

Proceedings of the 3rd Annual World Conference
of the Society for Industrial and Systems Engineering,
San Antonio, Texas, USA
October 20-22, 2014

A Multivariate Degradation Model Based on a Trivariate Gamma Process

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Abstract: This article considers that a device under study is affected by multiple environmental conditions, if these conditions are dependent it is important to find models that jointly consider the effects of multiple Accelerating Variables (AV) into a multivariate model in order to make accurate inferences about the reliability of the device. The degradation of any product will always be positive and strictly increasing, due to this the gamma process is considered to be the best way to model a degradation process given that it has independent an non-negative increments. We consider that three AVs have an effect on the degradation of some performance characteristic of a product and that each AV can be modeled marginally considering the shape parameters of the gamma processes, if the scale parameters are equal then is possible to obtain a joint trivariate gamma process via partial cumulative sums. The marginal gamma processes are defined based on the three AVs and the trivariate gamma is deducted including a general scheme of test based on the AVs.

Keywords: Degradation, Trivariate Gamma Process, Performance Characteristic