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CFD Analysis Nanofluids Turbulent Convective Heat Transfer

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Abstarct: **Rating improve heat transfer due to the use of nanofluids has recently become of interest to many researchers center. This category newly introduced liquid containing ultrafine nanoparticles has to offer (1-100 nm) cooling fantastic behavior during testing, including higher thermal conductivity and heat transfer coefficient improved compared to the pure liquid. This review article summarizes the numerical studies in this area. And it will perform a theoretical study of a single phase through a tube coming out. And it will not be considered in the CFD simulation of heat transfer characteristics of Nanofluid in a circular tube under constant temperature camouflage using the CFX solver (version 13.0) in a turbulent flow. Will Fe3O4nanoparticles in water with a concentration of 0.02%, 0.1%, 0.3% and 0.6% used in this simulation. It is assumed that all thermal and physical properties of nanofluids to be independent of temperature. the average particle size of 36 nm in this search is used. The goal is to know the change in the heat transfer coefficient with the change of the Reynolds number and concentration coefficient Convective heat transfer nanoparticles.Themaximum will be held with a change in the concentration of nanoparticles in water. It will be solved the equations of the model computational fluid dynamics (CFD) to predict the behavior of the hydrodynamic and thermal tube. It will be engineering problem and the complexity of it in ANSYS Workbench. ByANSYS models will have a 13.0 CFX solver solution.**

I. INTRODUCTION

With traditional liquid such as water transfer heat or ethylene glycol, used in refrigeration or heating of poor thermal properties. In recent years, many different techniques to improve heat transfer and are used in order to achieve a satisfactory level of thermal efficiency. Can be passively improved transfer rate change heat flow geometry and boundary conditions or by improving the thermal physical properties, for example, increasing thermal conductivity of liquids.heat transfer fluid temperature characteristics play an important development in equipment efficiency heat transfer in energy use paper. And promote the use of passive methods usually in the electronic and transport devices. But the working fluid, such as ethylene glycol, water and engine oil has poor heat dissipation. In this sense, the development of advanced heat transfer fluid with heat transfer characteristics in the presence of a strong demand. One way to improve the thermal conductivity of the fluid molecules addsmallsolid in the liquid. In addition Melli or solid particles of small size is one of thevery ancient techniques to improve heat transfer. Industrially, this technique is not attractive because inherentproblems as sedimentation, and increased pressure drop, fouling and erosion of the flow channel. Canbe overcome these problems nanofluids, a dispersion of nano-sized particles in a liquid base. nanometer sized particles increase the thermal conductivity of the base liquid, which in turn increases the heat transfer rate. This property has attracted the attention of researchers in the past decade, although the mechanism is not fully understood yet. Nanofluid is a liquid containing nano-sized particles, called infinitesimal. This liquid suspension is designed to be construed colloidal nanoparticles BUONGIORNO liquid base. usually are made of nanoparticles used in nanofluids of metals, oxides, carbides or carbon nanotubes and a common base liquids include water and ethylene glycol. Nanofluids have novel properties that make them potentially useful in many applications in the heat transfer, including microelectronics, fuel cells, pharmaceuticals engines and power generation, which has been interpreted Das et al. Exposure nanofluids improved thermal conductivity and coefficient of heat transfer of gestation, compared with the liquid base and PramuanjaroenkijKakaç. the thermal conductivity of nanofluids Fe3O4 by many researchers, most of the experimental work was explained and play to estimate the heat transfer from the coefficient of Al2O3 and copper nanofluids in a smooth tube and focused some researchers to estimate the heat transfer from

Nanofluid AL2O3 coefficient in smooth tube with coiled wire inserts twisted. The thermal conductivity of Fe3O4 magnetic Nanofluids available literature, experimental turbulent convective heat transfer and friction factor for Nanofluid Fe3O4 magnetic flux tube and the inclusion of twisted tape data is not available. The advantage of this liquid magnetic nanoparticles (Fe3O4) of basefluid as possible is separated, which is not possible with nonmagnetic (Al2O3, TiO2 and copper) type infinitesimal. This research is to estimate the heat transfer by forced convection and turbulent friction factor concentrations Fe3O4nanofluid different sizes in a tube under normal conditions turbulentflow. Based on the experimental data are generalized to the number of regression equations Winslet and put the friction factor.

