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Free convection enhancement in an annulus between horizontal confocal elliptical cylinders using hybrid nanofluids
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Abstract
In the present paper, natural convection in an annulus between two confocal elliptic cylinders filled with a Cu-Al2O3/water hybrid nanofluid is investigated numerically. The inner cylinder is heated at a constant surface temperature while the outer wall is isothermally cooled. The basic equations are formulated in elliptic coordinates and developed in terms of the vorticity-stream function formulation using the dimensionless form for 2D, laminar and incompressible flow under steady-state condition. The governing equations are discretized using the finite volume method and solved by an in-house FORTRAN code. Numerical simulations are performed for various volume fractions of nanoparticles ($0 \le \phi \le 0.12$) and Rayleigh numbers ($103 \le Ra \le 3 \times 105$). The eccentricity of the inner and outer ellipses and the angle of orientation are fixed at e1 = 0.9, e2 = 0.6 and $\gamma = 0°$ respectively. It is found that employing a Cu-Al2O3/water hybrid nanofluid is more efficient in heat transfer rate compared to the similar Al2O3/water nanofluid. © 2016, Copyright © Taylor & Francis Group, LLC.

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