

## **Non-Darcy mixed convection of hybrid nanofluid with thermal dispersion along a vertical plate embedded in a porous medium**

### **ABSTRACT**

The mixed convection flow of Cu-Al<sub>2</sub>O<sub>3</sub>/water nanofluid along a vertical plate embedded in a porous medium is numerically analyzed. Non-Darcy equation for porous medium with the thermal dispersion representation is used to model the present boundary layer problem. The reduced ordinary differential equations are computed using the bvp4c solver. The validation analysis shows a positive agreement between previous published and present results in few cases. The results imply that in the opposing buoyancy region, the dual solutions are expected, and the laminar boundary layer flow starts separating from the plate. The use of hybrid Cu-Al<sub>2</sub>O<sub>3</sub>/water nanofluid and increment of thermal dispersion parameter can extend the separation point. Moreover, the heat transfer rate and skin friction coefficient of Cu-Al<sub>2</sub>O<sub>3</sub>/water are greater than the pure water and Cu/water. The opposing flow shows a distinct behavior from the aiding flow.

**Keyword:** Non-Darcy porous medium; Hybrid nanofluid; Mixed convection; Dual solutions; Numerical solution