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ANALYSIS OF LIGHTING IN LECTURE ROOM

Muradov A., *student of ICE-162 academic group;* **Klevak I.**, *student of ICE-163 academic group*
Scientific advisers: **Pysarenko A.**, *PhD, Assoc. Prof.;* **Vilinskaya L.**, *PhD, Assoc. Prof.*
Odessa State Academy of Civil Engineering and Architecture

One of the factors that are taken into account when optimizing the conditions of training and labor is the lighting of workplaces. The main tasks of the organization of the illumination of workplaces are: ensuring the visibility of objects, reducing stress and fatigue of the organs of sight. Lighting in the workplace and in the classroom should be uniform and stable, have the correct direction of the luminous flux, and exclude the blinding effect of light and the formation of sharp shadows. Long-term work (study) in conditions of insufficient light levels and non-uniform distribution of luminous flux can have a negative impact on the physical condition of a person. In this regard, the development and implementation of measures to optimize the lighting characteristics of workplaces on the basis of modern methods for monitoring, measuring and evaluating light sources and lighting parameters established by the relevant regulatory documents are relevant.

Lighting of workplaces in buildings is determined by regulatory documents [1, 2]. In particular, the requirements are imposed on the light characteristics of the background, light sources and illuminated space. However, the quality of the light field is estimated by integral parameters such as the discomfort coefficients UGR and M. At the same time, the importance of taking into account local characteristics, for example, characteristics describing the redistribution of the illumination of the working surface, is emphasized by many authors [3, 4].

The purpose of this work is a numerical analysis of the distribution of illumination in a typical educational room in order to develop additional recommendations for zones of comfortable visual perception.

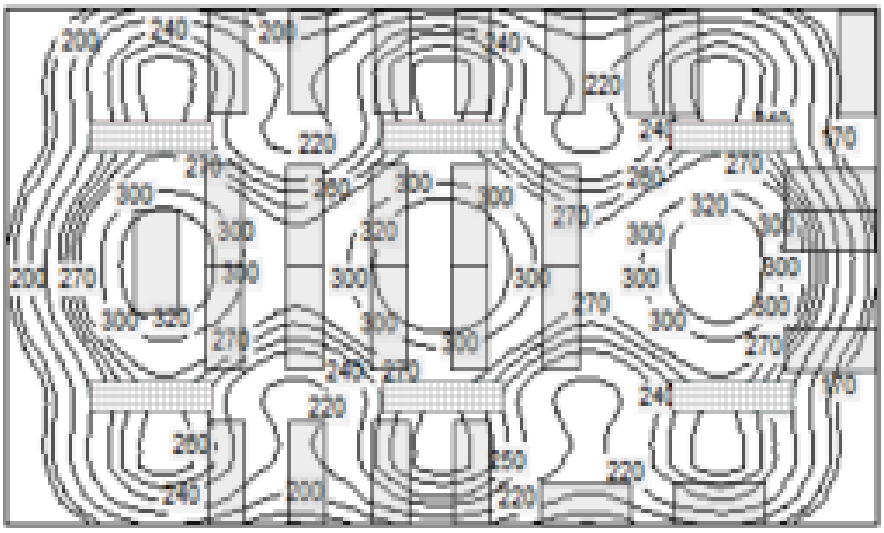

Figure 1. Isolux-lines for row M_2.

Numerical analysis was performed using the DIALux 4.13 program for a specific lecture room a.208. The following parameters were used in the calculations: luminaires (R2600/158 P8, luminous flux 5200 lm, power 54 W, mounting height 3.4 m), room parameters (dimensions 11.3×5.9×3.4 m; reflection coefficients: 70% (ceiling), 50% (walls), 20% (floor), height of the working plane 0.8 m). Numerical analysis was performed for the scene matrix $M_{ik} = \begin{pmatrix} 2 & 5.65 & 2.83 & 2 & 2.95 & 1.48 \\ 3 & 3.77 & 1.88 & 2 & 2.95 & 1.48 \\ 4 & 2.83 & 1.41 & 2 & 2.95 & 1.48 \end{pmatrix}$. The calculation results are shown in Figure 1 and Figure 2.

Figure 2 shows the change in the relative gradient of illumination along the axial line of the room (relative coordinate ε_X) for row M_1 (lamps C1-2 is indicated) and row M_3 (lamps C3-2 and C3-3 are indicated).

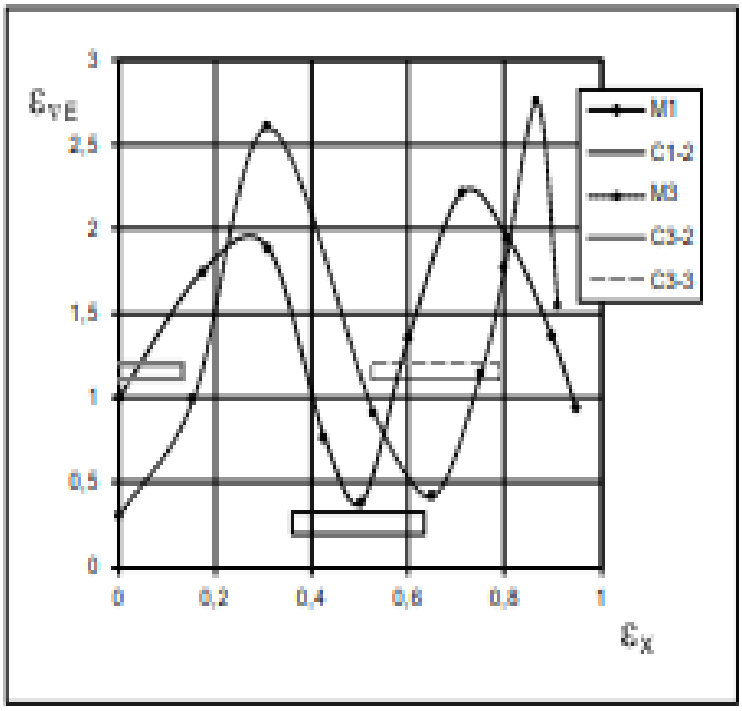

Figure 2. Spatial distribution of the light relative gradient.

The results of numerical experiments indicate the appearance of zones of comfortable visual perception CVP (Figure 1: areas with E ~ 300 lx; Figure 2: areas for which $\varepsilon_{\nabla E}$ = min), which merge into a single area for M_3. The transition $M_1 \Rightarrow M_3$ leads to an increase in the number of CVP zones. However, this process is accompanied by a nonlinear increase in the number of uncomfortable zones: $\varepsilon_{\nabla E} \rightarrow \max$.

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