

Bifurcation of airflow in a porous enclosure



Dalila Menacer

Unité de Recherche en Energies Renouvelables en Milieu Saharien URERMS, Centre de Développement des Energies Renouvelables CDER 01000, Adrar, Algeria
menacerdalila2018@gmail.com

INTRODUCTION

Fluid flow and heat transfer in a porous space are of interest in a variety of engineering activities as well in the environment, ground water pollution [1], metal cooling [2], solar power collector [3] etc. A computational work has been performed to analyse the heat transfer of supercritical n-decane in mixed laminar flow over a tube was documented by Weitong Liu et al [6]. They found that under the influence of increasing heat flux, heat transfer has been enhanced for natural convection. When the wall has reached the critical temperature and the local Nusselt number value decreases up to 17.4%.

The calculations have been carried out for a value of Richardson number $Ri=7.5$

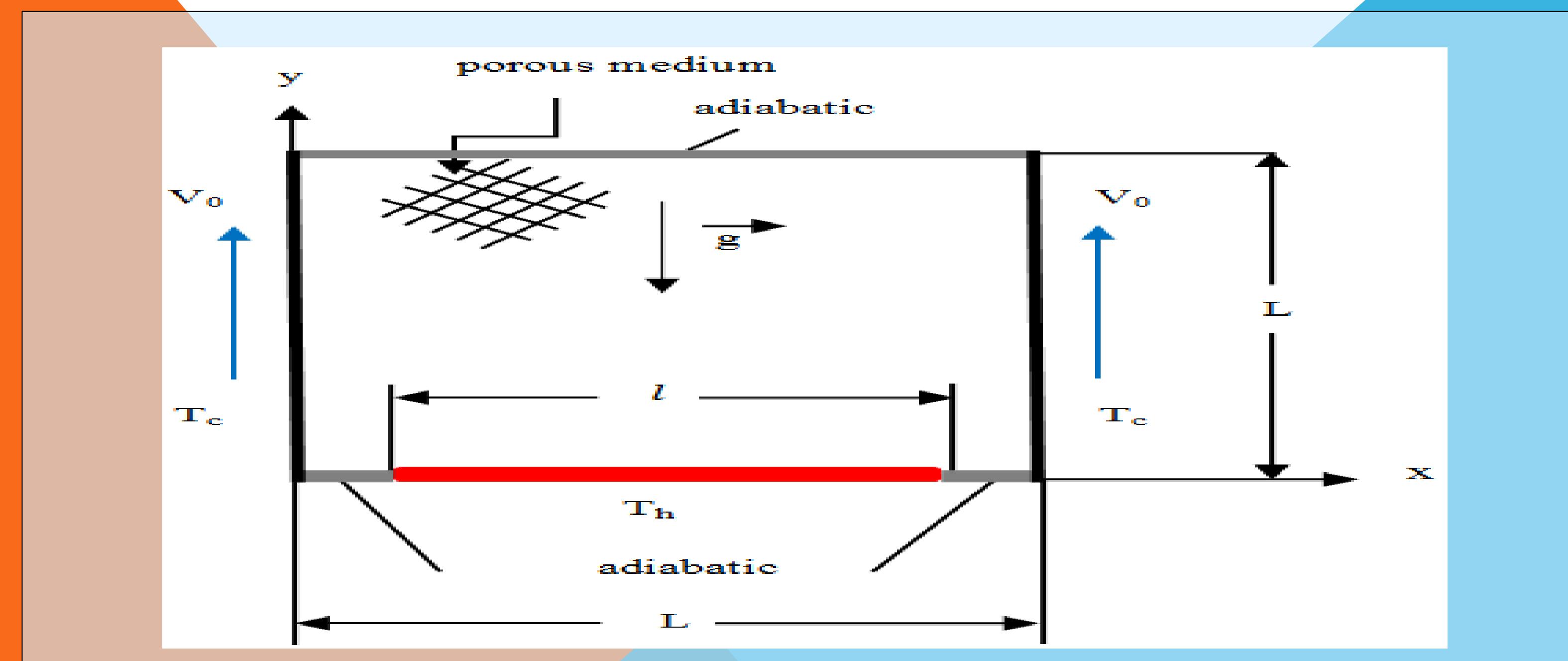
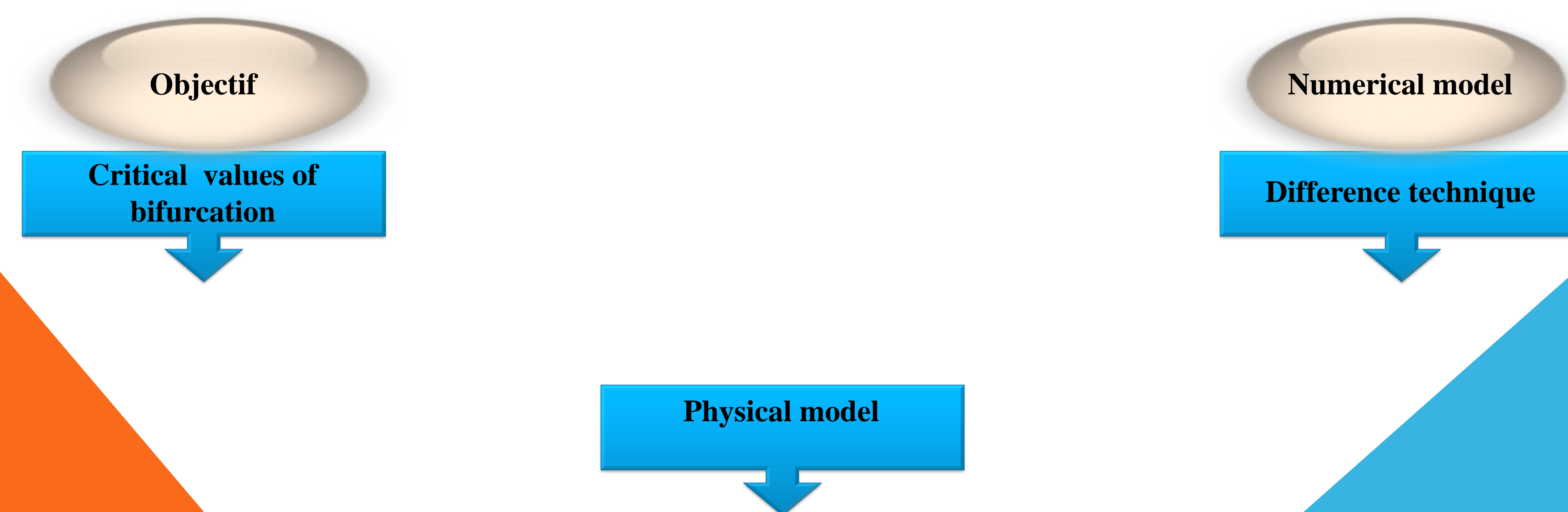


