ISPH simulations of natural convection from heated rotating paddles on a circular cylinder inside a cross-shaped cavity filled with a nanofluid

Abdelraheem Mahmoud Aly[1] and Ehab Mahmoud[2]

[1]King Khalid University
[2]Aswan University

November 26, 2020

Abstract

The numerical simulations of the uniform circular rotation of paddles on circular cylinder results natural convection flow of Al2O3-water in a cross-shaped porous cavity were performed by incompressible representation of smoothed particle hydrodynamics entitled ISPH method. The two vertical area of a cross-shaped cavity is saturated with homogeneous porous media and the whole horizontal area of a cross-shaped cavity is saturated with heterogeneous porous media. The inner paddles on the circular cylinder are rotating around their center by a uniform circular velocity. The whole embedded body of paddles on a circular cylinder has temperature Th. The wall-sides of a cross-shaped cavity are positioned at a temperature Tc. The current geometry can be applied in analysis and understanding the thermophysical behaviors of the electronic motors. The angular velocity is taken as ! = 7:15 and consequently the natural convection case is only considered due to the low speed of inner rotating shape. The performed simulations are represented in the graphical for the temperature distributions, velocity fields and tabular forms for average Nusselt number. The results revealed that an augmentation on paddle length rises the heat transfer and speed of fluid flow inside a cross shaped cavity. Also, an incrementation on Rayleigh number augments the heat transfer and speed of the fluid flow inside a cross-shaped cavity. The fluid flow is circulated only around the rotating inner shape when Darcy parameter decreases to Da = 105. Average Nusselt number Nu enhances by an increment on the paddle lengths and nanoparticles volume fraction

Hosted file

`RotPladdCross.pdf` available at https://authorea.com/users/379064/articles/495413-isph-simulations-of-natural-convection-from-heated-rotating-paddles-on-a-circular-cylinder-inside-a-cross-shaped-cavity-filled-with-a-nanofluid