

Numerical Study of Laminar Mixed Convection Heat Transfer of a Nanofluid in a Concentric Annular Tube Using Two-Phase Mixture Model

Authors : Roghayyeh Motallebzadeh, Shahin Hajizadeh, Mohammad Reza Ghasemi

Abstract : Laminar mixed convection heat transfer of a nanofluid with prescribed constant heat flux on the inner wall of horizontal annular tube has been studied numerically based on two-phase mixture model in different Rayleigh numbers and Azimuth angles. Effects of applying of different volume fractions of Al₂O₃ nanoparticles in water as a base fluid on hydrodynamic and thermal behaviours of the fluid flow such as axial velocity, secondary flow, temperature, heat transfer coefficient and friction coefficient at the inner and outer wall region, has been investigated. Conservation equations in elliptical form has been utilized and solved in three dimensions for a steady flow. It is observed that, there is a good agreement between results in this work and previously published experimental and numerical works on mixed convection in horizontal annulus. These particles cause to increase convection heat transfer coefficient of the fluid, meanwhile there is no considerable effect on friction coefficient.

Keywords : buoyancy force, laminar mixed convection, mixture model, nano-fluid, two-phase

Conference Title : ICAMAME 2014 : International Conference on Aerospace, Mechanical, Automotive and Materials Engineering

Conference Location : Istanbul, Türkiye

Conference Dates : March 24-25, 2014