II. LITERATURE REVIEW

Heat transfer plays an important role in many applications. For example, vehicles, heat generated from the main motor need be removed to complete the process. Similarly, electronic equipment, heat dissipation, requiring a cooling system. Include heating systems, ventilation and air conditioning are also various heat transfer processes. Heat transfer is an essential process in thermal power stations. Furthermore, many production processes involving heat transfer in various forms; Cooling may be the machine tool, and food pasteurization or temperature adjustment to trigger a chemical process. In most of these applications, the heat transfer is achieved through some of the heat transfer devices. Such as heat exchangers, evaporators and condensers, and heat sinks. Increase the efficiency of heat transfer of these devices is not desirable because it is through increased efficiency, the space occupied by the device can be minimized, which is important for applications with compactness requirements. Moreover, in most systems heat transfer and circulation of the working fluid through the pump, and can make improvements in the efficiency of heat transfer to reduce energy consumption associated.There are several ways to improve the efficiency of heat transfer. Some methods are the use of extended surfaces, applying vibration on the surfaces of heat transfer, and use of the tubes. It can also improve the efficiency of heat transfer by increasing the thermal conductivity of the working fluid. liquids such as water temperature and transmission ethylene commonly used engine oil has thermal connections are relatively low compared to the thermal conductivity of solids. High thermal conductivity of solid materials can be used to increase the thermal conductivity of the fluid by adding small solid particles fluid. The feasibility of using a suspension of solid particles such with sizes of the order of millimeters or micrometers have been investigated by several researchers observed significant disadvantages. These defects are particle deposition, and erosion obstructed channels of the channel walls, which prevented the practical application of the solid particles suspended in a base fluid also advanced work fluid in heat transfer applications [1,2] .

III. METHODOLOGY

With recent improvements in nanotechnology, the production of particles with sizes in the nanometer range (nanoparticles) can be achieved with relative ease. As a result, the idea of the suspension of these nanoparticles was suggested in a liquid base to improve the thermal conductivity recently [3,4]. This is called a suspension of nanoparticles in liquid Nanofluid Base. Because of their small size, nanoparticles easily fluidize within the base liquid, and as a result, clogging and erosion channels in the channel walls are no longer a problem. You can even use nanofluids in pipes [5.6]. When it comes to the stability of the suspension, it was found that the particle deposition can be prevented by using suitable dispersants. Of the most important motivations in the initial development of nanofluids is an urgent need in many industrial technologies, systems and better cooling. Inherently low thermal conductivity of the mass results in restrictions refrigerant equipment, lack of process efficiency, low thermal limits. heat rejection requirements are constantly increasing technological devices because of the small size. It is now widely recognized that the thermal management devices of nanometric size play a crucial role in the base of stability and performance optimization. It is reported that, due to the reduced phenomenon size and to increase processing speed and causing the energy density to double every three years, and degrees of heat and device access levels that prevent reliable operation [Borkar 1999]. At the macro level, the problem is also serious for internal combustion engines. With technologies extended thermal control surface (such as the use of fins and tubes) new technologies with the ability to improve the thermal properties of the cooling fluid of great importance stretched to the limits, and. Nanofluids offer a promising way forward to meet the cooling needs. For example, it may be 10 to 25% increase in the thermal conductivity of water have a huge impact on the components that use water as the cooling medium. Smaller and therefore heatable exchanger design lighter, and can be reduced by the high velocity flow, reducing energy requirements and pumping piping components less corrosive, and can improve lubrication and cooling during machining operations. At the other end of the design spectrum, you can achieve higher margins to thermal limits the size of the capabilities of the original components is maintained.

Over the past decade, research institutes and developed a research groups worldwide and focuses multidisciplinary nanofluids. Small businesses and large multinational companies working in nanofluids for their applications.Nanofluidis a new field of scientific research that has grown dramatically in the last decade. Despite a huge increase in nanofluids search, many questions about heat transfer mechanism remain unanswered nanofluids that requires further study in thisarea.

Particulate matter and liquid base

And use many different materials to prepare the Nanofluid particles. Often used Al2O3, CuO TiO2 Sik, cramps, Ag and Au nanoparticles copper and iron in Nanofluid research.Carbon nanotubes is also used due to the high thermal conductivity of (axial) highly longitudinal direction. based fluids are used primarily in the preparation of nanofluids are common working fluid for heat transfer applications. Such as water, ethylene glycol and engine oil. In order to improve the stability of the nanoparticles in the liquid base, some additions are added to the mixture in small amounts.

particle size

The nanoparticles used in the preparation Nanofluid usually have a diameter of less than 100 nm. As small as 10 nm particles were used in the search Nanofluid [7]. When the particles are not spherical, but stick or tube form, the diameter is even smaller than 100 nanometers, but the length of the particles can be in the limits micrometer. Also it is noted that due to the phenomenon of agglomeration, particles may form clusters with sizes in the micrometer range.

particle shape

spherical particles is mainly used in nanofluids. However, rod-shaped, and the use of nanoparticles in the form of a disc is also in the form of a tube. Moreover, the groups formed by the nanoparticles can be fractal-like shapes.

