Reliability Statistics with Weibull Analysis

Course Outline

1. Review of Quality Statistics
   - Measurement Uncertainty
   - Process Control
   - Process Capability
2. Basic Reliability Concepts
   - Key Definitions
   - Reliability Bathtub Curve
   - Four Conceptual models of Failure
   - Reliability Figures of Merit
   - Reliability by Design
3. Introduction to Reliability Statistics
   - Some Rules in Probability
   - Time to Failure Distributions
   - Introduction to Weibull Analysis
   - Continuous Probability Functions
   - Reliability, Unreliability, and Hazard
   - Parameter Estimation
4. Confidence Intervals for Reliability Statistics
   - Three Types of Statistical Intervals
   - Confidence Interval Terminology
   - Confidence Intervals for MTBF
   - Nonparametric Test Designs
   - Binomial Confidence Intervals
   - Chi-Square Approximation for Poisson Confidence Intervals
5. Graphical Techniques for Weibull Analysis
   - The Weibull Distribution
   - Weibull Probability Paper
   - Two Parameter Weibull Analysis
   - Median Rank Values
   - Projections of B_{10} Life
   - Implication of the Shape Parameter
   - Hidden Weibull Failure Modes
6. Reliability Models for Systems
   - Two Reliability Strategies
   - Reliability Block Diagrams
   - Reliability Allocation Models
   - Reliability Prediction Tools
   - Reliability Testing
7. Using Dirty Data – Planning for Clean Data
   - Uncertainty with Small Samples
   - Suspensions and Censored Data
   - Analysis of Curved Weibull Plots
   - Inconsistent Data/Multiple Failures
   - Planning for Future Data
8. Advanced Concepts in Weibull Analysis
   - Analysis of Grouped Data
   - Variables in Failure Forecasting
   - Confidence Intervals for Weibull
   - Weibull and Test Strategies

Course Description

Reliability Statistics with Weibull Analysis is a three-day course focused on first principles and practical application of techniques.

Course Objectives

By the end of this three-day course, participants will be able to:

- ✓ Understand process control implications.
- ✓ Calculate basic reliability figures of merit.
- ✓ Understand the basis of reliability statistics.
- ✓ Plot data on Weibull probability paper.
- ✓ Determine if Weibull is applicable.
- ✓ Interpret Weibull plots.
- ✓ Evaluate censored data.
- ✓ Correctly use confidence terminology.
- ✓ Evaluate criteria for a 3 parameter Weibull.
- ✓ Apply Weibull analysis to test strategies.
- ✓ Assess the goodness of fit of Weibull data.
- ✓ Use Weibull analysis for future projections.
- ✓ Use Weibull to guide design improvements.

About the Instructor

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Mark A. Morris is the President of M and M Consulting. He specializes in providing instruction and consultation in reliability, maintainability, and quality systems. Mark has 28 years of experience in tooling and manufacturing as a skilled machinist, toolmaker, college instructor, technical writer, and quality professional in roles from Quality Engineer to Director of Continuous Improvement. Mark's undergraduate degrees focused on manufacturing engineering, industrial education, and metal-working; his Master of Education degree is from Bowling Green State University; CQE, CRE, and CQA certifications are from ASQ. Mark also served on the team that rewrote the *R&M Guideline for Manufacturing Machinery and Equipment*.