

# Review On Conditioned Air Flow In A Space

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**Abstract:** Air conditioning need is increasing in Human comfort and commercial applications for controlled indoor environment. It is desired for the comfort to the occupants and to prevent the goods in a good thermal environment in order to maintain their condition without deterioration. Human performance and machine performance is also felt to be affected by the thermal environment around them. The air in the air conditioned space is supplied with the desired condition through the supply air locations. It establishes a comfortable condition in the conditioned space by proper distribution of this air. There are several methods and arrangements for the distribution of the air. The literature available show that many researchers and designers are continuously working towards finding the better ways, methods and arrangements of air flow and its distribution in the conditioned space so that the thermal environment for comfort could be achieved with the least consumption of energy involved in it. In this paper the outcomes of the work done by the researchers in air conditioning and air distribution as available in journals has been presented. It is found through the literature that researchers are working towards finding the flow and thermal patters in the conditioned space which helps the designers to optimise their design. Several works for several arrangements and design conditions simulate the flow parameters. The research methodology used in many of the works is found to be computer application based numerical simulation. The computational fluid dynamics (CFD) has been employed by many researchers in finding the solution of the problems effectively, economically and up to an acceptable accuracy.

**Keywords:** Thermal Comfort, Indoor Air, Numerical Simulation.

## I. INTRODUCTION:

Comfortable physical environment is needed to most of the people who spend a great part of their lifetime inside doors for their better living and performing activities. Temperature and flow are the key parameters besides other parameters of comfort conditions for both the living and non living beings. Air conditioning need is increasing in Human comfort and commercial applications for controlled indoor environment. It is desired for the comfort to the occupants and to prevent the goods in a good thermal environment in order to maintain their condition without deterioration. Human performance and machine performance is also felt to be affected by the thermal environment around them.

The air in the air conditioned space is supplied with the desired condition through the supply air locations. It establishes a comfortable condition in the conditioned space by proper distribution of this air. Air distribution

affects the indoor air velocity, purity of the air through containment removal. Humidity in the air and pressure of the air are the other factors of indoor environment. These parameters in combination are of different values for different time and seasons. Temperature and velocity are the important parameters for human comfort.

The condition of mind of the human being expressing satisfaction with thermal environment is defined as thermal comfort [1]. Thermal comfort has mainly two factors as personal and environmental factors. The personal factors involve human activity level and thermal insulation of the clothing. The environmental factors include temperature, velocity and humidity of the air. A controlled condition of air for these factors is said to have comfort condition in a space having air conditioning.

## II. TEMPERATURE DISTRIBUTION AND AIR MOTION:

Temperature distribution and air motion in a conditioned space is achieved by air distribution. It is very much essential to distribute the conditioned air into the space to be air conditioned. It may be said that it is the process for transferring conditioned air provided by the air conditioner into the conditioned spaces. Supply air diffusers are placed in the room at some suitable location in order to supply the conditioned air into the conditioned space. A good air distribution system is needed to provide a proper combination of temperature, humidity and velocity of the air into the space.

In the conditioned space human occupied space as defined as the space in the conditioned zone that is from the floor to a height of 1.8 m and about 30 cm from the walls is essentially maintained for comfort environment. As per the ASHRAE standards the maximum variation in temperature should be less than 1° C and the air velocity should be in the range of 0.15 m/s to 0.36 m/s for the comfort condition. The localized feeling of cooling or warmth is said to be draft and it is not desirable in the conditioned space. It is measured above or below the controlled room condition of 24.4°C and for the air velocity of 0.15 m/s at the centre of the conditioned room.

Movement of air in the air conditioned space is caused due to the forced convective airflow [2]. The thermal comfort in the conditioned space is achieved by the indoor air movement and temperatures of the air [3]. Air movement in the air distribution is controlled by the design features of the supply air devices. Apart from these several other

factors are also responsible for the air movement within a room [4].

Natural convection and the temperature difference causes the air movement as the conditioned air and the walls of the conditioned space and air movement caused by a differential pressure across the indoor structure are the factors affecting air motion.

Several numerical studies are therefore being done by the designers and researchers to achieve the thermal comfort, finding of alternative air conditioning technology, alternative refrigerants and design of various parts of air conditioning [5].

The cause of air movement in the conditioned space also includes the existence of the doorways and apertures inside a room which could have great impact on the indoor air movement [6]. The opening and closing of doors coupled with people's movement may also have important influence on the indoor air distribution.

### III. DESIGN OF AIR DISTRIBUTION SYSTEM:

The system of air distribution is designed with the prime objective of providing conditioned air uniformly in the occupied space. Choosing the location of the supply air diffuser, the type of diffuser and the location of the return air vent or grill contribute individually in this objective. The type of return air vent or grill and its location also affect the indoor conditions [7]. The effect of the type and location of the supply air diffuser and return air duct on the temperature and velocity in the conditioned space is need to be known to be able to provide comfort conditions.

The following are the parameters which affect the indoor thermal and velocity in the conditioned space:

- Temperature difference between the supply air and the room air temperature
- Flow conditions of the conditioned air and supply air diffuser.
- Supply air diffuser location
- Return air vent and its position in the conditioned space

### IV. CONCLUSION:

The present paper is focused on the review of air conditioning and the room air thermal environment. The parameters affecting the room air environment have been discussed as founds in the literature. The main parameters of the indoor thermal environment are the supply air conditions and the position of the supply and return air diffusers. The analysis of the temperature and velocity in the conditioned space provide us the information of the variations of the temperature and velocity in the room. This affects the thermal comfort and the energy requirement for the conditioning of the space. It is also found that such researches may be performed

experimentally. The chances of error in measurement and time requirement in conduction of test are too long. Thus the researchers are more focusing on the computational techniques as CFD for these types of analysis. The results obtained by these numerical techniques are low and the results obtained are acceptable with little differences in value of the parameters.

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