Contribution ID: **76** Type: **not specified**

Order-Restricted Bayesian Inference and Optimal Designs for for the Simple Step-Stress ALT

Monday, 17 May 2021 10:40 (20 minutes)

We investigate the order-restricted Bayesian estimation and design optimization for a progressively Type-I censored simple step-stress accelerated life tests with exponential lifetimes under both continuous and interval inspections. Based on the three-parameter gamma distribution as a conditional prior, we ensure that the failure rates increase as the stress level increases. In addition, its conjugate-like structure enables us to derive the exact joint posterior distribution of the parameters without a need to perform an expensive MCMC sampling. Upon these distributional results, several Bayesian estimators for the model parameters are suggested along with their individual/joint credible intervals. We then explore the Bayesian design optimization under various design criteria based on Shannon information gain and the posterior variance-covariance matrix. Through Monte Carlo simulations, the performance of our proposed inferential methods are assessed and compared between the continuous and interval inspections. Finally, a real engineering case study for analyzing the reliability of a solar lighting device is presented to illustrate the methods developed in this work.

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Session Classification: Sensitivity/design optimization

Track Classification: Data Science in Process Industries