

Dichotomous-Data Reliability Models with Auxiliary Measurements

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Abstract

We propose an innovative model for study reliability data that contains a dichotomous and several continuous repeated observations, all measured from same experiment units. The dichotomous response indicates whether the unit fails or not at the measuring time. The continuous repeated responses are regarded as surrogate measurements of an underlying degradation process. The objective of the study is to decide, based on the dichotomous observations, which repeated response is the best surrogate. In the model, the lifetime of experiment units, which cannot be directly observed, is considered as a latent variable that plays a role of linking the two types of observed responses. To evaluate the validity of individual repeated responses as degradation measurements, we provide a criterion called correct classification probability (CCP) to select the best degradation measurement. We also show that with the help of repeated responses, the estimation efficiency can be significantly improved. In the end, the methodology is applied to the analysis of electro-explosive device (EED) data.