World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Numerical Study of Natural Convection Heat Transfer in a Two-Dimensional Vertical Conical PartiallyAnnular Space

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Abstract : In this paper, a numerical study of two-dimensional steady flow has been made of natural convection in a differentially heated vertical conical partially annular space. The heat transfer is assumed to take place by natural convection. The inner and outer surfaces of annulus are maintained at uniform wall temperature. The annulus is filled with air. The CFD FLUENT12.0 code is used to solve the governing equations of mass, momentum and energy using constant properties and the Boussinesq approximation for density variation. The streamlines and the isotherms of the fluid are presented for different annuli with different boundary conditions and Rayleigh numbers. Emphasis is placed on the influences of the height of the inner vertical cone on the flow and the temperature fields. In addition, the effects on the heat transfer are discussed for various values of physical parameters of the fluid and geometric parameters of the annulus. The heat transfer on the hot walls of the annulus is also calculated in order to make comparisons between the cylinder annulus for boundary conditions and several Rayleigh numbers. A good agreement of Nusselt number has been found between the present predictions and reference from the literature data.

Keywords : natural convection, heat transfer, numerical simulation, conical partially, annular space
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020

Open Science Index, Mathematical and Computational Sciences Vol:14, No:12, 2020 publications.waset.org/abstracts/1602.pdf