Applied Mathematical Modelling
Volume 62, October 2018, Pages 383-403

Bayesian accelerated life test plans for series systems with Weibull component lifetimes

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Highlights

- This article presents optimal Bayesian ALT plans for series systems.
- Independent and dependent component lifetimes are considered.
- Component lifetimes are assumed to follow Weibull distributions.
- Optimal plans are obtained by solving constrained optimization problems.
- Global optimality of the ALT plans is ensured using General Equivalence Theorem.

Abstract

This article presents optimal Bayesian accelerated life test plans for series systems under Type-I censoring scheme. First, the component lifetimes are assumed to follow independent Weibull distributions. The scale parameters of Weibull lifetime distributions are related to the external stress variable through a general stress translation function. For a fixed number of design points, optimal Bayesian ALT plans are first obtained by solving constrained optimization problems under two different Bayesian design criteria. The global optimality of the resulting fixed-point optimal designs is then verified via the General Equivalence Theorem. This article also provides the optimized compromise ALT plans which are extremely useful in real-life applications. A detailed sensitivity analysis is then performed to find out the effect of various planning inputs on the resulting optimal Bayesian ALT plans. A simulation study is then conducted to visualize the resulting sampling variations from the optimal Bayesian ALT plans. Finally, this article considers a series system with dependent component lifetimes. Optimal ALT plans are obtained assuming a Gamma frailty model.