Reliability Analysis of the Newly Power Half-Normal Model via Improving Adaptive Progressive Type II Censoring and Its Applications

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Abstract

Anew statistical model, called the power half-normal (PHN) lifetime model, has been introduced by incorporating an additional shape parameter into the traditional half-normal distribution. The study is conducted using incomplete data obtained through a novel censoring strategy known as improved-adaptive progressive censoring of Type II. This strategy ensures that the test will not go on for too long and stops it after a certain number of failures have been recorded. Using both likelihood and Bayesian approaches, we estimate the parameters of the PHN model and assess associated reliability time features when dealing with the proposed censored data. Assuming independent gamma priors for the model parameters, Bayesian inference is performed using a Markovian chain sampler in Monte Carlo based on the squared-error loss (SEL). Various methods are employed to construct interval estimators, including asymptotic intervals based on likelihood and log-likelihood, along with two types of Bayesian credible intervals. Extensive simulations are carried out through computer programming to assess the accuracy and performance of the estimators. Additionally, four different criteria are used to identify the optimal removal design. To show how well the suggested model works in real-life situations, we looked at two sets of genuine data as follows: one from the engineering domain involving electrical appliance failure data and another from the cases of coronavirus disease 2019 in Saudi Arabia. The same applications show that the PHN model provides a superior fit compared to eight alternative models previously studied, including half-normal, generalized half-normal, alpha-power exponential, generalized exponential, Nadarajah–Haghighi, Weibull, and gamma.

Keywords

Bayesian and likelihood, improved adaptive censoring, Markovian chain, optimum removal, power half-normal model, survival analysis.

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