NUMERICAL STUDY OF THE MIXED CONVECTION HEAT TRANSFER IN ANNULUS HEATED BY JOULEAN EFFECT

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ABSTRACT. In the present work, we numerically study the three-dimensional mixed convection heat transfer between tow concentric horizontal pipes, the external pipe is heated by an electrical intensity passing through its small thickness while the inner cylinder is insulated. The convection in the fluid domain is conjugated to thermal conduction in the pipes solid thickness. The physical properties of the fluid are thermal dependant. The heat losses from the external outside pipe surface to the surrounding ambient are considered. The model equations of continuity, momenta and energy are numerically solved by a finite volume method with a second order spatiotemporal discretization. The obtained results show the three dimensional aspect of the thermal and dynamical fields with considerable variations of the viscosity and moderate variations of the fluid thermal conductivity. As expected, the mixed convection Nusselt number becomes more superior to that of the forced convection when the Grashof number is increased. At the solid-fluid interface, the results show clearly the azimuthal and axial variations of the local heat flux and the local Nusselt numbers. Following these results, we have tried modelling the average Nusselt number as a function of Richardson number. With the parameters used, the heat transfer is quantified by the correlation: $Nu_A = 12.8678 \quad Ri^{0.1426}$.

KEYWORDS: *Laminar Mixed Convection, Concentric Pipes, Conjugate Heat Transfer, Numerical simulation.*