



Numerical Simulation of Thermal Environment in a Conditioned Room With Variable Air Supply

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ABSTRACT

The motive of this type research is to learning the appearances of indoor thermal background on the room of Indian Building. Experimental measurements were accompanied in assessment room by means of the Floor level Air Distribution (FLAD) schemes. This research examines supply air stream velocity and the temperature distribution in different locations such as Inlet, roof, floor, left wall, and right wall of the room building at the indoor environment. The experimental results of supply air flow velocity and temperature distribution display that the supply air flow velocity for a single supply vent and for first case is 0.20 m/s for the V1 option, and for second case is 0.25 m/s for the V2 option; and for third case is 0.30 m/s for the V3 option. The results also show that the indoor vertical temperature distribution is influenced by the distance between the measuring location and the supply vent position. When the measuring position is nearby to the source opening, the temperature distribution contour is inclined through the supply habituated airflow at inlet is 293k, Roof is 300k, Floor is 295k, and Left wall is 305k, Right wall is 305k. While the distance from the source opening is greater than 0.20 m, the temperature distribution comes to be somewhat dependable. The temperature distribution outline isn't inclined meaningfully via the return openingsite. The supply air stream rate and air flow velocity can variation the temperature distribution.

KEYWORDS :

Introduction

Floor level Air Distribution schemes also denoted in short form is FLAD, initially was presented in the 1950s. The main purpose of floor level Air Distribution schemes was to eliminate great warmth loads in the places. FLAD schemes were presented in an on-workplace building in West Germany in 1970s, to eliminate heat weight in the workplace. Freshly, FLAD schemes have significant recognition in Europe, Africa, Japan and America countries. Floor level Air Distribution schemes are slightly altered from conventional overhead ventilation schemes. A typical FLAD scheme has a floor level supply plenum and an elevated access floor to supply the habituated air over the supply outlets at the floor level. The habituated air is inserted upward into the occupied region. Room air formerly returns over return outlets on the ceiling.

Experiment Set-up

The field measurements are accompanied on the room of Indian Building in state Indian University of Science and Technology. An investigation compartment, the habituated air is delivered through one rectangular supply openings by the size of 40 cm in length \times 20 cm in width on the floor. The room air exhausts the space through the arrival openings on the ceiling, becoming the arrival air, and as a final point rises back to the air conditioners to be chilled air. The air is flowing in the room with a velocity V_1 for case-I, velocity V_2 for case-II, velocity V_3 for case-III as shown in Fig.2. The room area is 500 cm (length) \times 450 cm (width) \times 400 cm (height) and the area in front of Display stand is 120 cm (length) \times 170 cm (width) \times 400 cm (height). The measuring instruments consist of Hot-wire anemometer for measuring the supply velocity, DICKSON TK550 thermistor for measuring the outside temperature and the supply air temperature by the occurrence of 4 minutes break for each dual successive dimensions and T-type thermocouple for measuring the interior temperature by means of the rate of recurrence of 2 seconds break for each dual successive dimensions.

Velocity variation (20cm/s, 25cm/s, 30cm/s) at all limits in three cases in which single diffuser is 0.20 meter wide, situated middle position on the floor (2.5 meter out of floor length of 5 meter) for supply air opening. There are two exit in the roof is 0.10 meter wide, situated 0.20 meter as well left side wall as right side wall. These velocity contours are presented in the graph.1: for 20cm/s, graph.2: for 25cm/s, graph.3: for 30cm/s and graph.4: for analysis of comparison of three velocities at all limits.

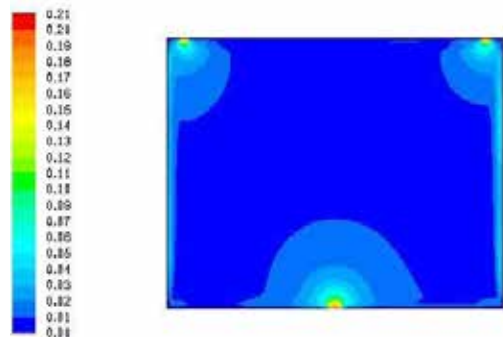


Fig.1 better velocity variation using single diffuser in floor level air distribution schemes

Results and Discussion

Whole supply air flow degree and the temperature outline in the room by FLAD schemes. The investigational results of the supply air velocity dimensions illustrate that the supply air velocity for a single supply opening is 0.20 m/s for the V_1 option, 0.25 m/s for the V_2 option and 0.30 m/s for the V_3 option. In this indoor environment, Fig. 2, illustrates that present is a stratified interface in the room. The positions which are close to the supply air openings, are distinct as the air supply areas, the sites far absent from the supply air openings are distinct as the allowed areas, and the sites just further down the yield air openings are distinct as the air yield areas. Once the supply air flow velocity rises, the temperature stratification reductions causing from the stronger supply thrust. If the dimension position is nearby to the supply vent, the temperature outline is inclined through the supply habituated airflow. The temperature outline isn't affected innocently at the site of air arrival area.

Fig. 2, shows the velocity variation using single diffuser in the conditioning room for three velocities like that 0.20m/s for first case, 0.25m/s second case and 0.30m/s for third case to find out the appropriate velocity for better energy saving aspect.

3.2. The temperature stratification against the different air flow velocity

Fig. 2, shows the temperature variation using single diffuser in the

conditioning room for three velocities to changes the temperature 20 °C at inlet also known as supply opening, 33°C at roof, 27°C at floor level, 38°C at left wall and 38°C at right wall for three cases at all limits. Also diagram shows the temperature outlines of the air supply zone and the permitted zone. When two temperature outlines spread the identical temperature, the altitude of the identical temperature is distinct as the throw elevation. The elevation is measured as the determined elevation that the supply habituated air can spread.

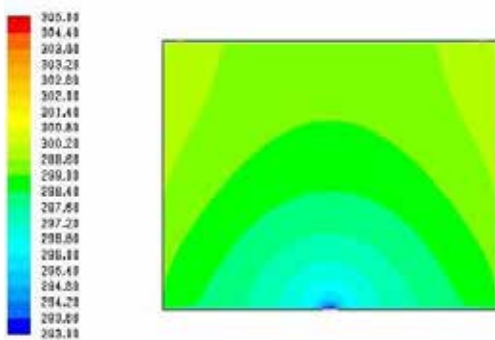


Fig.2 better temperature variation using single diffuser in floor level air distribution schemes.

4. Conclusions: our work on numerical simulation of thermal environment in a conditioned room with variable air supply we found that with 0.20m/s velocity of supplying air at the floor level more thermal ease is providing and also energy is saving were as comparing with other cases we found less thermal ease and also unbalanced conditions are obtaining.

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