



Bayesian Inference For Step-Stress Accelerated Life Testing Using Generalized Eyring Exponential Model Under Type II Censoring

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Abstract

In this study, we introduce an accelerated life testing methodology under combined stress conditions, incorporating both thermal and non-thermal stress factors into the Eyring model framework. It is assumed that the lifetime of products follows an exponential distribution, which is well-suited for modeling time-to-failure data in reliability analysis. To estimate the model parameters, a Bayesian estimation strategy is used under three different loss functions: the squared error loss function, the general entropy loss function, the linear exponential loss function. The Bayesian framework enables flexible and robust inference by incorporating prior knowledge and adapting to diverse decision-making scenarios. The proposed methodology offers reliability engineers an effective tool for estimating product lifetime under complex stress conditions, enhancing predictive accuracy and supporting accelerated life testing applications. A simulation study was conducted to compare the performance of Bayesian estimates with maximum likelihood estimation. Finally, a real life application was considered for illustration purposes.

Keywords Step-stress ALT · Generalized Eyring Exponential distribution · Type-II censoring · Bayesian estimation

Mathematics Subject Classification 62E10 · 62F15 · 62N05 · 60E05 · 62P30 · 62N01 · 62N02

1 Introduction

Accelerated life testing (ALT) has become a cornerstone approach for rapidly assessing product failure behavior in reliability engineering. When products exhibit high

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