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Commentary

# Predicting the Phenomena of Nano Fluids by Natural Convection Heat Transfer

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## DESCRIPTION

Computational Fluid Dynamics is used to study the natural convection heat transfer and fluid flow characteristics of water-based $Al_2O_3$ Nano-fluids in a symmetrical and unsymmetrical perforated ring enclosure. The inner cylinder is held at a constant cold temperature while the outer cylinder is heated isothermally. Eight corrugated annulus enclosure concepts with a constant aspect ratio of 1.5 are included in the research. The stream vertices formulation in curvilinear dimensions is used to solve the governing equations of fluid motion and heat transfer. PHI=0-0.25 is the range of solid volume fractions for nanoparticles, while Rayleigh number ranges from 104-107. This research looked into streamlines, isotherms, local and average Nusselt numbers of inner and outer cylinders. For eight models and five values of volume percentage of Nano particles, sixty-four correlations for the average Nusselt number for the inner and outer cylinders as a function of Rayleigh number have been derived with an accuracy range of 6%-12%. The average heat transfer rate increases dramatically as the particle volume percentage and Rayleigh number increase, according to the findings. Furthermore, increasing the number of undulations in unsymmetrical annuli lowers heat transfer rates, which remain larger than in symmetrical annuli.

Due to the wide range of practical applications in industry, fluid field and heat transfer characteristics through free convection inside enclosure have received a lot of attention. Effective cooling systems for electronic components, solar collectors, thermal storage systems, nuclear reactors, and other applications are among them. Many academics have attempted to improve the heat transfer rate using porous medium and nanotechnology in recent years. The second approach was applied in this research. The aim is to create a novel fluid termed "Nano fluid" that has a great thermal conductivity than regular fluids. Heat energy is transferred in variety of industrial operations. Heat must be added, withdrawn, or transported from one process stream to another across every industrial facility, and it has become a crucial responsibility for industrial requirement. These procedures are used to recover energy and heat or cool process fluids. Enhancing heating or cooling in an industrial process can save energy, reduce process time, increase thermal rating, and extend the equipment's operating life. Enhanced heat transmission can even have a qualitative impact on some processes. High-performance thermal systems for heat transfer improvement are increasing these days.

There are a number of ways to increase heat transfer efficiency using extended surfaces, applying vibration to heat transfer surfaces, and using tiny channels are few examples. The thermal conductivity of the working fluid can also be increased to improve heat transfer efficiency. When compared to the thermal conductivity of solids, common heat transfer fluids such as water, ethylene glycol, and motor oil have poor thermal conductivities. Adding tiny solid particles to a fluid with high thermal conductivity can be utilized to improve the thermal conductivity of that fluid. Nano fluid is a novel type of heat transfer medium that contains nanoparticles (1nm-100 nm) that are dispersed evenly and consistently in a base fluid. The thermal conductivity of the Nano fluid is considerably enhanced by these scattered nanoparticles, which are usually metal or metal oxide. This raised conduction and convection coefficients, allow increasing heat transfer.

For almost two decades, Nano fluids have been investigated for use as improved heat transfer fluids. However, no consensus exists on the magnitude of possible benefits of employing Nano fluids for heat transfer applications due to the broad diversity and complexity of Nano fluid systems.

Nano fluids thermo physical qualities are critical for predicting their heat transfer behavior. It is critical in terms of industrial and energy-saving control. Nano fluids have picked the interest of industry. When compared to traditional particles such as fluid suspension, millimeter and micrometer sized particles; nanoparticles have a lot of potential to improve heat transfer capabilities. Nano fluids have received a lot of interest in the recent decade because of their improved thermal characteristics. conductivity of Nano fluids is dependent on a number of elements, including particle volume fraction, particle material, particle size, particle shape, base fluid composition, and

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temperature, according to experiments. The amount and kind of additives, as well as the acidity of the Nano fluid were shown to be useful in improving thermal conductivity. Increases in effective thermal conductivity are critical for better fluid heat transfer behavior. A variety of additional factors are also important. The heat transfer coefficient for forced convection in tubes, for example, is determined by a number of physical properties of the fluid or the geometry of the system through which the fluid is moving. Extrinsic system factors such as tube diameter and length as well as intrinsic fluid qualities such as thermal conductivity, specific heat, density, and viscosity, are included in these values. As a result, measuring the heat transfer capability of Nano fluids directly under flow circumstances is critical. Researchers discovered that Nano fluids had superior heat conductivity and convective heat transfer capabilities than conventional fluids.