



Analysis of thermal performance of a car radiator employing nanofluid

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Abstract: In this study, thermal performance of a car radiator with employment of Ethylene Glycol/copper nanofluid in disparate environmental conditions has been investigated. The governing equations for heat transfer in the car radiator have been written and solved by using a generated computer code in different environmental states and the changes in the output nanofluid temperature have been studied. It has been shown that by increasing the values of volume fraction of nano-particles and also, Reynolds number of inlet air, one can observe a raise in the values of overall heat transfer coefficient of the air side and the rate of heat transfer. Furthermore, it is observed that by adding nano-sized particles to the coolant fluid in radiator, one can significantly reduce its output temperature. In addition, it has been demonstrated that by adding 5% of nano-particles to the coolant fluid, thermal performance of the radiator in a hot weather of 50° C can be better than its performance in the weather of 20° C.

Keywords: Nanofluid, Thermal Performance, Car Radiator, Environmental Conditions, Numerical Analysis

1. Introduction

Technical improvement in car industries has augmented the need for engines with high efficiencies. High efficiency of an engine is not only dependant on its function, but also it relies on the optimal fuel consumption and lower production of pollution. Reducing the weight of a car with optimal design of its radiator is a necessity for ecological systems. Adding fins is one of the ways to increase the rate of cooling in automobile radiators, in which more amounts of surface for heat transfer is created and convection heat transfer of air can enhance. Nonetheless, this method has been the subject of study of many researchers in the past and has almost reached its limit. One of the other proposed ways to increase the rate of heat transfer in automobile radiators is the employment of a coolant fluid with high conductivity coefficient or augmentation of the conductivity in a common coolant fluid.

Due to the fact that the conduction coefficient of coolant fluids such as water or ethylene glycol is very low, increasing their conductivity has been the taken into

consideration by numerous scientists. So far, there has been vast number of theoretical and experimental studies on enhancing the conduction heat transfer of a fluid by suspending very small particles in them, which is a new approach in thermal sciences. In this regard, Maxwell [1] did some experiments in which he added some particles in the size of micron and nano to the fluid. The problem encountered in these fluids was the fact that particles settled in the bottom of the tank and also the flow rate of fluid reduced. Furthermore, corrosion in the pipes and significant pressure drops in the flows were another disadvantages of these fluids.

In comparison with micron-sized particles, since nano-particles have a high ratio of area to volume, they can create more stable suspensions; therefore, they can highly reduce the amount of sediments in the pipes and channels. Adding metallic materials with the size of nano to common fluids such as water, ethylene glycol and industrial oil, was first presented by Choi [2]. In addition, studies have demonstrated that adding metallic particles to base fluids can notably result in the raise of conductivity in fluids [3,4].

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Preparation, Characterization, Properties, and Application of Nanofluid I. M. Mahbubul, 2018-09-20 Preparation Characterization Properties and Application of Nanofluid begins with an introduction of colloidal systems and their relation to nanofluid Special emphasis on the preparation of stable nanofluid and the impact of ultrasonication power on nanofluid preparation is also included as are characterization and stability measurement techniques Other topics of note in the book include the thermophysical properties of nanofluids as thermal conductivity viscosity and density and specific heat including the figure of merit of properties In addition different parameters like particle type size concentration liquid type and temperature are discussed based on experimental results along with a variety of other important topics The available model and correlations used for nanofluid property calculation are also included Provides readers with tactics on nanofluid preparation methods including how to improve their stability Explores the effect of preparation method and stability on thermophysical and rheological properties of nanofluids Assesses the available model and correlations used for nanofluid property calculation

Fluid Mechanics and Fluid Power (Vol. 1) Suvanjan Bhattacharyya, Himadri Chattopadhyay, 2023-03-29 This book presents the select proceedings of the 48th National Conference on Fluid Mechanics and Fluid Power FMFP 2021 held at BITS Pilani in December 2021 It covers the topics such as fluid mechanics measurement techniques in fluid flows computational fluid dynamics instability transition and turbulence fluid structure interaction multiphase flows micro and nanoscale transport bio fluid mechanics aerodynamics turbomachinery propulsion and power The book will be useful for researchers and professionals interested in the broad field of mechanics

