

## Mixed Convection Heat Transfer of Copper Oxide-Heat Transfer Oil Nanofluid in Vertical Tube

**Authors :** Farhad Hekmatipour, M. A. Akhavan-Behabadi, Farzad Hekmatipour

**Abstract :** In this paper, experiments were conducted to investigate the heat transfer of Copper Oxide-Heat Transfer Oil (CuO-HTO) nanofluid laminar flow in vertical smooth and microfin tubes as the surface temperature is constant. The effect of adding the nanoparticle to base fluid and Richardson number on the heat transfer enhancement is investigated as Richardson number increases from 0.1 to 0.7. The experimental results demonstrate that the combined forced-natural convection heat transfer rate may be improved significantly with an increment of mass nanoparticle concentration from 0% to 1.5%. In this experiment, a correlation is also proposed to predict the mixed convection heat transfer rate of CuO-HTO nanofluid flow. The maximum deviation of both correlations is less than 14%. Moreover, a correlation is presented to estimate the Nusselt number inside vertical smooth and microfin tubes as Rayleigh number is between  $2 \times 10^5$  and  $6.8 \times 10^6$  with the maximum deviation of 12%.

**Keywords :** mixed convection, heat transfer, nanofluid, vertical tube, microfin tube

**Conference Title :** ICSEE 2018 : International Conference on Software and Electrical Engineering

**Conference Location :** Dubai, United Arab Emirates

**Conference Dates :** December 20-21, 2018