

Degradation Analysis with Measurement Errors

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Degradation models are widely used to assess the lifetime information for highly reliable products. When there are measurement errors in monotonic degradation paths, unsuitable model assumptions can lead to contradictions between physical/chemical mechanisms and statistical explanations. This study presents a Lévy degradation-based process that simultaneously considers the unit-to-unit variability, the within-unit variability and the measurement error in the degradation data. Several case studies show the advantages of the proposed models. This paper also uses a separation-of-variables transformation with a quasi-Monte Carlo-type method to estimate the model parameters and provides a simple model-checking procedure to assess the validity of model assumptions.

Keywords: bootstrap, gamma process, inverse Gaussian process, random effect, Wiener process.
