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Evaluation of Thermal Comfort, IAQ and Energy Consumption in an Impinging Jet Ventilation (IJV) System with/without Ceiling Exhaust

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Abstract

One of the alternative ventilation systems for an occupied space is the impinging jet ventilation (IJV) system. Several design factors influence on the thermal comfort, the local thermal discomfort and the energy consumption of the system. Draught discomfort and vertical temperature gradient are the main reasons of local discomfort in IJV systems. In this study, the effect of return air vent location, existence and non-existence of ceiling exhaust, on the IJV system performance is investigated under three different supply air temperatures. Computational fluid dynamics (CFD) method is employed to evaluate each case. The results are validated against experimental measurements of previous research works. The results indicate that the location of return air vent has major impact on the thermal comfort and the energy consumption of the system and minor effect on the draught discomfort criteria. In addition, using ceiling exhaust reduces the system energy requirement. Based on the results, the energy consumption in cases with ceiling exhaust air vent may be reduced up to 30% depending on inlet air temperature. The vertical temperature gradient changes with the inlet air temperature and decreases using ceiling exhaust.

Keywords:

Impinging jet ventilation, Thermal comfort, Energy consumption, Indoor air quality, Computational fluid dynamic

1- Introduction