Progress in Engineering Technology V Muhamad Husaini Abu Bakar, Tajul Adli bin Abdul Razak, Andreas Öchsner, 2023-05-27 The book contains a selection of peer reviewed papers from the 2022 conferences which took place at the Universiti Kuala Lumpur Malaysian Spanish Institute UniKL MSI Kedah Malaysia This book contains twenty two papers written by researchers participating in the conferences Topics covered in this book include composite materials thermodynamics vibration dynamics of structures manufacturing processes computer aided manufacturing CFD analysis design and optimization of devices and procedures The topics are commonly encountered in industries and become an interest in the academic world The learning of engineering technology s curricular across universities is now an essential topic covered in various higher learning institutions Therefore it is hoped that this book serves as an excellent reference for researchers and graduate students working with on multidisciplinary engineering technology

Nanofluids Shriram S. Sonawane, Parag P. Thakur, 2024-07-02 Nanofluids provides insight to the mathematical numerical and experimental methodologies of the industrial application of nanofluids It covers the fundamentals and applications of nanofluids in heat and mass transfer Thoroughly covering the thermo physical and optical properties of nanofluids in various operations the book highlights the necessary parameters for enhancing their performance It discusses the application of nanofluids in solar panels car radiators boiling operations and

CO₂ absorption and regeneration The book also considers the numeric approach for heat and mass transfer and applications in addition to the challenges of nanofluids in industrial processes The book will be a useful reference for researchers and graduate students studying nanotechnology and nanofluids advancements within the fields of mechanical and chemical engineering

Applications of Nanofluids in Chemical and Bio-medical Process Industry Shriram S. Sonawane, Hussein A. Mohammed, Arvind Kumar Mungray, Shirish H. Sonawane, 2022-06-17 Applications of Nanofluids in the Chemical and Biomedical Process Industry provides detailed knowledge about the mathematical numerical and experimental methodologies of the application of nanofluids in heat transfer mass transfer and biomedical processes The book is divided into three main sections with the first providing a detailed overview of the thermophysical and optical properties of nanofluids enhancement in heat exchangers and boiling operations The second section gives a detailed overview of nanofluid application in CO₂ absorption regeneration and metal extraction stripping operations while the third provides an overview of the application of nanofluids in biomedical processes The book includes recent advances as well as challenges to nanofluid applications in industrial processes and will be useful for researchers and professionals working in industry or academia as well as others interested in the applications of the nanofluids to industrial processes for design purposes Includes numerical and experimental investigations of hybrid and mono nanoparticle based nanofluids Investigates the comparative performance of various nanofluids for CO₂ absorption regeneration and metal extraction stripping operations Covers industrial operation challenges and scale up challenges for nanofluid applications in the industrial process

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Advanced Functional Materials for Sustainable Environments R. K. Kotnala, Anjali Sharma Kaushik, S. Shankar Subramanian, Amit K. Vishwakarma, 2024-09-30 The book gives an insight into the latest research going on worldwide in the area of functional materials that specifically utilized for the energy harvesting storage and environmental monitoring Since the technology is moving very fast day by day it has become a need

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Nanofluids for Heat and Mass Transfer Bharat Bhanvase, Divya Barai, 2021-04-29
Nanofluids for Heat and Mass Transfer Fundamentals Sustainable Manufacturing and Applications presents the latest on the performance of nanofluids in heat transfer systems Dr Bharat Bhanvase investigates characterization techniques and the various properties of nanofluids to analyze their efficiency and abilities in a variety of settings The book moves through a presentation of the fundamentals of synthesis and nanofluid characterization to various properties and applications Aimed at academics and researchers focused on heat transfer in energy and engineering disciplines this book considers sustainable manufacturing processes within newer energy harvesting technologies to serve as an authoritative and well rounded reference Highlights the major elements of nanofluids as an energy harvesting fluid including their preparation methods characterization techniques properties and applications Includes valuable findings and insights from numerical and computational studies Provides nanofluid researchers with research inspiration to discover new applications and further develop technologies

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Analysis Of Thermal Performance Of A Car Radiator Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Analysis Of Thermal Performance Of A Car Radiator**," published by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we shall delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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