

Non-Decreasing Degradation Data Analysis

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Abstract

For high-reliability products, degradation analysis is a commonly used tool to predict the product's lifetime. For the degradation model, the gamma process (GP) model is widely applied to the monotonic degradation path. However, when the degradation path exhibits a non-decreasing situation, the GP model can't be used to analyze this kind of data. In this work, we develop the non-decreasing gamma process model incorporated mixture probability distribution to deal with the non-decreasing degradation data. Furthermore, taking the fact that the degree of decay is violent with tested time into account, we consider the probability of zero-increment should be affected by the tested time. Therefore, we propose the non-homogeneously non-decreasing gamma process (NNGP) model incorporated assuming the probability of zero-increment to be a function of time. Based on the simplified method of multiple optimizations, the maximum likelihood estimates of the NNGP model parameters can be obtained as well as the reliability prediction. Simulation studies is carried out to examine the NNGP model. Finally, a real data is applied to the proposed NNGP model to reveal the benefits. (This is joint work with Shi- Hong Chen)

Keywords: Non-decreasing; Degradation; Gamma process; Non-homogeneous.