Asigurarea Calităţii – Quality Assurance, ISSN 1224–5410
Vol. XV, Issue 58, April-June 2009
Pages 24 - 29

Optimization of a Step-stress Accelerated Life Test Plan by Genetic Algorithm

Pascal LANTIERI[1], Fabrice GUERIN[2]
[1] LPMI, Arts & Metiers ParisTech, CER Angers, Angers, France; [2] LASQUO, Université d'Angers, Angers, France
fabrice.guerin@istia.univ-angers.fr

Abstract
The accuracy of estimates obtained from a step-stress accelerated test (SSALT) depends on the distribution of failures among the different stress levels. When prior estimates are available for the lifetime parameters, random generation of times-to-failure can be used to simulate different SSALT defined with given profiles. Then, the simulation results can be processed to obtain posterior estimates and thus errors with prior estimates. The best SSALT could be found by minimizing this error but evaluating a wide enough range of plans takes a too long calculation time. On the other hand, limiting the possible plans may eliminate the best one. To shorten the minimization process without a priori limitation in the ranges of tested plans, this paper suggests using a genetic algorithm.

Keywords: SSALT, reliability, estimation accuracy, optimization, genetic algorithm.

References:

[1] V. Bagdonavicius & M. Nikulin, Accelerated life models, Chapman & Hall/CRC, 2002.
[2] V. Bagdonavicius, L. Gerville, M. Nikulin, Parametric inference for step-stress models, IEEE Trans. Reliab 51, 2002.
[3] J.H. Bompas-Smith, Mechanical Survival: the use of reliability data, Mc Graw Hill book, 1973.
[4] E. Gouno, A. Sen, & N. Balakrishnan, An inference method for temperature accelerated step-stress accelerated life testing, IEEE Trans. Reliab. 53-3, 2004.
[5] J. Holland, Adaptation in Natural and Artificial Systems, Ann Arbor, University of Michigan Press, 1975.
[6] E.A. Elsayed, Optimum multiple-stress-type accelerated life testing plans based on proportional odds model with simple step-stress loading, J. Eur. Sys. Aut. 40 – 7, 2006.
[7] P. Lantiéri, F. Guérin & D. Lepadatu, Reliability Estimation From Accelerated Life Testing Based On Finite Elements Method. Qualita 2005.
[8] P. Lantiéri, Essais accélérés en cours de conception, PhD, 2006.
[9] P. Lantiéri & F. Guérin, Method for optimizing an accelerated scaled step-stress test, WO/2006/040467, 2006.
[10] P. Lantiéri, F. Guérin & S. Voiculescu, LSE method using the CHSS model. J Stat Plann Infer., 139-5, 2009.
[11] W. Nelson, Accelerated Testing: Statistical Models, Test Plans and Data Analyses, Wiley Intersience Publication, 1990.
[12] H. Pham, Handbook of reliability engineering, Springer, 2003.
[13] S. Voiculescu & F. Guérin, Bayesian estimation in accelerated life testing, Qualita 2005.