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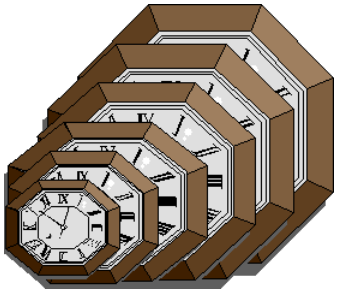
Course: Accelerated Test, Design, and Analysis for Demonstrating Reliability

Course Format: 3.5 Hours Webinar, $350

Description



This course is designed to focus on all aspects of Accelerated Testing, its Design and Analysis. We will first overview accelerated test historical models (for Temperature, Temperature-Humidity-Bias, Temperature Cycle, Temp. Cycle Frequency Effect, Engelmaier Solder Joint Model, Vibration, Electromigration (Black Model, Silver migration), Capacitor-Voltage, Dielectric Breakdown, and General Power Law models). We will overview how to determine key parameters for these models. We will then discuss accelerated test planning. How do we know what test to do and at what stage to do them in a program plan? How to use a top-down FMEA as a program planning tool. We will introduce a stage gate approach. Test design by failure modes will be utilized in planning. We will also overview general qualification test planning including multi-accelerated test design to demonstrate one failure rate with confidence bonds and accelerated end-of-life reliability test planning. Included will be a "CALT" like method for environmental profiling so that one can profile a product's environment more accurately as field stress conditions vary. This will help set realistic accelerated test goals and will make for more accurate MTBF predictions. In the analysis area we will look at statistical data methods, including Chi-squared accelerated multi-test planning, the new Chi-squared and other accelerated reliability growth methods, lifetime accelerated testing using Weibull/Lognormal test analysis, and multi failure mode assessment. What to do when multiple independent tests are performed and

Course Outline:

Accelerated Testing Models & Methods

- Temperature Arrhenius Model
  - Historical Activation Energies
  - Testing to Find an Activation Energy for a Failure Mode
- Temperature-Humidity-Bias Model
  - What to do if test biased causes the local relative humidity to change significantly due to device heating
  - Estimating the Local Relative Humidity Assessment in power devices
- Temperature Cycle Models
  - Coffin-Manson
  - Modified Coffin-Manson (Norris-Lanzberg)
  - Engelmaier Model
- Accelerated Vibrations Test Models
  - Sine vs. Random Accelerated Testing
- Voltage Acceleration (Capacitors) Model
  - Dielectric Breakdown
- Silver Migrations Testing
- Mechanical Accelerated Test Power Law Model
  - Power Exponent Testing
- Electromigration Black Model
- Environmental Profiling Your Product's Multiple Stress Use Conditions for Test Planning

Accelerated Test Design & Analysis

- Key Published Standards on Qualification Testing
- Typical Accelerated Test Plans for Semiconductors, Hybrids and Assemblies
  - Using Test Standards
  - Designing Your Own Test Plan
- Test Design by Failure Modes Using Top Down FMEA

we wish to include all data in our analysis. This is an intense course, be prepared for the full session.	• Zero Failure Test Design
	  ○ What is Confidence (Engineering vs. Statistical Confidence)
	  ○ Chi-Squared Confidence Testing
	  ○ Single Environment Test Design & Analysis (MTBF)
	  ○ Multiple Environment Test Design & Analysis (Combined MTBF Assessment)
	  ▪ Confidence Testing for an MTBF value with multiple test environments
	• Accelerated Lifetime Test Using Weibull & Lognormal Analysis
	  ○ Main Distributions of the Bathtub Curve, Weibull,
	  ○ Exponential, Weibull and Lognormal
	  ○ Weibull Beta
	  ○ Reliability Plotting (life data analysis, censored data)
	• Reliability Growth Testing
	  ○ Chi-Squared Accelerated Reliability Growth
	  ○ DART Testing (Including HALT)
	• Publishing Your Accelerated Test Results for Your Company

Instructor: Dr. Feinberg has a Ph.D. in Physics and is the principal author of the book, *Design for Reliability*. He is also the owner of the company DfRSoft, which provides software and services worldwide for Reliability, Quality and Engineering. Alec has provided Reliability & Quality engineering services in all areas and on numerous products in diverse industries for over 35 years that include solar, thin film power electronics, defense, microelectronics, aerospace, wireless electronics, and automotive electrical systems. He has extensive expertise in the area of Design for Reliability & Quality, shock, vibration, and HALT test and analysis methods in working on Military and Commercial products. He has provided training classes in Design for Reliability and Quality, Shock and Vibration, HALT, Reliability Growth, Electrostatic Discharge, Dielectric Breakdown, DFMEA and Thermodynamic Reliability Engineering. Alec has presented numerous technical papers and won the 2002 RAMS Alan O. Plait best tutorial award for the topic, "Thermodynamic Reliability Engineering". He is a major contributing author to the new book *Physics of Degradation in Engineered Materials and Devices* due out soon. Alec is based in Raleigh, North Carolina.