



Supply air conditions and Comfort in air conditioning of spaces

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Abstract: Air conditioning of spaces is essentially meant to provide comfort to the occupants by controlling factors which affect the comfort. Several factors affect the comfort and efficiency in indoor environment. Temperature, velocity, humidity, Temperature of surrounding surfaces, Odour, dust and lighting are some of the major factors affecting human comfort in air conditioning. The factors of thermal interaction with the human body affect the human comfort. For the design of an air conditioning system, the air distribution is of great importance in ensuring human comfort in conditioned spaces. Air distribution is meant to supply the conditioned air with designed supply air parameters. When this air is distributed in the conditioned space, its effect on overall environment of the conditioned space is also to be known. To investigate the effect of supply air conditions of conditioned air experimental and numerical methods are being used by the researchers. The objective of this paper is to present literature on air conditioning for comfort in conditioned space and the application of Computational Fluid Dynamics (CFD) in evaluation and simulation of indoor environment.

Keywords: Comfort conditions, Air Distribution, CFD

1. Introduction:

Human performance is affected by the thermal conditions around him along with the other conditions. Performance of machines is also affected by the temperature in several situations. Human comfort is the need of modern society. Modern society is concerned about the performance, livelihood and energy conservation. Air conditioning is now becoming necessity for the man and

machine both. Not only human but machine performance is also affected by the thermal conditions around them. With the changing time and the raising importance of comfort, engineers and researchers are continuously working to provide means of comfort conditions.

Air conditioning is meant to provide air with the required conditions. This method has been widely used in residential, industrial and commercial applications where the occupants are provided comfort environment by supplying conditioned air with suitable temperature and velocity. These are the two most important factors which are to be given due consideration in assuring comfort in air conditioned spaces. The way the comfort is achieved is by distribution of conditioned air in the spaces. If the air is not distributed effectively it will cause poor indoor thermal environment and also non economic air conditioning. Researchers have shown their results of investigations that huge energy can be saved without compromising comfort if the air is effectively distributed in the conditioned space.

2. Thermal Comfort

Thermal comfort as defined by ASHRAE Standard 55-2004 is “that condition of mind which expresses satisfaction with the thermal environment and is accessed by subjective evaluation”. The comfort of the occupant differs with their different conditions such as clothing, metabolism, activity etc. The velocity and the supply air temperature both affect the thermal comfort to the occupants. It is good to know the flow patterns of indoor air in the conditioned space to analyse the comfort conditions in the space.

3. Energy Use in Air Conditioning

Huge energy is being used in air conditioning of residential and commercial buildings. The corresponding Green House Gas (GHG) emissions are also of considerable amount. A major part of total energy consumption is in space air conditioning and therefore in GHG emissions. Conservation of energy is therefore become the interest of engineers and researchers worldwide. They are continuously searching new technology for sustainable development. The technology of air conditioning is being improved and developed with the aim of maintaining and improving quality of air to provide comfort to occupants with minimum use of energy. Energy performance depends both on the individual performance of system components and jointly.

4. Air Distribution

The air distribution is the supply of conditioned air into the conditioned space to provide comfort conditions in the occupied space. Much of the comfort of occupants depends upon the air distribution method. The selection of diffuser and supply air conditions jointly contribute to effective air distribution. There are various methods of air distribution such as overhead and under floor air distribution.

Air flow patterns are changed with the type and location of the supply air diffusers and the return air inlets. Air flow patterns help the designer and engineer to design and optimise the design of air distribution system.

In a conventional Air Distribution System as shown in figure 1, the conditioned air is supplied at a particular value of velocity and temperature into the room through diffusers placed at the ceiling. This air is mixed with the room air and produces homogeneous indoor thermal environment. The air is returned through the return air vents. The velocity and temperature are

homogeneous in the conditioned space after mixing of conditioned supply air with the room air.

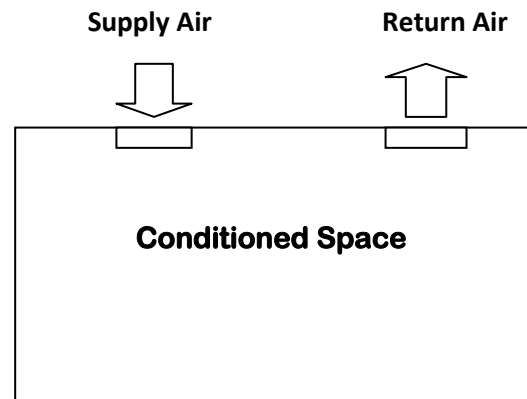


Figure 1: Conventional Air Distribution System

5. Methods of Research

To investigate the indoor environment, various research methods have been used by the researchers. The selection of particular method depends upon the objective of the research in general. The methods used by the researchers in indoor environment study comprises test room measurements, field study and use of modern tools such as Computational Fluid Dynamics (CFD) to simulate the flow patterns and evaluate performance parameters.

Numerical techniques have been gaining importance over the experimental methods because of their capability to provide results in various required forms and at low cost with acceptable accuracies. Various researches have validated the numerical approach by their experimental findings.

6. Conclusion

The objective of this paper is to present various key features of air conditioning of spaces. The need of thermal comfort in the conditioned spaces and supply air conditions affecting the indoor thermal environment has been discussed in this paper. The research methods for representation of flow and thermal patterns as available in literature have been



experimental and numerical methods. Numerical methods have been found to be increasingly opted by researchers in investigation of performance of air conditioning system components and performance analysis. An understanding of all relevant literature has been provided in this review.

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