

Training Classes From DfRSoftware Company

Reliability, Physics of Failure, ESD, Quality, Shock & Vibration Classes

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Two or three day tailored courses designed for your needs available at your facility or on-line either by videos or webinar. Courses include class slides and instructional software. We teach at your site to a minimum of 4 people (**\$875 -2 days, \$985 -3 days per person**). Program includes free consulting on class material. We guarantee our courses are by far the *best in the industry*.

Combined 3 Day Course: Reliability, Quality, Physics of Failure, ESD, Shock & Vibration

An intense three-day course that combines all our classes into one, tailored to specific subjects of interest.

Design for Reliability, Quality & Special Topics Training Class (2 Days)

Intense two-day Course Covering: 1) Practical Approach in Reliability Program Planning, 2) Basic and Advanced Reliability Mathematics, 3) System Block Diagrams Analysis, 4) Series and Parallel Redundancy (N of K, Switching, Etc.) and Allocation, 5) Reliability Growth, 6) Reliability Predictions, 7) FMEA Methods, 8) Demonstrating Reliability Using A) Reliability Plotting (Weibull, Lognormal, Etc.), B) Mixed Modes, C) Accelerated Test & Design, D) Environmental Profiling, E) Test Design by Failure Modes, F) Field Returns Analysis, G) Device Hours, 7) HALT & HASS 8) Availability & Sparing, 9) Key Quality Tools (SPC, Lot Sampling, Cpk, Yield, DOE, & Six Sigma) 9) Special Topics: Shock & Vibration, Physics of Failure (Mechanical & Electrical), ESD, Weibul Beta Related to PoF Laws, Parametric Reliability (Extra Topics Selected May Extend to 3 Days).

Shock & Vibration: Test, Design and Design Assurance (2 Days)

Intense two-day Course Covering: 1) Basics Terms G, Grms, G-Force Etc., 2) Types of Shock, Shock Test & Design, Shock Equipment, Understanding Electrodynamical Shaker System, 3) Sine Vibration (Basic Math, Transmissibility, Q Factor, Sweep Rates, Dwells, Sine Fatigue, S-N Curves, Accelerated Sine Testing, 4) Random Vibration, Why Random not Sine, Frequency & Time Domains, Tri-Axial test, Accelerometers, Transportation Vibration, Sine-on-Random, Random-on-Random, Repetitive Shock, HALT, Accelerated Random Vibration Testing, 5) System Level Degradation, Vibration Noise, Parametric Failure, 6) Material Selection in Design, Elastic Deformation, Yielding, Cumulative Creep, Cyclic Fatigue, Miner's Rule, FDS, S-N Curves, PCB Fatigue Life, Steinberg Method, Englemaier BGA Model, 7) Design Margin, Safety Factors, Electrical Derating, 8) Stack-Up, Monte Carlo Analysis, WCSA, 8) Isolation And Damping, Vibration Isolation, Shock Isolation, Packaging Guides, 9) Reliability & Quality Tools, System Reliability, Advanced Reliability Mathematics, 10) Accelerated Testing, Environmental Profiling, Quality Aids, 11) Physics Of Failure – Creep, Fatigue, Wear, Intermetallics, Corrosion, Ag Migration, CTE Mismatch.

Physics of Failure (1 Day)

Mechanical Physics of Failure and Material Selection Stress Considerations: Elastic Deformation, Yielding (With Vibration) and Ductile Rupture (with Shock) Material Considerations, Cumulative Creep Fatigue Material Considerations, Viscoelastic Creep, Creep Acceleration Factor, Excessive Wear; Friction & Lubrication – Types Of Wear, Vibration Wear, Material Selection & Hardness, Wear Acceleration Factor, Cyclic Fatigue: Exact Method for Damage Estimation, Miner's Approximation, Stress Concentration, SN Curves – Material Selection, Fatigue (SN Curves, High and Low Cyclic Fatigue, Loading Types - Stress Corrections, Fracture Mech. Vibration Fatigue, when SN Curves not Available), PCB Fatigue Life - Circuit Board Component Fatigue Life Analysis –Steinberg Method (Sine and Random), Thermal Cycle (Acceleration Factors, Coffin-Manson & Norris-Landzberg, Combining Thermal & Vibration Fatigue, and ***Physics of Failure 7 Step Problem Solving***.

Electronic & IC Physics of Failure Considerations: Thermal Cycle CTE Stress Issues, CTE's Mismatch, Thermal Fatigue, Englemaier IPC Solder Joint Life Model & Underfill Modification, BGA life, Drop Shock & Vibration Electronic Failure Modes, Thermally Activated Failure Modes, Top IC Failure Modes, Popcorn Cracking, Voiding Delamination, Junction Temperature Issues & Modeling, Voltage Issues, ESD and EOS – Dielectric Breakdown, Current Density & Fusing of Bond wires, Misc PoF Failure Modes: Design Warnings, Electrolytic Caps, Assembly Errors, IC Failure Modes (Latch up, Gate Sinking, Hot Carrier,...), Solder Failures (non wetting, grain size, leaching, coverage), Intermetallics - Au Embrittlement, Purple Plague, Corrosion, Corrosion Requirements, Key Forms of Corrosion, Dendrite Growth, Ag Migration & Electromigration, RoHS Lead Free Solder Issues, Pb-Free Failure Modes, SAC Solders, PCB Copper Dissolution from reflow - Via issues, PCB CTE Z-direction issues, Tin Whiskers, Surface finishes (ENIG, Immersion Silver, Immersion Tin, OSP, Benefits, Issues).

Physics of Failure Analysis Tools: Digital Microscopy, SEM (FE-SEM, EDS), Focused Ion Beam, Scanning Auger, C-SAM, Real Time Radiology, X-Ray Maps, X-Ray, XRF, FTIR, Thermal Imaging, Electrical Test (Curve Trace), EMI, EMC.

Short Courses (On-line Videos or Webinars) \$385 Per Person 3-4 Hours

- 1) Vital Methods for Reliability & Quality, 2) Accelerated Test, Design, & Analysis
- 3) Understanding Shock & Vibration, 4) Advanced ESD-CDM Practices, Audits, and Investigations
- 5) Physics of Failure (electrical & mechanical), 6) Cutting Edge Physics of Failure Methods and Models

Brochures at DfRSoft.com