بسم الله الرحمن الرحيم

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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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The Use of Fenestration Insulation to Optimize Thermal and Lighting Performance of the Building

A Thesis Presented in Partial Fulfillment of the Requirements for Master of Science Degree in Architectural Engineering

By

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Disclaimer

This thesis is submitted as partial fulfillment of M.Sc. degree in Architecture, Faculty of Engineering, Ain Shams University.

The work included in this thesis was carried out by the author and no part of it has been submitted for a degree or qualification at any other scientific entity. The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

Fenestrations are one of the energy indicators in any building and have been under research for the last few deacdes. They are the critical component in any space as they are responisble for natural lighting which can increase the indoor temperature of the space. Adjusting the balance between the thermal comfort and the lighting comfort is very important for the indoor envrionmental quality and for decreasing the energy consumption.

This research contributes to enhancing the thermal and the lighting performance in an office space for reducing the cooling loads while maintaining an acceptable level of daylighting without increasing lighting loads. It studied the main factors in any fenestration affecting its thermal and lighting performance, the main component of any fenestration and their thermal and lighting effect. It then reviewed the different types of glazing as glazing is the majority of the area of any fenestration. Glazing is categorized into conventional glazing, advanced glazing or other saying the insulated glazing units and the smart glazing.

After the literature review, the research came up with a better understanding of the effect of the glazing types used in fenestration in Cairo climate on thermal and lighting performance in each orientation.

This research is divided into four chapters, then it ends with a conclusion and recommendations. The first chapter mentioned the fenestration types and role in a building, its performance factors and its main components. The second and the third chapters studied the different types of glazing considered as the main element in any fenestration. A simulation was done in the fourth chapter using Design Builder for modelling and Energy Plus for thermal analysis. This simulation was conducted in Cairo in Egypt in an office building where glazing types were examined in each orientation. Annual cooling loads and lighting loads for each glazing was calculated to find the best type that optimize both the thermal and lighting performance in each orientation.

The results proved that advanced glazing technologies have a better perfromance than conventional one, and each orientation differs than the other for its best glazing types. North and East orientations have some close results while South and West orientations are also close in their results.

The research provided a recommendation for each orientation the best glazing types from conventional and advanced types, single, double and triple types. It also states the glazing types to stay away from in each orientation. Furthermore, the research stated the best types of frames and spacers to be used in fenestrations.

Keywords

Fenestration; Conventional Glazing ; Insulated Glazing Unit; Smart Glazing; Thermal Performance; Lighting Performance; Design Builder; Energy Plus.