Accepted Manuscript

Optimization of MWCNTs (10%) –Al_2O_3 (90%)/10W40 nanofluid viscosity using experimental data and artificial neural network

Mohammad Hemmat Esfe, Mahdi Reiszadeh, Saeed Esfandeh, Masoud Afrand

PII: S0378-4371(18)30912-9
DOI: https://doi.org/10.1016/j.physa.2018.07.040
Reference: PHYSA 19865

To appear in: *Physica A*

Received date : 24 February 2018
Revised date : 1 June 2018

Please cite this article as: M.H. Esfe, M. Reiszadeh, S. Esfandeh, M. Afrand, Optimization of MWCNTs (10%) –Al_2O_3 (90%)/10W40 nanofluid viscosity using experimental data and artificial neural network, *Physica A* (2018), https://doi.org/10.1016/j.physa.2018.07.040

Optimization of MWCNTs (10%) – Al_2O_3 (90%)/10W40 Nanofluid Viscosity Using Experimental Data and Artificial Neural Network

Mohammad Hemmat Esfe[1,*], Mahdi Reiszadeh[2], Saeed Esfandeh[3], Masoud Afrand[4,*]

1- Department of Mechanical Engineering, Imam Hossein University, Tehran, Iran

2- Department of Mechanical Engineering, Shahreza Branch,Islamic Azad University,Shahreza,Iran.

3- Department of Mechanical Engineering, Kashan university, Kashan, Iran

4- Department of Mechanical Engineering, Najafabad Branch, Islamic Azad University, Najafabad, Iran

* Corresponding Authors
E-mails: m.hemmatesfe@gmail.com (M. Hemmat Esfe)
masoud.afrand@pmc.iaun.ac.ir (M. Afrand)

Abstract

The present study aimed at predicting the viscosity of MWCNT (10%)-Al_2O_3 (90%) hybrid nanofluid in the lubricant 10W40 using artificial neural networks (ANNs). Artificial neural network modeling was performed in the temperature range of 5-55 °C at different volumetric fractions of 0.05 to 1% using 174 experimental data. Three inputs and one output (viscosity) were determined for ANN. The MLT-artificial neural network (MLT-ANN) was used in this study. The results showed the accuracy and reliability of the proposed model according to criterions of R-squared and mean square error. According to the results of one factor and two factor analysis, temperature variation had the greatest effect on viscosity in comparison to shear rate and solid volume fractions. Also a correlation was proposed to predict the viscosity of the hybrid nanofluid with 10W40 fluid as its base fluid in terms of temperature, solid volume fraction and shear rate. The R-squared values for the new correlation and ANN were 0.99703 and 0.9998, respectively.

Keywords: Nano-lubricants; Artificial neural networks; MLP neural network; Rheological behavior