

THERMO-HYDRAULIC PERFORMANCE OF A PLATE HEAT EXCHANGER USING CuO-Al₂O₃/WATER HYBRID NANOFLUIDS

A project report

Submitted in partial fulfilment of the requirements for the award of the
degree

**BACHELOR OF TECHNOLOGY
IN
MECHANICAL ENGINEERING**

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CERTIFICATE

This is to certify that the project entitled “**THERMO-HYDRAULIC PERFORMANCE OF A PLATE HEAT EXCHANGER USING CuO-Al₂O₃/WATER HYBRID NANOFLUIDS**” is the bonafide work done by

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in the Department of Mechanical Engineering, B. V. Raju Institute of Technology, Narsapur, Medak (Dist) and submitted to Jawaharlal Nehru Technological University, Hyderabad in partial fulfilment of the requirements for the award of B. Tech degree in Mechanical Engineering in the academic year 2020-21. This work has been carried out under my guidance.

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DECLARATION

We hereby declare that the entire project work embodied in this dissertation entitled “**THERMO-HYDRAULIC PERFORMANCE OF A PLATE HEAT EXCHANGER USING CuO-Al₂O₃/WATER HYBRID NANOFLUIDS**” has been independently carried out by us. As per my knowledge, no part of this work has been submitted for any degree in any institution, university, and organization previously.

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ABSTRACT

With the development of thermal engineering and industrial intensification, more efficient and compact heat transfer systems are needed. Therefore, many efforts have been devoted to improving the heat transfer equipment design. The plate heat exchanger (PHE) is widely used in many applications including food processing, heating and cooling applications and chemical industry for its high efficiency and compactness (low volume/surface ratio). Also during the recent times, hybrid nanofluids have appeared as an innovative group of working fluids for many heat transfer applications owing to special heat carrying characteristics. It is found from the literature review that no work has been reported on thermo-hydraulic performance of a plate heat exchanger using CuO-Al₂O₃/water hybrid nanofluids. In view of the importance, a numerical study is carried out to examine the heat transfer and pressure drop characteristics for laminar flow of CuO- Al₂O₃/water hybrid nanofluids as coolants in a plate heat exchanger under forced convection conditions in the present work. The thermo-physical properties of hybrid nanofluids are estimated using the law of mixtures and correlations available in the literature for different volume fractions of nanoparticles. The heat transport rate and pumping power features of PHE is to be numerically investigated using CuO- Al₂O₃/water hybrid nanofluids for different mass flow rates, with the volume fractions ranging from 1% to 3%. Also the numerical results are obtained to determine rate of heat transfer and pressure drop for flow of Al₂O₃-water, and CuO-water mono nanofluids and pure water in the PHE under identical conditions of mass flow rate and volume fraction of nanoparticles in nanofluid. The performance of CuO-Al₂O₃/water hybrid nanofluids is to be compared. Also the performance of PHE with CuO-Al₂O₃/water hybrid nanofluid is compared with Al₂O₃-water, CuO-water and pure water, hybrid nanofluid is to be compared with CuO-water mono nanofluids and base fluid water for heat transfer and pressure drop. The numerical results obtained for mono nanofluids are to be compared with experimental data available in the literature to validate the present model.

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