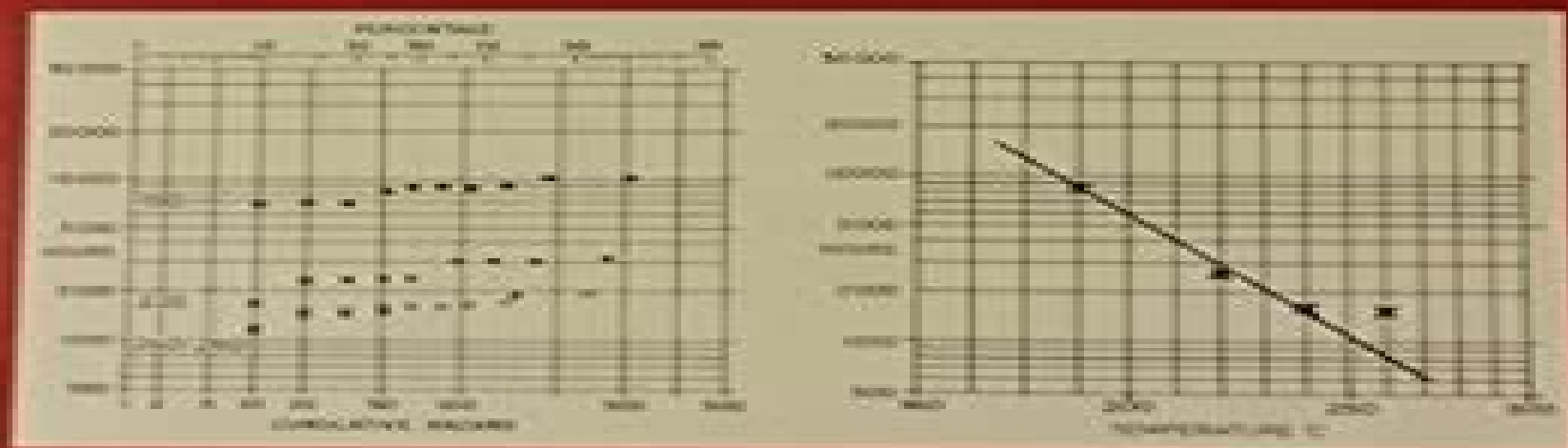


ACCELERATED TESTING

Statistical Models, Test Plans, and Data Analyses



Wayne Nelson

A Volume in the
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Accelerated Testing Wayne B. Nelson,1992-07-01 **Accelerated Testing** Wayne Nelson,1990-02-16 Accelerated Testing Statistical Models Test Plans and Data Analyses Contents Preface 1 Introduction and Background 2 Models for Life Tests with Constant Stress 3 Graphical Data Analysis 4 Complete Data and Least Squares Analyses 5 Censored Data and Maximum Likelihood Methods 6 Test Plans 7 Competing Failure Modes and Size Effect 8 Least Squares Comparisons for Complete Data 9 Maximum Likelihood Comparisons for Censored and Other Data 10 Models and Data Analyses for Step and Varying Stress 11 Accelerated Degradation Appendix A Statistical Tables References Index **Accelerated Testing** Wayne B. Nelson,2009-09-25 The Wiley Interscience Paperback Series consists of selected books that have been made more accessible to consumers in an effort to increase global appeal and general circulation With these new unabridged softcover volumes Wiley hopes to extend the lives of these works by making them available to future generations of statisticians mathematicians and scientists a goldmine of knowledge on accelerated life testing principles and practices one of the very few capable of advancing the science of reliability It definitely belongs in every bookshelf on engineering Dev G Raheja Quality and Reliability Engineering International an impressive book The width and number of topics covered the practical data sets included the obvious knowledge and understanding of the author and the extent of published materials reviewed combine to ensure that this will be a book used frequently Journal of the Royal Statistical Society A benchmark text in the field Accelerated Testing Statistical Models Test Plans and Data Analysis offers engineers scientists and statisticians a reliable resource on the effective use of accelerated life testing to measure and improve product reliability From simple data plots to advanced computer programs the text features a wealth of practical applications and a clear readable style that makes even complicated physical and statistical concepts uniquely accessible A detailed index adds to its value as a reference source **Smart Structures and Materials** ,2000 **The OEE Primer** D.H. Stamatis,2017-08-15 A valuable tool for establishing and maintaining system reliability overall equipment effectiveness OEE has proven to be very effective in reducing unscheduled downtime for companies around the world So much so that OEE is quickly becoming a requirement for improving quality and substantiating capacity in leading organizations as well as a required area of study for the ISO TS 16949 Breaking down the methodology from a historical perspective The OEE Primer Understanding Overall Equipment Effectiveness Reliability and Maintainability explores the overall effectiveness of machines and unveils novel methods that focus on design improvement including hazard analysis rate of change of failure ROCOF analysis failure rate finite element analysis FEA and theory of inventive problem solving TRIZ It covers loss of effectiveness new machinery electrical maintenance issues Weibull distribution measurement techniques and mechanical and electrical reliability The book also Discusses Reliability and Maintainability R M not as tools to be used in specific tasks rather as a discipline Covers the application of OEE as an overall improvement tool Assesses existing and new equipment from classical reliability and

