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A computational algorithm for the evaluation on the lifetime performance index of products with Rayleigh distribution under progressive type I interval censoring

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Abstract

It is a very important topic these days to assessing the lifetime performance of products in manufacturing or service industries. Lifetime performance indices C_L is used to measure the larger-the-better type quality characteristics to evaluate the process performance for the improvement of quality and productivity. The lifetimes of products are assumed to have Rayleigh distribution. The maximum likelihood estimator is used to estimate the lifetime performance index based on the progressive type I interval censored sample. The asymptotic distribution of this estimator is also developed. We use this estimator to build the new hypothesis testing algorithmic procedure with respect to a lower specification limit. Finally, two practical examples are given to illustrate the use of this testing algorithmic procedure to determine whether the process is capable.

Keywords: Censored sample; Rayleigh distribution; Maximum likelihood estimator; Process capability indices; Testing algorithmic procedure

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1. Introduction

In the manufacturing industries, the quality of products is a very crucial factor for the concerns of most consumers. For measuring the quality of products, process capability indices (PCIs) including C_p, C_{pk}, C_{pm} and C_{pmk} had been widely used to measure the target-the-better type quality characteristics with bilateral tolerances(See Montgomery [1] for more examples and details). The lifetime of products is expected to be a larger-the-better type quality characteristic, the index C_L is considered to assess the performance of lifetime following a Burr XII distribution. For exponential distribution lifetime, Tong *et al.* [2] constructed the uniformly minimum variance unbiased estimator (UMVUE) of C_L and built a hypothesis testing procedure for the complete sample. Laumen and Cramer [3] proposed the Inference for the lifetime