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Buoyant convective transport of nanofluids in a non-uniformly heated annulus

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Abstract

This paper reports the influence of non-uniform thermal conditions on buoyancydriven convection of water based nanofluids in a cylindrical annulus. Annular geometry is formed by two upright co-axial cylinders. In this analysis, two different non-uniform temperature profiles are applied at bottom boundary, while the side boundaries are kept at lower temperature and top boundary is taken as thermally insulated. For the first case, the bottom boundary is sinusoidally heated, while linear thermal profile is applied in the second case. The annular gap is filled with water based nanofluids with copper nanoparticle. Using ADI based finite difference technique, the model equations are solved for vast range of parametric values. Numerical simulation results reveal the bi-cellular flow pattern for both non-uniform thermal conditions at all range of Rayleigh numbers. Further, the heat transport rates are highly sensitive to nonuniform conditions supplied at the bottom wall. The results of this analysis could be utilized for applications involving non-uniform thermal conditions in an annular geometry.

Keywords:
Nanofluids, copper nanoparticle, co-axial cylinders, non-uniform temperature

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