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Adaptive Design and Inference for a Step-Stress Accelerated Life Test

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Advancement in manufacturing has significantly extended the lifetime of a product while at the same time it made harder to perform life testing at the normal operating condition due to the extensively long life spans. Accelerated life tests (ALT) can mitigate this issue by testing units at higher stress levels so that the lifetime information can be acquired more quickly. The lifetime of a product at normal operation can then be estimated through extrapolation using a regression model. However, there are potential technical difficulties since the units are subjected to higher stress levels than normal. In this work, we develop an adaptive design of a step-stress ALT in which stress levels are determined sequentially based on the information obtained from the preceding steps. After each stress level, the estimates of the model parameters are updated and the decision is made on the direction of the next stress level by using a design criteria such as D- and C-optimality. Assuming the popular log-linear assumption between the mean lifetime and stress levels, this adaptive design and inference are illustrated based on exponential lifetimes with progressive Type-I censoring.

Keywords

accelerated life tests; adaptive design; step-stress loading

Special/invited session

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