Using neural network and RSM to evaluate improvement in thermal conductivity of nanodiamond-iron oxide/antifreeze

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Abstract

This study aimed to investigate the accuracy of the artificial neural network in estimating thermal conductivity (k) of ferrofluid-based nanofluids. The parameters of $k_{ND+Fe_2O_3/EG-water}$ and $k_{EG-water}$ have been measured at 20–60 $^{\circ}C$, 0.05, 0.1, and 0.2 vol.% and the results showed that $k_{Fe_2O_3/EG-water}$ was greater than $k_{EG-water}$ by 89%, which is obtained at 60 $^{\circ}C$ and 0.2 vol.%. To estimate $k_{ND+Fe_3O_4/EG-water}$ a three-layer ANN was developed that contained two, three, and one neurons, respectively. This neural network was able to estimate $k_{ND+Fe_3O_4/EG-water}$ with less than 0.8% error considering of $R^2 = 0.996$. The response surface methodology was also implemented,