

Fatigue life prediction in presence of mean stresses using domain knowledge-integrated ensemble of extreme learning machines

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Abstract

An accurate and stable data-driven model is proposed in this work for fatigue life prediction in presence of mean stresses. In the model, multiple independent extreme learning machines are trained using different training data and neural network configurations, and are then combined equally in an ensemble to model the complex correlations between fatigue life, material properties and mechanical responses. Meanwhile, theoretical prediction, as a representation of domain knowledge, is integrated to optimize the data-driven processes of model training and prediction, diversifying the information source of fatigue life modeling. Extensive experimental results covering thirteen metallic materials and a wide range of mean stress levels are collected from the open literature for model training and evaluation. The results demonstrate that the proposed model can achieve high accuracy and good stability [simultaneously](javascript:;), even with a small training dataset, showing great applicability for fatigue life prediction under mean stress loading conditions.

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