



Determining the best structure for an artificial neural network to model the dynamic viscosity of MWCNT-ZnO (25:75)/SAE 10W40 oil nano-lubricant

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Abstract

In this paper, an artificial neural network (ANN) was utilized to examine the dynamic viscosity of MWCNT-ZnO (25:75)/SAE 10W40 oil nano-lubricant. The effect of temperature, shear rate (SR) and solid volume fraction (SVF) on dynamic viscosity is studied at a temperature ranging from $T=5-55^{\circ}\text{C}$, SR varying SR=50-900rpm, and SVF=0.05-1%. A set of 172 experimental data is determined and applied as a training dataset of ANNs with various structures. A two-layer ANN with 17 neurons in the hidden layer is selected with $R^2=0.9999$ and $\text{MSE}=7.77\text{e-}5$ to predict the dynamic viscosity. Results show that SR is the most influential parameter having an inverse effect on the dynamic viscosity, i.e. by increasing this parameter from 50 to 900rpm, the viscosity reduces from 600cP to 40cP.