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An automotive radiator with multi-walled carbon-based nanofluids: A study on heat transfer optimization using MCDM techniques

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ABSTRACT

In this work, multi-criteria decision-making (MCDM) techniques namely the additive ratio assessment (ARAS) method and the combinative distance-based assessment (CODAS) are applied for predicting the automobile radiator performance under 27 different operating conditions using multiwall carbon nanotubes (MWCNTs)- based nanofluid. The multiwall carbon nanotubes (MWCNTs) – SG-based nanofluids were prepared at different concentrations of 0.2, 0.4, and 0.6 vol %. Thermal transport properties namely density, specific heat capacity, thermal conductivity, and viscosity of solar glycol (SG) – MWCNTs based nanofluids were measured experimentally. The three different types of SG – MWCNTs based nanofluids used at different mass flow rates in the present study as 30, 60, and 90 g/s. The developed regression formulae for input parameters are inlet temperature of the nanofluids (°C), volume concentrations of the nanofluids (%), and the mass flow rate of the nanofluids (g/sec), and responses are Nusselt number and friction factor was determined. The optimum parameters from the MCDM technique are obtained at experiment number 21 as a temperature of nanofluid 70 °C, volume concentrations of the nanofluids 0.2%, and mass flow rate 90 g/s under ARAS and CODAS technique. The experimental outcomes displayed a maximal enhancement of the "*Nu*" by 18.39% with an inlet temperature of 70 °C, 0.6% of MWCNTs nanomaterials, and a mass flow rate of 90 g/s (Exp. number27). The maximal rise of "*ff*" by 0.25 with an inlet temperature of 70 °C, 0.6% of MWCNTs nanoparticles, and a mass flow rate of 30 g/s (Exp. number 25). The outcomes of the regression analysis designated those substantial input factors for enhancing the thermal transfer with the automobile radiator.

1. Introduction

The cooling system is a heart of an automobile engine that is used for removing heat from engine heat to the ambient with a help of

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