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Mathematical model for the prediction of strength degradation of composites subjected to constant amplitude fatigue

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Abstract

Residual strength models are widely used for the fatigue analysis of composites subjected to both constant and variable amplitude fatigue. However, they often require large experimental efforts to determine the model parameters. The aim of this research is to develop a simplified mathematical model which uses a single set of parameter values to predict the strength degradation of the elements subjected to different load levels, and thus, to reduce the required experimental effort for the determination of model parameters for each load level separately. The new two-parameter model is developed here on the basis of normalization of the difference between the residual strength and maximal applied load in the constant amplitude cyclic loading, herein referred to as the strength reserve, with respect to initial conditions. The model is validated using different experimental data sets from the literature. High correlation with the experimental data is observed. Moreover, the curves obtained by using the single set values of parameters matched the curves of some of the most accurate residual strength models from the literature.

Keywords: Fatigue, composites, residual strength, mathematical model, constant amplitude

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