

## Development and Identification of a Probabilistic Two-Scale Model for High Cycle Fatigue Prediction

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The present paper is concerned with the development of a probabilistic two-scale model for HCF that accounts for the failure of sample but also for the thermal effects during cyclic loadings. We assume that HCF damage is localized at the microscopic scale. So the microplasticity appears without affecting the behaviour of the material at the macroscopic scale. The development of the model is presented in three successive stages. In the first one, the model is deterministic and we show how to interpret the thermal effects by integrating the conduction heat equation. So we justify the empirical method proposed to estimate quickly the mean fatigue. We improve then the model by introducing a probabilistic characteristic at the microscopic scale. We assume that the number of active sites, i.e. a site whose the microplasticity appears, follows a Poisson process. We show that the new model represents better the thermal effects than the first model. With this approach the scatter can be determined but not the mean fatigue limit of a fatigue sample. A method of identification is also proposed. It is based on the analysis of the thermal effects for the scatter and is applied on a dual-phase steel. A first validation of the model is effected by predicting the scatter of the S/N curve. And a second validation is proposed by showing a good agreement between the experimental result and the predicted model for bending fatigue test.

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