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Effect of inlet opening number for a heated room

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Abstract

The CFD tool is an important tool to facilate the study of HVAC system. Using this tool, this work involves testing the effect of inlet opening number to follow it impact on the temperature distribution. This numerical study was developed using ANSYS Fluent 17 . The numerical results given by the software proves that the room is colder with eight inlet opening.

Keywords: Ventilation, manikin, Temperature, Inlet opening.

1.Introduction

The HVAC (heating, ventilation, and air conditiong) sytems have an important energy consumption . Also the overwall objectif is the decrease of the dependance between fossil fuel energy and buildings [1]. And the quality of air into the buildings should be fresh so ventilation systems are used for this objectifs by recyling fresh air and descharge heat [2]. In this context, Ali and al focused on ventilation effectinesess with mixing systems [3,4]. Adittion to that, Canha and al sums up the different types of mechnical ventilation [5]. The ventilation performance can be characterize by QAI where Zhang S , Cheng Y and Al optimized the air quality in order to find a thermal comfort adn to reduce energy consumption [6]. Displacement ventilation was tested by Qiau H ,Li Y and Al also by Yin Y ,Xu W and al [7,8] . Morever , strutum ventilation was stutied by evaluation of indoor temperature [9,10]. Berlango FA ,Olmedo I and Al treated ventilation effeciency of different mixing systemin hopital rooms [11]. Concerning the thermal comfort in occupied zones and the thermal indices , Zhang S , Cheng Y and Al studied the characterization of micro climates using PMV index in order to optimize the thermal sensation indoor classes [12] . Too, Kong X , Xi C and Al examined a comparaison between two method assisting to calculte a assessment index [13] Too, CFD can be a usefuel tool that characterise the indoor air quality [14]. In this context, using the CFD tool ,the effect of inlet geometry and number will be tested to facilite the study of ventilation sytem indoor a room containing a seated manikin with a computer.

2.Numerical method

2.1. Geometry

A room with a length L= 6 m, a width W = 3.9 m and a height H = 2.35 is considered in this works. This room is occupied by a manikin with 1.6 m of height. This manikin is sitting front a computer considered as a second heat source. This configuration was tested experimentally by Xu (2009).

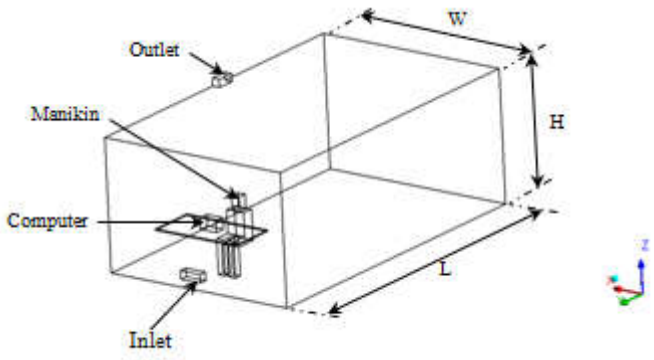

Fig 1. Geometry system

2.2. Boundary conditions

The boundary conditions fore this study are two heat sources are placed; the manikin with a heat flux equal to 76 W and the computer with a heat flux equal to 40 W. In the inlet, the air is characterized by a temperature equal to T=19 °C and a flow rate equal to Q=43 m-3 h-1 . In the outlet, the pressure is equal to the atmospheric conditions.

2.3. Meshing

Figure 2 presents the mesh used for the numerical simulation. In fact, an unstructured mesh with inflation is used around the manikin and for the walls. Elsewhere, it is a structured mesh. This mesh is characterized by a number of nodes equal to 2161924.

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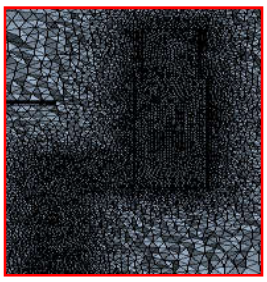

Fig 2.Meshe

2.4. Effect of opening inlet number

Figure 3 shows the different configuration of the inlet opening. In fact, we used four configurations where we keep the same surface 0.4×0.15 but we modified the number of opening.

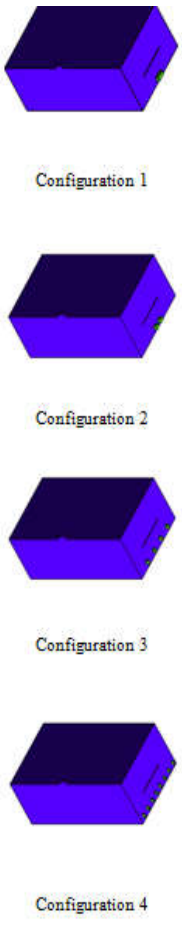

Fig 3. Different configurations of inlet opening

3. Results and discussions

Figure 4 displays the distribution of temperature for different configuration. According to these results, it has been observed that the temperature diffusion was influenced by the multiplication of inlet opening number. As a consequence, it does not passed 295 K along the directions defined y=0.29 m. Hence, the room becomes coldest using eight exhaut diffusers.

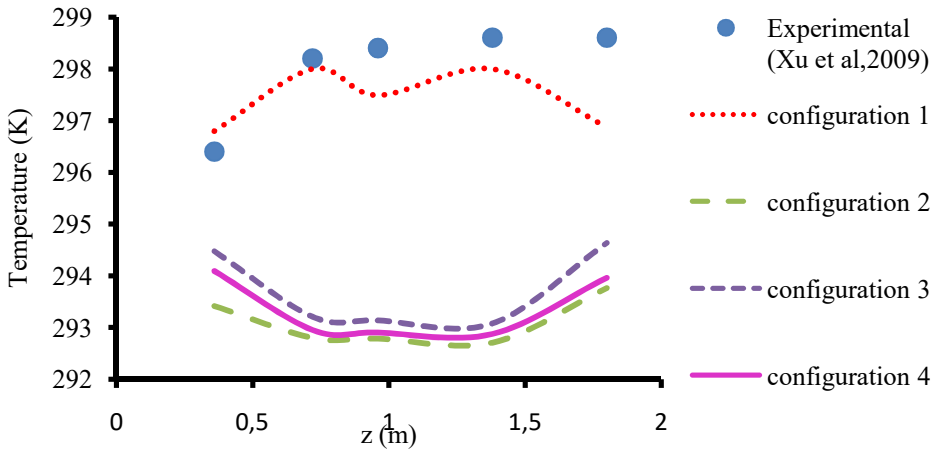

fig 4. Temperature distribution for the diffferent configurations

4. Conclusion

In this works, we have tested a numerical simulation to display the impact of the modification of the number of the inlet ventilation indoor a room containing a manikin and a computer. The numerical results shows that the multiplication of the rectangular opening.

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