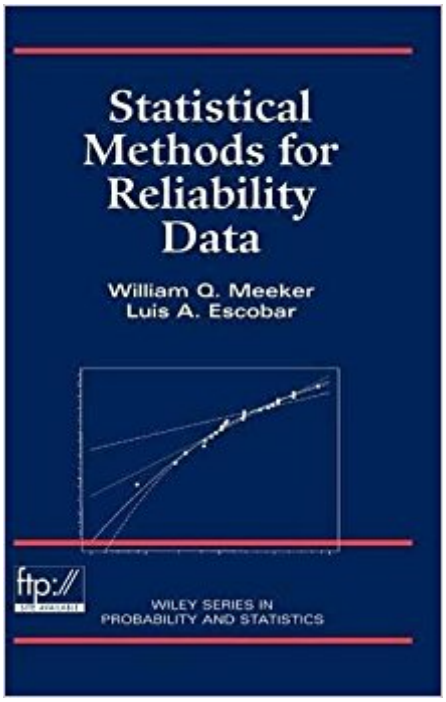
Statistical Methods For Reliability Data



Synopsis

Amstat News asked three review editors to rate their top five favorite books in the September 2003 issue. Statistical Methods for Reliability Data was among those chosen. Bringing statistical methods for reliability testing in line with the computer age This volume presents state-of-the-art, computer-based statistical methods for reliability data analysis and test planning for industrial products. Statistical Methods for Reliability Data updates and improves established techniques as it demonstrates how to apply the new graphical, numerical, or simulation-based methods to a broad range of models encountered in reliability data analysis. It includes methods for planning reliability studies and analyzing degradation data, simulation methods used to complement large-sample asymptotic theory, general likelihood-based methods of handling arbitrarily censored data and truncated data, and more. In this book, engineers and statisticians in industry and academia will find: A wealth of information and procedures developed to give products a competitive edge Simple examples of data analysis computed with the S-PLUS system-for which a suite of functions and commands is available over the Internet End-of-chapter, real-data exercise sets Hundreds of computer graphics illustrating data, results of analyses, and technical concepts An essential resource for practitioners involved in product reliability and design decisions, Statistical Methods for Reliability Data is also an excellent textbook for on-the-job training courses, and for university courses on applied reliability data analysis at the graduate level. An Instructor's Manual presenting detailed solutions to all the problems in the book is available upon requestfrom the Wiley editorial department.

Book Information

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Customer Reviews

"Ã¢â ¬Â¦provides state-of-the-art developments in reliability theory and applications." (Journal of Statistical Computation and Simulation, June 2005)

This title has been awarded the: Association of American Publishers Professional/Scholarly Publishing Division Award for Excellence and Innovation in Engineering

Reliability and survival analysis both deal with time to failure data. Much of the methodology is essentially the same. The term reliability is generally used to apply to hardware or software whereas survival analysis is a term for biological systems such as animals or humans. This book includes the standard nonparametric and parametric methods for estimating reliability functions and parameters. It includes system reliability and repairable systems and deals with recent developments with repairable systems including Nelson's mean cumulative function. A couple of years ago I asked Wayne Nelson if and when he might revise his popular text "Applied Life Data Analysis". He said he did not plan to do it because Meeker and Escobar had just finished a work that would be as good as any revision he might want to produce. Other topics include failure time regression models including the popular Cox proportional hazards model and accelerated life test models. It also includes modern topics such as bootstrap confidence intervals (both semi-parametric and nonparametric) for reliability parameters. The book is comprehensive and up-to-date. It also includes discussion of Bayesian methods. Some case studies are also included. The only topics it misses are reliability growth and warranty and service contracts. These topics are covered in the recent book by Blischke and Murthy "Reliability Modeling, Prediciton, and Optimization" also published by John Wiley and Sons, Inc.Numerical examples are done using the SPlus software from MathSoft. An ftp site is available to download data sets to use with SPlus.

