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Prediction and extensive analysis of MWCNT-MgO/oil SAE 50 hybrid nano-lubricant rheology utilizing machine learning and genetic algorithms to find ideal attributes

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Abstract

Genetic algorithms and machine learning methods can accurately anticipate hybrid nanofluids' complicated rheology. Scientists and engineers can understand hybrid materials by using genetic algorithms to optimize and machine learning to discover complicated relationships between input variables and rheological responses. As a continuation of the author's previous research on the rheological properties of a nano-lubricant based on engine oil and hybrid nanoparticles, this study uses machine learning and genetic algorithms to theoretically assess the dynamic viscosity of the MWCNT-MgO/oil SAE 50 hybrid nanofluid and identify optimal properties. MLR, D-Tree, Ridge, PLR, SVM, Lasso, ECR, GPR, and MPR are used for regression analysis. Best multi-objective issue solutions are represented by the Pareto front. The NSGA-II algorithm determines the Pareto front. The MPR and NSGA-II algorithms provide a Pareto front with the most precise optimal spot boundaries. The Weighted Sum Method (WSM) simplifies multi-objective problems into single-objective problems, making optimal solutions easier to find. The results show that the maximum margin of deviation for μ_{nf} and τ is −2.5615 and −5.239, respectively. According to the Taylor chart, the best μ_{nf} mode for R, RMSE and STD is equal to 0.9983, 7.6639, 130.0056. Also, these values for τ are equal to 0.9996, 15.4515, and 516.0219.