PERFORMANCE EVALUATION OF WATER-FLOW WINDOW GLAZING

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Abstract

The study is to evaluate the performance of an innovative water-flow glazed window system. It is a combination of both active and passive solar designs that can be utilized in most circumstances where hot water is in need. Not only that this glazing can absorb solar radiance and output energy in the form of hot water, it also helps to reduce the indoor heat gain and therefore air-conditioning (AC) system energy consumption. Considering the current climate change and fossil fuel depletion problems, there is great potential for wide application of this system.

In this study, two experiments have been completed. The first experiment related to tests on a scale-down water-flow glazing system through the use of a solar box. Afterwards, a full-size water-flow glazing system was tested by means of an environmental chamber with two identical test cells. Its performance under real building condition was compared with an adjacent room provided with normal glazing. The system thermal performances in terms of water heat gain in both experiments were analyzed. The influence to indoor visual environment was also examined in the full-size experiment.

Numerical models for the water-flow glazing system have been developed, and demonstrated to be of good quality by comparing the simulation results with the experimental data. The models were then used in year-
round performance prediction and system design optimization.

The overall building energy performance with water-flow glazed window was also analyzed via the ESP-r building energy simulation platform. By the combined use of ESP-r with the visual environment simulation software Radiance, the indoor luminance condition was simulated and the daylighting control was then applied to the numerical computation. The integrated contribution to the AC system and water heating system energy consumptions were calculated for three room types, including gym, office and canteen. The economical pay-back period of the water-flow glazed window was also estimated. From the simulation results, the water-flow glazed window can help reduce energy consumption in building considerably, and has great potential for building applications where there are substantial hot water demands.
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