

Optimal Test Planning for Heterogeneous Wiener Processes

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Abstract

Degradation models based on heterogeneous Wiener processes are commonly used to assess information on the lifetime of highly reliable products. An optimal test plan given limited resources is generally obtained using numerical methods for heterogeneous Wiener processes. However, numerical searches for optimal test plans have the disadvantage of being time-consuming and may provide unclear explanations for the findings. To overcome these difficulties, we derive an explicit expression for decision variables (such as the termination time, number of measurements, and sample size) of D - and V -optimal test plans with cost constraints. The theoretical results not only ensure that the optimal test plan is found, but also provide clear insights into the decision variables affected by model parameters and experimental costs. Some numerical examples are presented to support the efficiency and applicability of the optimal test plans.

Keyword: First passage time, Intraclass correlation coefficient, Invariance, Mean-time-to-failure, Random coefficients