: [3]

- Using the value of luminance (flux, illumination), that is by assuming the light from the outdoors and calculates illuminance existing interior
- Using the relative magnitudes (daylight factor), that is by calculating the ratio of illuminance on the measuring point in space to the outdoor illuminance. DF value is fixed so if the bright light outside the room, then in the light as well, and vice versa, if the outside dim the inside too dim.

DF value, as the reference natural lighting condition, grouped by function space is as follows :

- Activity residence DF value by 1% to 2%,
- Activity office building DF value of 2% to 4%

Nomenclature	
DF	Daylight Factor
E_i	E (Ilumination) Indoor
E_o	E (Ilumination) Outdoor
SC	Sky Component
ERC	Externally Reflected Component
IRC	Internally Reflected Component

2. Daylight Factor

2.1. Natural lighting

Natural lighting is the lighting that comes from nature, which naturally exist in nature. For example: sunlight, moonlight, stars. Areas of natural lighting during the day is a comparison of the level of lighting at a point of a particular field in a space on a flat field illumination level in the open field, which is a measure of the performance of the skylight room.