

# Natural Convection in A Square Cavity with Partitions from Top and Bottom Adiabatic Walls

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**ABSTRACT:** In the present study, the natural convection in a square cavity with partitions is investigated using control volume based computational procedure. The cavity is bounded by uniformly heating left vertical wall, right cold wall and the top and bottom horizontal adiabatic walls. The numerical simulations adopted in the present study yields consistent performance over a wide range of parameters (Rayleigh number  $103 \leq Ra \leq 106$ , Height of partition  $0 \leq H \leq 0.55$  and  $Pr = 0.7$ ) with respect to uniform heating and cold vertical walls. The Phenomenon inside the enclosure with centrally located and vertically varied partitions are also analyzed through isotherm pattern, streamline pattern, local and average Nusselt number. It is found that the average Nusselt number increases with increase of Rayleigh number. The conduction is dominated for a Rayleigh number up to  $5 \times 10^3$  and increases further with increase of height of partitions vertically. It is noticed that when height of centrally located partition increased beyond a height of  $0.3H$ , the heat transfer decreased drastically for all Rayleigh numbers.

**KEYWORDS:** Heat transfer; Square cavity; Natural convection; Partitioned enclosure; Rayleigh number.

## I. INTRODUCTION

The analysis of heat and fluid flow is occupied the centre stage and prototype of many industrial and engineering applications. However since from one decade, awareness on natural convection in a closed cavity with partitioned has been increased very rapidly. The computations of heat and fluid flow plays an important role in the field of engineering such as the card or any projections on mother board of a computer, the placement of electronic components inside the electronic cabinet, the plastic coated partitions in a refrigerator, and wooden partitions in an air conditioned rooms. Protruded instruments used for intrusive measurement can also considered as insulated partitions. The flow and thermal field is caused due to density difference. The internal buoyancy flows are more complex, due to the essential coupling between transport properties of thermal and flow fields. In the present work by considering the complexity of phenomenon of internal flow inside a partitioned cavity with higher Rayleigh numbers, a brief review of the relevant literature has been hereby presented.

## II. OBJECTIVES

The main objective of the present investigation is to study the shielding effect of partitions located at centre and offset from the adiabatic horizontal walls of a square cavity. The height ( $0.1H \geq h \geq 0.55H$ ) and location ( $0.3 \geq \epsilon \geq 0.7$ ) of the partition is varied by keeping thickness of partition constant (see Figure. 1). The simulations are carried out for different Rayleigh numbers ( $10^3 \geq Ra \geq 10^6$ ),  $Pr = 0.7$  for horizontal adiabatic end walls and isothermal vertical walls.

### III. MATHEMATICAL MODEL

Figure 1 shows the schematic diagram of the physical model.

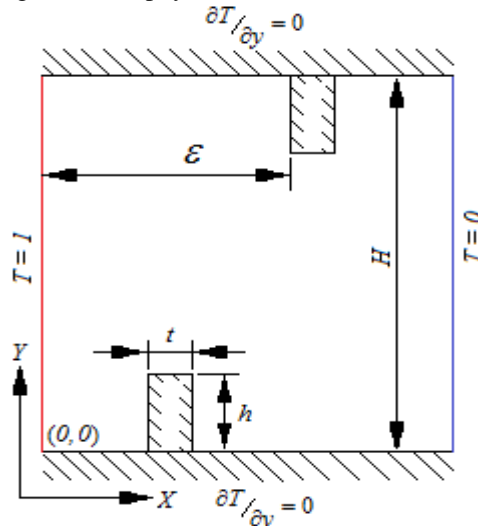


Figure 1; Computational domain

### IV. RESULTS AND DISCUSSION

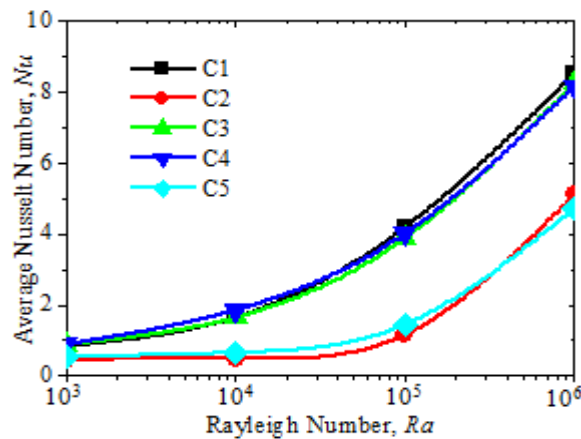


Figure 2; Variation of average Nusselt number v/s logarithmic Rayleigh number for different cases

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