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SUCCESSFULLY CONDUCT LIFE TESTING TO IMPROVE PRODUCT RELIABILITY This book illustrates how experimental design and life testing can be used to understand product reliability in order to enable reliability improvements. The book is divided into four sections. The first section focuses on statistical distributions and methods for modeling reliability data. The second section provides an overview of design of experiments including response surface methodology and optimal designs. The third section describes regression models for reliability analysis focused on lifetime data. This section provides the methods for how data collected in a designed experiment can be properly analyzed. The final section of the book pulls together all of the prior sections with customized experiments that are uniquely suited for reliability testing. Throughout the text there is a focus on reliability applications and methods. It addresses both optimal and robust design with censored data. To aid in reader comprehension examples and case studies are included throughout the text to illustrate the key factors in designing experiments and emphasize how experiments involving life testing are inherently different. The book provides numerous state of the art exercises and solutions to help readers better understand the real world applications of experimental design and reliability. The authors utilize R and JMP software throughout as appropriate and a supplemental website contains the related data sets. Written by internationally known experts in the fields of experimental design methodology and reliability data analysis sample topics covered in the book include: An introduction to reliability lifetime distributions censoring and inference for parameter of lifetime distributions Design of experiments optimal design and robust design Lifetime regression parametric regression models and the Cox Proportional Hazard Model Design strategies for reliability achievement Accelerated testing models for acceleration and design of experiments for accelerated testing. The text features an accessible approach to reliability for readers with various levels of technical expertise. This book is a key reference for statistical researchers reliability engineers quality engineers and professionals in applied statistics and engineering. It is a comprehensive textbook for upper undergraduate and graduate level courses in statistics and engineering.

Accelerated Testing, 2006 Introduction Probability fundamentals Distributions Parameter estimation Accelerated test plans Accelerated testing models Environmental stress screening Test equipment methods and applications **How to Plan an Accelerated Life Test** William Q. Meeker, Gerald J. Hahn, 1985 **Advanced Data Analysis and Test Planning for Highly Reliable Products** Ye Zhang, 2014 Accelerated life testing ALT has been widely used in collecting failure time data of highly reliable products. Most parametric ALT models assume that the ALT data follows a specific probability distribution. However the assumed distribution may not be adequate in describing the underlying failure time distribution. In this dissertation a more generic method based on a phase type distribution is presented to model ALT data. To estimate the parameters of such Erlang Coxian based ALT models both a mathematical programming approach and a maximum likelihood method are developed. To the best of our knowledge this dissertation demonstrates for the first time the potential of using PH distributions for ALT data analysis. To shorten the test time of ALT degradation tests have been studied as a useful alternative.

Among many degradation tests destructive degradation tests DDT have attracted much attention in reliability engineering. Moreover, some materials/products start degrading only after a random degradation initiation time that is often not even observable. In this dissertation, two-stage delayed degradation models are developed to evaluate the reliability of a product with random initiation time. For homogeneous and heterogeneous populations, fixed effects and random effects Gamma processes are considered, respectively. An expectation maximization algorithm and a bootstrap method are developed to facilitate the maximum likelihood estimation of model parameters and to construct the confidence intervals of the interested reliability index, respectively. With an Accelerated DDT model, an optimal test plan is presented to improve the statistical efficiency. In designing the ADDT experiment, decision variables related to the experiment must be determined under the constraints on limited resources such as the number of test units and the total testing time. In this dissertation, the number of test units and stress level are pre-determined in planning an ADDT experiment. The goal is to improve the statistical efficiency by selecting appropriately allocate the test units to different stress levels to minimize the asymptotic variance of the estimator of the p quantile of failure time. In particular, considering the random degradation initiation time, a three-level constant stress destructive degradation test is studied. A mathematical programming problem is formulated to minimize the asymptotic variance of reliability estimate.

Data Analysis and Experimental Design for Accelerated Life Testing with Heterogeneous Group Effects Kangwon Seo, 2017. In accelerated life tests, ALTs, complete randomization is hardly achievable because of economic and engineering constraints. Typical experimental protocols such as subsampling or random blocks in ALTs result in a grouped structure which leads to correlated lifetime observations. In this dissertation, generalized linear mixed model (GLMM) approach is proposed to analyze ALT data and find the optimal ALT design with the consideration of heterogeneous group effects. Two types of ALTs are demonstrated for data analysis. First, constant stress ALT (CSALT) data with Weibull failure time distribution is modeled by GLMM. The marginal likelihood of observations is approximated by the quadrature rule and the maximum likelihood (ML) estimation method is applied in iterative fashion to estimate unknown parameters including the variance component of random effect. Secondly, step stress ALT (SSALT) data with random group effects is analyzed in similar manner but with an assumption of exponentially distributed failure time in each stress step. Two parameter estimation methods from the frequentist's and Bayesian points of view are applied and they are compared with other traditional models through simulation study and real example of the heterogeneous SSALT data. The proposed random effect model shows superiority in terms of reducing bias and variance in the estimation of life stress relationship. The GLMM approach is particularly useful for the optimal experimental design of ALT while taking the random group effects into account. In specific planning ALTs under nested design structure with random test chamber effects are studied. A greedy two-phased approach shows that different test chamber assignments to stress conditions substantially impact on the estimation of unknown parameters. Then, the D-optimal test plan with two test chambers is constructed by applying the quasi-likelihood

approach Lastly the optimal ALT planning is expanded for the case of multiple sources of random effects so that the crossed design structure is also considered along with the nested structure *Development of Statistical Models for Data Analysis*
D. Y. Downham, Great Britain. Health and Safety Executive, 2000-01-01

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