MIXED CONVECTION IN AN ECCENTRIC ANNULUS FILLED BY COPPER NANOFLUID

by

Wael El-MAGHLANY [a*], Mohamed ABO ELAZM [b] Ali SHAHATA[c], Yehia ELDRAINY [d]

[a,d] Faculty of Engineering, Alexandria University, Egypt

[b,c] Arab Academy for Science and Technology and Maritime Transport, Egypt

A numerical study of mixed convection flow and heat transfer of Copper (Cu)–water nanofluid inside an eccentric horizontal annulus is presented. The inner and outer cylinders are kept at constant temperatures as T_h and T_c, respectively. The inner cylinder rotates to generate the forced convection effect. The numerical work was carried out using an in-house CFD code written in FORTRAN. Different scenarios were explored to explain the effects of different parameters on the studied problem. These parameters are Richardson number, eccentricity ratio, and solid volume fraction. The range of the Richardson number Ri, solid volume fraction of the nanoparticles ζ, and the eccentricity ratio ε, are $0.01 \leq Ri \leq 100$ (natural convection), $0 \leq \zeta \leq 0.05$, $0 \leq \varepsilon \leq 0.9$ respectively. All results were performed with thermal Grashof number Gr, and radius ratio Rr, equaled to 10^4 and 2, respectively. The effects of eccentricity, nanoparticles volume fraction, and Richardson number on the average Nusselt number, streamlines and isotherms were investigated. Results were discussed, and were found to be in good agreement with previous works. It was also found that, the eccentricity has a positive remarkable effect on the average Nusselt number, while the effect of nanoparticles concentration was more pronounced at mixed convection region (Ri=1).

Key words***:*** *Mixed convection, eccentric annulus, nanofluid, numerical study*