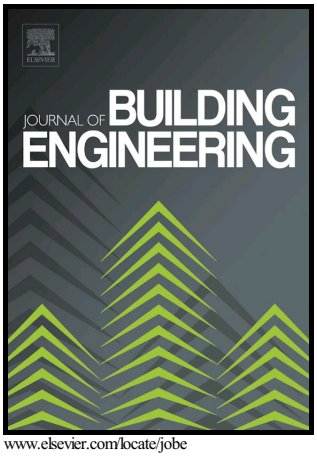

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PII: S2352-7102(17)30135-3
DOI: http://dx.doi.org/10.1016/j.jobe.2017.06.002
Reference: JOBE277

To appear in: *Journal of Building Engineering*

Received date: 10 March 2017
Revised date: 2 June 2017
Accepted date: 3 June 2017

Cite this article as: Nedjmeddine Kimouche, Zinelabidine Mahri, Aissa Abidi Saad, Catalin Popa, Guillaume Polidori and Chadi Maalouf, Effect of inclinatio angle of the adiabatic wall in asymmetrically heated channel on natura convection: application to double-skin façade design, *Journal of Buildin Engineering,* http://dx.doi.org/10.1016/j.jobe.2017.06.002

Effect of inclination angle of the adiabatic wall in asymmetrically heated channel on natural convection : application to double-skin façade design

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Abstract

A numerical study was conducted on the inclination angle effect of the adiabatic wall in a channel asymmetrically heated on the laminar natural convection behavior. The center of the other wall of the channel has been subjected to a uniform heat flux density. Different inclination angles have been studied ($-10° \leq \alpha \leq +10°$) for a modified Rayleigh number $Ra^* = 4.5\times10^6$. A finite volume method was used to solve the governing equations using the ANSYS FLUENT commercial code. The results showed a huge influence of the inclination angle on the velocity and pressure fields and on the flow within the channel.

Keywords:

laminar natural convection; vertical channel; CFD; inclination angle; asymmetric heating

Introduction

Heat transfer by natural convection in a vertical channel is representative of many industrial applications, such as the heating and cooling of buildings, fires in buildings, double skin façades or solar collectors.

Several studies [1-4] have shown that the use of double skin façades in the building improves thermal comfort. Other studies of literature, numerical and experimental, have been devoted to understanding the natural convection in vertical channels.

For example, the first correlation between the mean Nusselt number and the channel Grashof number was proposed by Elenbass [5] who has experimentally studied free convection in a channel formed by two isothermal plates. Bodoia and Osterle [6] have developed a numerical solution using a finite differences method. Their results showed a good agreement with experimental data of