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Hierarchical Bayesian fatigue data analysis

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Abstract

The problem minimizing the number of specimens required for fatigue data analysis is considered in this research. Assuming unknown hyperparameters described via prior distributions, a hierarchical Bayesian model with accumulated prior information was proposed to deal with this issue. One of the main advantages of hierarchical Bayesian model over the empirical Bayesian model is that the prior distributions with hierarchical structure can incorporate structural prior and subjective prior simultaneously. The probabilistic stress-cycle (P - S - N) curves are generated from the predictive distributions, involving both the randomness of parameters and the scatter of observations, and calculated by an identical hierarchical structure. The numerical calculation is done via the Gibbs sampler, which makes the whole process simple and intuitive.

Keywords:

Fatigue data analysis, P - S - N curves, Hierarchical Bayesian model, Bayesian inference, Markov chain Monte Carlo

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