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Failure Inference and Optimization for Step Stress Model Based on Bivariate Wiener Model

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Abstract : In this paper, we consider the situation under a life test, in which the failure time of the test units are not related deterministically to an observable stochastic time varying covariate. In such a case, the joint distribution of failure time and a marker value would be useful for modeling the step stress life test. The problem of accelerating such an experiment is considered as the main aim of this paper. We present a step stress accelerated model based on a bivariate Wiener process with one component as the latent (unobservable) degradation process, which determines the failure times and the other as a marker process, the degradation values of which are recorded at times of failure. Parametric inference based on the proposed model is discussed and the optimization procedure for obtaining the optimal time for changing the stress level is presented. The optimization criterion is to minimize the approximate variance of the maximum likelihood estimator of a percentile of the products' lifetime distribution.

Keywords : bivariate normal, Fisher information matrix, inverse Gaussian distribution, Wiener process
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