Abstract :

In the present paper, laminar mixed convection in horizontal annulus filled with a TiO_2/water nanofluid and Ag-TiO_2/water hybrid nanofluid has been numerically studied. The outer cylinder is uniformly heated while the inner cylinder is adiabatic. The governing equations with the appropriate boundary conditions are discretized by the finite volume method with second order precision, and solved by using the SIMPLER and Thomas algorithms. The numerical simulations are performed for various nanoparticles volume fractions, between 0 and 8% and Grashof numbers between 10^5 and 10^6. The results shows that for all studied Grashof numbers, the local and average Nusselt numbers, and the bulk temperature increase with the increasing of the volume fraction and the Grashof number. The heat transfer is very enhancement when using a Ag-TiO_2/water hybrid nanofluid compared to the similar TiO_2/water nanofluid. Moreover, the exploitation of the numerical results that we obtained enabled us to develop two new correlations, which allow the estimation of the average Nusselt number. The results reveal that the numerical data are in a good agreement with the correlation data. The maximum error for nanofluid and hybrid nanofluid was around 2.5% and 4.7% respectively. Hence, among the multitude of the obtained results in this work, it remains that the new correlations developed, especially for the hybrid nanofluid Ag-TiO_2 / water, constitute for their originality, the most significant result of this research.