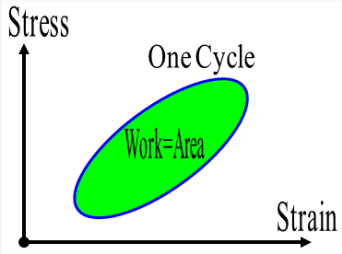
DfRSoft 2-Day Course
Shock & Vibration: Test, Design, and Design Assurance

Understanding of vibration and shock stresses is important for the design of reliable products for diverse applications, ranging from consumer portable devices to safety critical equipment operating in extreme environments. The initial sections of the course covers vibration and shock concept, test methods and test equipment in detail. How to use vibration and shock equipment as design aids is also covered. Practical examples are used to illustrate the concepts and the attendees will perform the calculations themselves to help reinforce learning.



Design methods for vibration and shock are covered next part. We start by looking at the typical design maturity stages and how these will relate to different activities for the design process. For the actual design, we look at material selection relative to shock and vibration stress environmental conditions (issues for material modulus, yield strength, hardness, creep requirements, wear issues, fatigue, etc). We then detail isolation and damping design methods to protect against vibration and shock environments. We then look at design margins to assure robustness. A Monte Carlo method is introduced for stack up issues. A key to a successful design program and managing a project is the FMEA tool. We will overview both a top down and bottoms up approach to assure product success.

We then look at design assurance some of which was initially covered with the stage gate approach in design. We discuss reliability and quality analysis so the engineer has an understanding on their importance for design. We then go over some visual inspection methods that help in final product release. The course includes physics of failure and analysis methods so the engineer also has a chance to look at potential historical failure modes in manufactured products, how they occur and what failure analysis tools are needed to help determine root cause issues.

The course targets designers, engineers, test engineers and management. However, different sections vary in engineering level. We provide software to help in test and analysis to make the math easier. Students will be given a trial version of the DfRSoft software (30 day activation) for this course which is not mandatory but helps to accelerate learning. DfRSoft software is a multi-level program with different tools that includes shock and vibration module which greatly helps in teaching this course.

Section 1 (168 Slides)
Understanding Shock & Vibration and its Tests

- Sine wave basics; phase effect, track & dwell, resonance & Q, RMS values
- Sine wave math – amplitude, velocity, acceleration
- Transmissibility, Q, two graphical methods for Q
- Harmonic oscillator physics; natural & forcing frequency, academic & real world Q
- Details of damping, transmissibility Q, resonance
- Sine amplitude equations with Q factor
- Estimates of Q when it cannot be measured for systems & components
- Sweep Rate – Octaves, consequences of too fast a sweep rate
- Dwell sine testing
- Sine Fatigue Life S-N Curves, how the b factor effects the acceleration model
- S-N curves, references
- Accelerated testing using S-N curve information or historic information

Section 1.3

Section 2 (49 Slides)
Complex System Degradation Analysis Methods

Section 3 (312 Slides)
Design Methods for Shock and Vibration

- Lead Free Issues
- ESD & Electrical Overstress

Course, Instructor Biography

Instructor: Alec Feinberg, founder of DfRSoft

Alec has a Ph.D. in Physics and is the principal author of the book, *Design for Reliability*. He is also the author of the software package DfRSoft, which is used worldwide. Alec has provided reliability engineering services in all areas of reliability 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 shock, vibration, and HALT test and analysis methods in working on Military and Commercial products. He has provided training classes in Design for Reliability, Shock and Vibration, HALT, Reliability Growth, Electrostatic Discharge, Dielectric Breakdown, DFMEA and Thermodynamic Reliability Engineering. Alec has presented numerous technical papers and won the 2003 RAMS Alan O. Plait best tutorial award for the topic, "Thermodynamic Reliability Engineering". He is currently an invited author to contribute on a new book on the Physics of Degradation in Engineering Devices and Materials.

Alec is based in Raleigh, North Carolina.

Enrollment

Send purchase order to:
DfRSoft
9510 Centerwood Dr.
Raleigh, NC 27617

Email: support@dfrsoft.com

Payment Method by purchase order, paypal or credit card)

For further information, please call Dr. Alec Feinberg at 617-943-9034.

On-Site Company Cost Information (same price as on line for >5 people call or email)

- Two day course - $950 Per Peronson (Min. 4 people of $3800 payment)
- Note 5-10 people, $850
- No Extra Cost (i.e. DfRSoft pays for its travel expenses)
- Optional - Design for Reliability, Quality, Engineering Software $395, Free Trial copy included for class