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Simulation study on the Natural Ventilation of College Student' Dormitory

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Abstract

The students' dormitory is the minimum living unit of the universities' campus, carrying the students' living, communication and learning activities. In this paper, CFD method is used to simulate the indoor environment of the student dormitory in Jinan. The indoor natural ventilation of the interior corridor dormitory and the outer corridor dormitory was analyzed under two meteorological conditions. The results show that the natural ventilation of outer corridor dormitory is better than the natural ventilation of interior corridor dormitory. And based on these analyses, this paper puts forward a design strategy and optimization method of natural ventilation in the dormitory. Through the discussing of natural ventilation design in college students' dormitory in this paper, hoping that the natural ventilation design in the design of the college dorms is valued, so as to attach importance to students' dormitory, a particular type of building which is closely related to students' daily life.

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Keywords: CFD; natural ventilation; optimization design; college dormitory

1. Introduction

Natural ventilation is a passive cooling method, can reduce building energy consumption, so by a high degree of attention [1]. The study of the law of air flow and the influence on the thermal environment in the students' dormitory under the condition of natural ventilation is an important condition to ensure the environment of scientific design dormitory [2]. In the study of the law of air flow in dormitories, most of them use macroscopic models to

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establish the relationship between air flow and thermal environment. In the literature[3], the interaction between the natural ventilation volume and the indoor air temperature in the natural ventilation room was established. The thermal environment under the natural ventilation condition was simulated by the coupling effect model of the natural ventilation system and the building thermal process system. In the literature [4], the mathematical model of indoor natural ventilation under hot pressing was established, and the theoretical calculation method of natural ventilation was put forward. But these cannot accurately describe the distribution of indoor air flow.

With the development of computer technology, computational fluid dynamics (CFD) has been applied in many fields [5]. The numerical simulation and improvement of air flow using CFD have been paid attention to in contemporary architectural design [6]. With the improvement of the fluid calculation model and the improvement of the calculation speed, the numerical simulation method has become an effective tool for indoor and outdoor airflow simulation, indoor air quality and comfort evaluation. Based on the CFD simulation technique, this paper analyses the distribution law of the wind speed in the student dormitory, and puts forward the concrete direction of improving the natural ventilation of the dormitory.

2. Methods

2.1. Object of study

Two types of student dormitories include outer corridor dormitories and interior corridor dormitories were studied in Jinan.

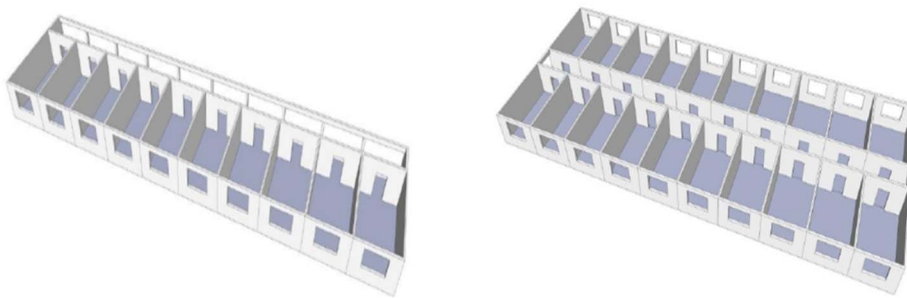


Fig. 1. Structure of the outer corridor dormitory and the interior corridor dormitory

Table 1. Size of doors and windows

Project	Wide (m)	High (m)	Height from the ground m
Door	0.8	2	0
Window	2	1.8	1

2.2. Environmental meteorological conditions

According to the meteorological data of the region, the typical summer meteorological conditions were selected in the analysis of summer indoor natural ventilation. Southerly and southeast winds are more common in the summer of Jinan. The average wind speed is 2m/s. The indoor ventilation condition at the temperature of 30 ° C is selected for simulation. Two simulated meteorological conditions were determined, as shown in Table 2.

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