IMPROVING NATURAL VENTILATION DESIGN FOR SPACES WITH SINGLE-SIDED VENTILATION USING COMPUTATIONAL FLUID DYNAMICS

By

Reem Samy El Haddad

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
In
ARCHITECTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

IMPROVING NATURAL VENTILATION DESIGN FOR SPACES WITH single-sided ventilation USING Computational fluid Dynamics

Key Words:
Natural ventilation, CFD, Passive techniques, Wing- Wall.

Summary:
The research developed into three parts. The first part is a critical literature review which includes the physical science of natural ventilation, its strategic design as well as the design measures that control air flow. The literature reviews also include the computational fluid dynamic physical science and its uses in natural ventilation improving and designing.
In the second part the natural ventilation performance in the case study was quantitatively evaluated through conducting field objective. In this evaluation study the airflow of the case study was measured, monitored and simulated on CFD program respectively
The third part is consisted of three stages. The first stage is modeling the test unit, and the second one is setting up the variables, such as the openings and wing – wall positions, lengths, inclined angle and shape. Finally, the third stage is testing the variables using CFD to reach the optimum windows and wing-wall position and length to induce the air inside the unit and raise the air velocity to meet ASHRAE ventilation requirements which is 0.2 m/s.

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