Economic Designs of Life Test Sampling Plans for Repairable Products

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Economic life test sampling plans for repairable products which are sold under a general rebate warranty policy are proposed. The power law process which is a nonhomogeneous Poisson process with an intensity function

$$v(t) = \lambda \beta t^{\beta-1}, \quad t > 0 \tag{1}$$

is considered as a model for describing the failure times of products. It is assumed that the products in each lot have the same failure intensity function given by (1), but the parameters λ and β are random variables varying from lot to lot according to a known prior distribution. A discrete prior distribution on β and a gamma prior distribution on λ are used. A test procedure with both time and failure truncation is considered;

A sample of size n is placed on test simultaneously and test continues until either the r-th failure occurs or a fixed test time t_0 is reached, whichever comes first. If the r-th failure occurs first, the lot is rejected and otherwise, the lot is accepted.

Cost models are constructed which involve three cost components ; test cost, accept cost, and reject cost. Test cost consists of the costs associated with the length of test duration and the number of test items. Accept cost is the external failure cost associated with the products in the accepted lot. Reject cost is scrap or reprocessing cost for products in the rejected lot. Methods of finding optimal sampling plans which minimize the expected average cost per lot are presented and numerical examples are given. Sensitivity analyses for parameters of the prior distribution are performed and the results indicate that the sampling plan

based on the expected cost is reasonably robust to small changes in the parameters of the prior distribution.