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Fatigue S-N curve parameters prediction of Steels based on Machine learning models

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Fatigue analysis heavily relies on understanding the stress-life (S-N) curve. Factors such as chemical composition, tensile and hardness properties also influence the analysis, as suggested in studies by [1][2]. Recent research has shown significant potential for using Machine Learning to predict material properties based on chemical composition and hardness, [3]. However, in this context, the most predicted mechanical properties are the Ultimate Tensile Strength and Yield Strength. While fatigue life prediction has still been poorly addressed. Therefore, this work delves into fatigue analysis and explores the intricate relationship between material properties such as chemical composition, tensile, and hardness properties, and fatigue life prediction. The aim is to employ Principal Component Analysis (PCA) and clustering techniques to identify material families and validate the findings of [1]. Additionally, the investigation extends to the comparison of predictive models, specifically a Fully Connected Neural Network (FCNN) and Random Forest (RF), against the traditional Coffin-Manson equation. Leveraging a comprehensive steel database, results demonstrate promising accuracy in predicting S-N curve parameters.

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