Optimal step-stress accelerated degradation test plan for Gamma process

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Abstract

Step-stress accelerated degradation test (SSADT) is a useful tool for assessing the lifetime distribution of highly reliable products (under a normal-use condition) when the available test items are very few. Recently, an optimal SSADT plan has been proposed in the literature which is based on the assumption that the underlying degradation path follows a Wiener process. However, the degradation model of many materials (especially in the case of fatigue data) maybe more appropriately modeled by a Gamma process which exhibits a monotone increasing pattern. Hence, in practice, designing an efficient SSADT plan for Gamma degradation process is of great interest. In this paper, we first introduce the SSADT model when the degradation path follows a Gamma process. Next, under the constraint that the total experimental cost does not exceed a constrained budget, the optimal settings such as sample size, measurement frequency, and termination time are obtained by minimizing the approximate variance of the estimated MTTF of the lifetime distribution of the product. Finally, an example is presented in order to illustrate the proposed method.