Reliability data isn't amenable to treatment with the ubiquitous normal distribution, a fact which should catch the attention of any practicing engineer with only that bullet in his gun. Reliability data has other distinguishing features. The data are usually censored, which means the exact failure times are not known so the observations can only provide bounds on the actual failure times. Inferences and predictions usually require extrapolations, making engineering and physics-based modeling an important adjunct to statistical methods. Whereas many *statistical* problems focus on

parameter estimation (e.g.: mean, standard deviation), these are not of primary interest to engineers who need specific measures of product reliability (e.g.: failure probabilities, life distribution quintiles, failure rates).The chapter headings provide an overview of the book:1) Reliability Concepts and Reliability Data 2) Models, Censoring, and Likelihood for Failure-Time Data 3) Nonparametric Estimation 4) Location-Scale-Based Parametric Distributions 5) Other Parametric Distributions 6) Probability Plotting 7) Parametric Likelihood Fitting Concepts: Exponential Distribution 8) Maximum Likelihood for Log-Location-Scale Distributions 9) Bootstrap Confidence Intervals 10) Planning Life Tests 11) Parametric Maximum Likelihood: Other Models 12) Prediction of Future Quantiles 13) Degradation Data, Models, and Data Analysis 14) Introduction to the Use of Bayesian Methods for Reliability Data 15) System Reliability Concepts and Methods 16) Analysis of Reparable System and Other Recurrence Data 17) Failure-Time Regression Analysis 18) Accelerated Life Tests 21) Accelerated Degradation Tests 22) Case Studies and Further Applications Appendix A - Notation and Acronyms Appendix B - Some Results from Statistical TheoryThis book is written for practitioners - engineers and statisticians - yet does not presume an undergraduate degree in statistics. More involved statistical ideas (Bayesian thought, censored observations, bootstrapping, et cetera) are all described to the user with the assumption that they have had little prior exposure. The book’s concepts are presented in an unstuffy and intuitive manner. For example, for Meeker and Escobar likelihood is simply "the probability of the data," making a maximum likelihood estimator one which maximizes the probability that the experiment turned out the way it did. (Contrast this to the hushed tones in many "engineering statistics" texts which suggest that Likelihood is a profound concept beyond the (limited) capacity of the engineer and best left to the trained statisticians.) The wholesome, unpretentious, and practical approach taken by Meeker and Escobar is quite pleasing to this reviewer, a professional engineer whose formal statistical education began later in life.The book should be interesting to statisticians too. It can be used as a two-semester graduate statistics course, a one-semester course for engineers and statisticians, or as the basis for workshops and short courses on selected topics for industry practitioners. Each chapter is suffused with examples using real data and ends with thought-provoking exercises. While this is a practical book, it does not neglect statistical theory (after all, the authors are well-known academic statisticians) - although it is interesting to note that for censored observations there may be no *exact* theory for statistical inference. While the book’s emphasis is more on results than on theoretical proofs, I think the practicing statistician will be quite pleased with the book’s balance.Not only are its 680 pages chock-full of ideas, information, and techniques, _Statistical Methods for Reliability Data_ is a noteworthy paradigm for technical exposition: Even before each chapter’s

introduction, there is a brief statement of chapter objectives, followed by an overview which places the chapter in perspective, stating for example, that the material is a prerequisite for this or that future topic, or conditions under which it could be omitted, or why its is useful. This makes it easy for a practitioner to find his way around the text.In summary: Buy this book. If competitive advantage through reliable products is central to your company's future, then Meeker and Escobar, _Statistical Methods for Reliability Data_ can help you reach your objectives.

The purpose of this book was supposed to serve very broad groups of people: students, statisticians and engineers. Unfortunately, I found this book not quite suitable in engineering practice. From practical point of view, when dealing with reliability estimations, one has to connect mathematical theory with real-life data. It appears that to accomplish this task it is necessary to understand some basic statistical ideas, plus specifics of the subject under consideration. Sometimes common sense knowledge can come in handy. Strangely enough but many fundamental principles are in fact surprisingly simple, elegant and thus beautiful. What is missing in the book is the lack of clear explanations of fundamental statistical concepts that certainly can be presented in a complicated form but in reality they are not. On the other side, the book could serve as a solid textbook to students, statisticians and mathematicians.

One of the best books on Reliability Data analysis with an excellent set of examples and clear writing style.

This book might be of use to someone who's interested in all of the math behind reliability estimation, but it's of little practical use to anyone who doesn't have a year to study it. It's full of little gems like: "This [equation] can be used to parametrically adjust the nonparametric estimate of probability plot shown in...". You get equation after equation with no explicit way to get from the abstract math to the plots and conclusions you really need.Not for anyone who needs a quick, practical guide to reliability analysis.

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