Production Methods

• The production of nanoparticles

Production of nanoparticles and can be divided into two main categories, namely, synthesis and physical and chemical composition. Yu et al. [8] production technology joint nanofluids are listed as follows.

Physical preparation: mechanical comminution, condensation Technology inert gas.

Chemical composition: chemical precipitation, chemical vapor deposition, well, spray pyrolysis, thermal spraying and emulsions.

• *Production Nanofluids*

There are basically two forms of Nanofluid production, a technique that the two-step technique and one step. In this technique two steps, the first step is the production of nanoparticles The second step is the dispersion of nanoparticles in a liquid base. A two-step technique is useful when mass production of nanofluids, because at present, the nanoparticles can be produced in large quantities, using a technique condensing inert gas [9]. The main drawback of this technique is that the nanoparticles form clusters two steps during the preparation Nanofluid prevents proper distribution of the nanoparticles within the liquid [8] base.

A step that combines the production of nanoparticle technology and the dispersion of nanoparticles in a liquid base in one step. There are several variations of this technique. In one of the common methods, direct evaporation method called one-step, Nanofluid sclerosis nanoparticles, which are initially the gas phase, the liquid within the base [7] occurs. Nanofluids scattering techniques produced with the characteristics of a step are better than those produced with a two-step technique [8]. The main disadvantage of the technology is a step that are not suitable for mass production, limiting [8] marketed.

IV. RESULTS

There are two ways to solve the problem stated above: (i) analytical method and (ii) CFD method. Lee and Mudwar, 2007 have used analytical method. The method consists of calculation of heat transfer coefficient (h) from either of depending on whether flow is laminar or turbulent, calculation of bulk mean temperature of fluid using Eq. 4.12 followed by the calculation of wall temperature using eq. 4.13. The results given by Lee and Mudwar, 2007 are having errors in wall temperature and mean temperature calculation at the given inlet mass flow rate. Hence, in the present study, the analytical values of heat transfer coefficients are calculated using. The heat transfer coefficients are also obtained using CFD methods and then both the values are compared.The CFD method follows the use of commercial software ANSYS CFX 13.0 to solve the problem. The specified solver uses a pressure correction based iterative SIMPLE algorithm with 1st order upwind scheme for discretizing the convective transport terms. The convergence criteria for all the dependent variables are specified as0.001. The default values of under-relaxation factor are used in the simulation work.

V. CONCLUSION

In this project, and simulate the heat transfer coefficient in the region and developed from the pipeline flow containing Fe3O4 Nanofluid water flow through the constant temperature using CFD. The focus of research to evaluate the effect of the concentration of particles the size of the properties of convective heat transfer in the region and developed from the flow tube of water containing Fe3O4 Nanofluid. It was noted that 0.6% of nanofluids showed the highest heat transfer properties of the base fluid (water).

The average coefficient of heat transfer and the Nusselt number by increasing the particle concentration and flow rate. Nanofluid average temperature decreased with increasing particle size. In this work was the study of hydrodynamics and thermal behavior of circular tubes. Considered clean water and nanofluids have (Fe3O4) in the tube channel. Simulation computational fluid dynamics (CFD) stable condition by ANSYS Fluent 13.0 models here. The effect of the Reynolds number and the number Winslet flow behavior of the pipe.

Discussed and numerical study of fluid flow and a step in the tube.And water-based fluid image using nanofluids used as a fluid medium. We can summarize the main findings of this chapter as follows.

Ø computational results validate the analytical data successfully channeled circular tubes.

 heat transfer coefficient is constant through the circular channel conditions due to advanced fully

 it increases the concentration of ultrafine particles increases the coefficient of heat transfer as well, with an increase in the number Winslet

high temperature side wall inside the trend circular flow channel in the very low simulate the response of the fluid flow of a single phase in a circular channel

 wall heat little higher degree Reynolds number has changed

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