Figure 1 : Schematic representation of the problem

(RESULTS)

Effect of Darcy parameter on the dynamic fields

The results show that for $Da=0.001$, the streamlines approach near the left and right walls thus forming regions of strong velocity gradient (seen Fig2). at the other hand, if $Da=0.01$, two weaker cells are formed near the side walls. The structure of the flow changes which means that the fluid is fully convected for higher Darcy ($Da=0.1$). [5]

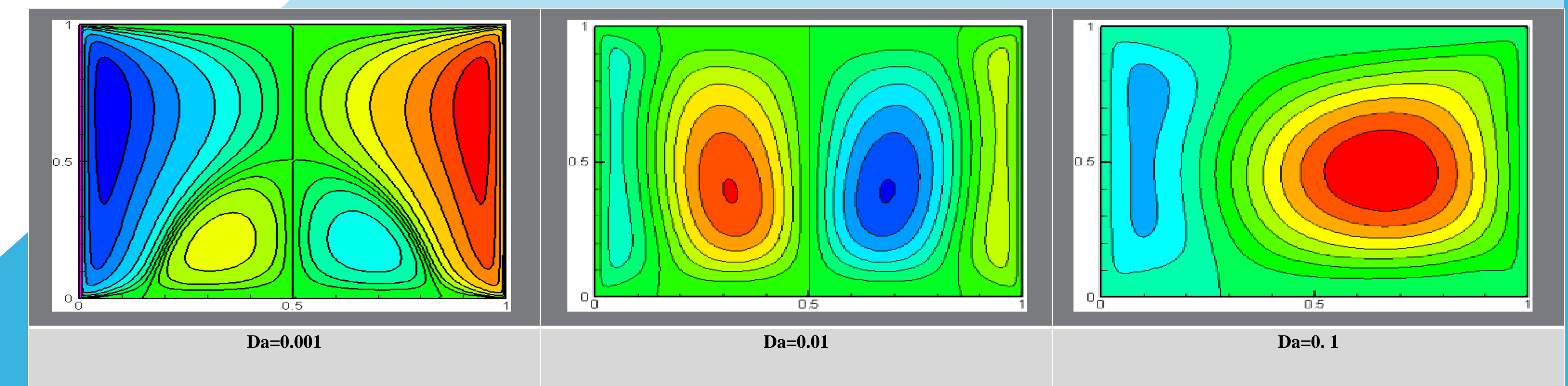


Figure 2 : Streamlines for different Darcy numbers

Effect of Darcy parameter on the heat transfer rate

the temporal evolution of the rate of heat transfer for $Da \leq 0.1$ represented on figure 3 shows that the Nusselt number decreases abruptly during all the first instants, then it decreases regularly to stabilize at a fixed value. But, this number will be having an oscillations for Darcy value of 0.1

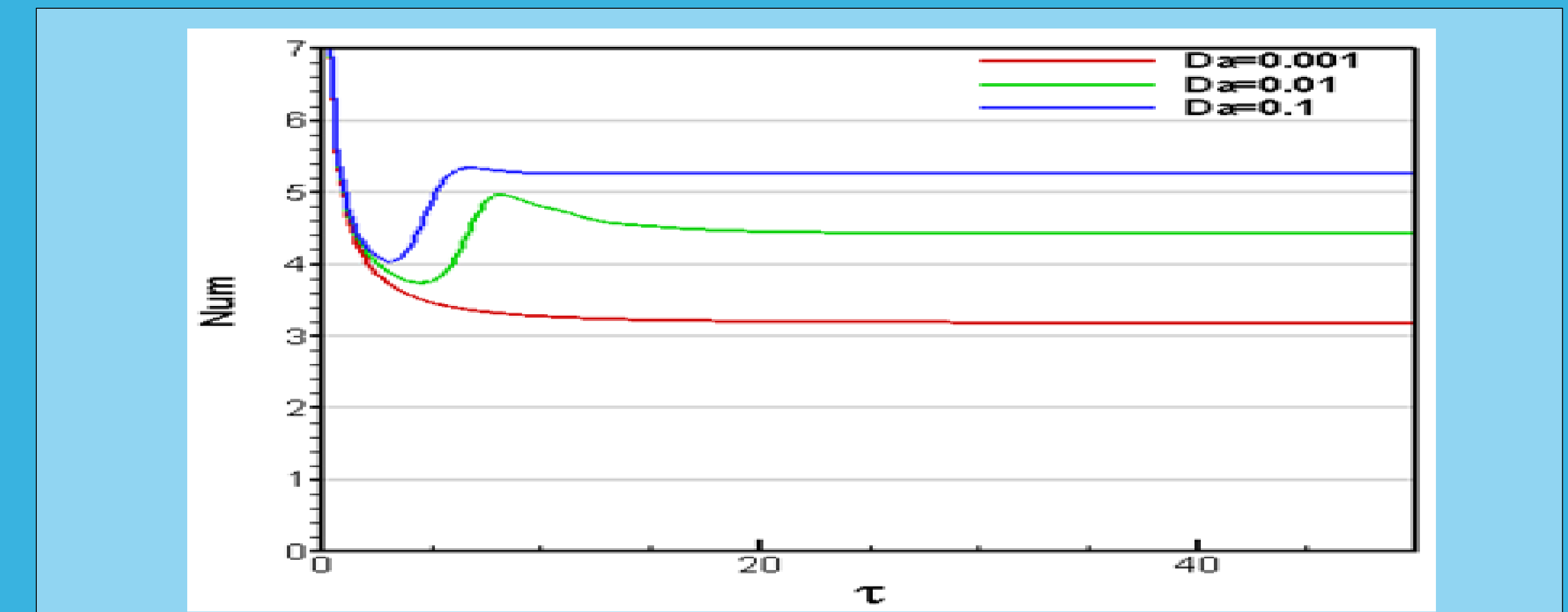


Figure 3 : Time evolution of Nusselt number

CONCLUSION

This study leads to the numerical mastery of the heat transfer in a porous cavity, the flow evolution is in contradiction with the symmetrical nature for higher Darcy values.

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