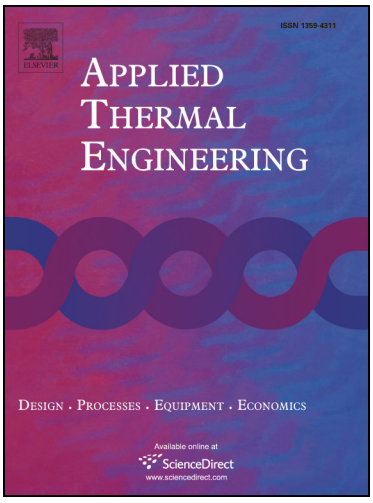

Numerical study on the thermal performance of lightweight temporary building integrated with phase change materials

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Numerical study on the thermal performance of lightweight temporary building integrated with phase change materials

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Abstract: The phase change materials (PCMs) integrated in building envelope structure can decrease the buildings' energy consumption and improve indoor thermal comfort quality. This paper numerically studied the application effect of PCMs as a passive alternative in lightweight building with high shape coefficient for temporary accommodations under Tianjin climate, and the impacts of some key design parameters, such as the location, thickness and orientation, on building's thermal behavior were explored when single orientation layout scheme was adopted. Besides, the multi-orientation layout schemes were put forward to achieve further optimization on indoor thermal comfort. The simulation results stated that the proper application of PCMs could obviously improve and promote indoor thermal comfort. In detail, the results indicated that PCM layer with a reasonable thickness, e.g. 5.0 mm in this paper, which was positioned to the interior surface was recommend when single orientation layout was applied. When incorporating the PCM layer in at least five orientations (S5), the proposed multi-orientation optimization schemes could ensure a comfortable indoor climate under the extreme closed condition without extra mechanical cooling measures. Thereby, the numerical results in this paper support and highlight the potential of using PCMs and multi-orientation optimization in lightweight temporary buildings.

Key Words: Numerical simulation, Thermal performance, Modular prefabricated PCM panel, Indoor thermal environment, Multi-orientation optimization

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