

Design for Vibration and Shock Seminar

OBJECTIVES

Highlights the different types of vibration tests and different type of equipment and fixtures. Reviews combined testing as well as fatigue calculations.

WHO SHOULD ATTEND

This course is intended for those involved in design, test, or analysis, who want a better understanding of advanced statistical concepts to use during design and testing a product.

OUTLINE

Designing for vibration and shock

- Stress Strength Analysis

Classical sinusoidal vibration never observed in service; useful concept

- Introduction: terminology, structural resonant behavior, passive and active isolation
- Sinusoidal vibration measurements: units, sensors, readouts, errors
- Calibration of sensors and systems; traceability to NIST

Complex vibration; introduction to spectrum analysis

Sinusoidal vibration testing

- Electrohydraulic and electrodynamic shakers; theory, tradeoffs, limits
- Power amplifier theory, operation, limitations, distortion effects
- Controls for sinusoidal vibration testing
- Sinusoidal vibration test practice
- Interpretation of standards; Government and commercial
- Controversial test methodology: tracking filters, multiple sensors

Introduction to random vibration

- Sources of random vibration in service and transportation
- No possible equivalence to sinusoidal vibration
- Terminology and definitions
- Spectral density measurement and analysis - the frequency domain
- Probability density - the time domain

Random vibration testing

- Controls
- Combined environment (CERT) testing; reliability tests, e.g. MIL-STD-781

Accelerated testing; HALT and HASS**Fatigue Calculations****Environmental stress screening (ESS) of electronics hardware production**

- Single vs. multi-axis vibration
- Pneumatic repetitive-shock machines

Vibration and shock test fixtures; fixtures for stress screening

- Recommended designs, materials, fabrication methods
- Experimental evaluation before use
- Practical limits: transverse motion; specimen size and weight

Gunfire vibration testing**Combined temperature, humidity, vibration and altitude testing****Instrumentation for measuring shock in service and during tests**

- Sensors, readouts, errors; calibration
- Shock spectrum analysis; shock response spectrum

Shock testing per Method

- Shock testing machines; limitations
- Use of shaker for shock testing

Summary