

Multi-mode Failure Models for Attribute Test Data in Reliability Systems, a Bayesian Analysis Approach Using Multi-nomial Distribution Model

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Abstract. This paper describes the extending model of Multi-mode Failure Models by using the Weibull and Gamma distribution models presented in a conference [1,2]. Different than the models in the previous papers which are for variable test data, in this paper we will describe the use of attribute test data for our model. In reliability theory, the most important problem is to determine the reliability of a complex system from the reliability of its components. The weakness of most reliability theories is that the systems are described and explained as simply functioning or failed. In many real situations, the failures may be from many causes depending upon the age and the environment of the system and its components. Another problem in reliability theory is one of estimating the parameters of the assumed failure models. The estimation may be based on data collected over censored or uncensored life tests. In many reliability problems, the failure data are simply quantitatively inadequate. The Bayesian analyses are more beneficial than classical analyses in such cases. The Bayesian estimation analyses allow us to combine past knowledge or experience in the form of an apriori distribution with life test data to make inferences of the parameter of interest. In this paper, we have investigated the application of the Bayesian estimation analyses to multi-mode failure systems for attribute test data. The cases are limited to the models with independent causes of failure. We select our investigation by using the Multi-nomial distribution as our model. This distribution is widely used in reliability analysis for attribute test data. This model describes the likelihood function and follows with the description of the posterior function. A Beta prior is used in our analysis for each model and it is followed by the estimation of the point, interval, and reliability estimations.

Keywords: Multi-mode failure systems, Attribute test data, Likelihood function, and Posterior/prior function.