# Abstract

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### A novel technique for heat transfer enhancement from a horizontal heated pipe by using nanofluid restrained flow

In this paper, a numerical investigation using an in-house CFD code written in FORTRAN is carried out for an effective cooling of a horizontal heated pipe. The study focuses on the heat transfer enhancement by using nanofluid as a cooling medium comprising CuO nanoparticles and water as a base fluid. More- over, a confined circular jacket surrounds the heated pipe with axial slot inlet and outlet ports. Via the circular jacket, the eccentricity between the heated pipe and the circular jacket centers is implemented as a control key for the heat transfer rate. Also, the circular jacket enables the nanofluid to be in direct contact with the hot pipe. Cold nanofluid exchange heat by both forced and natural convection (mixed convection). The presented study is performed for two mixed convection cases, assisting and opposing. The Grashof number is fixed at 10 4 while the Richardson number is varied in the range of 0.01–100 via the Reynolds number of the nanofluid. The CuO solid volume fraction has been varied from 0 to 0.05 while the eccentricity ratio has been changed from ?0.5 (downward direction) to 0.5 (upward direction). Through the study, the radius ratio is kept constant at 2. The numerical solution was compared with pre- vious work, and good agreement was found. It was also found that the assisting flow enhanced the rate of heat transfer when compared to the opposing flow. Moreover, the nanoparticles have a positive effect on the rate of heat transfer over the entire range of Richardson number however, for natural convection domain (Ri > 10), the nanoparticles concentration should be extensively increased in order to enhance the heat transfer rate.