

Course Introduction to Vibration

Why a vibration test?

Quality, reliability, expectation, credibility, cost.

Vibration test system limitations

Will the system do the test?

Maximum system performance (Displacement, Velocity, Acceleration and Force)

True limitations (Dynamic mass, Isolated systems)

Cross-axial motion and rotational problems.

Off-set loads: balancing the test load (C of G)

Electrodynamics Vibration Generator System Performance ISO 5344

Sinusoidal Tests.

Sine test specification parameters and their interpretation

Frequency, displacement, velocity and acceleration calculations.

Test tolerance (aborts) dB and what it means.

Sweep rates (log, linear), sweep direction and rate.

Why log sweep?

Resonance search and resonance dwell.

Fixed frequency tests.

Stepped profiles.

Control problems, servo systems, compression rate (damping).

Measurement modes (peak, RMS, tracking filters).

Control methods: averaging, extremal

Setting up a test

Random Tests.

Random test specification parameters and their interpretation

What is random? Spectrum analysis, FFT, aliasing, windows.

PSD (ASD) g^2/Hz , m^2/s^3

Slopes dB/octave dB/decade

Total acceleration RMS: G_{RMS} m/s^2_{rms} and how to determine.

Crest factor, Sigma, what they mean and the effect they have.

Resolution, bandwidth, channels of analysis, DOF.

Out of band energy. Narrow band random.

How to determine velocity_{rms} and displacement_{rms}

Road load data, MIL and IEC specifications.

Test tolerance, control problems, notching.

Mixed modes

Setting up a test

Bump/Shock Tests

Bump/Shock test specification parameters and their interpretation

Pulse shapes (Classical and user defined).

Pulse duration.

Pre/Post pulse percentage: what it does and why it is very important.

Pre/Post pulse shapes and how they affect the system requirements.

Tests without pre-pulses, pre-conditioning, compensation pulse (crash tests).

Optimisation (displacement, velocity, time)

High level tests.

Bump/Shock: System limitations.

SRS explained.

Setting up a test

Accelerometers, conditioning amplifiers

How and where to attach.
Selecting the correct type.
Conditioning amplifiers.
Earth loops
Calibration.

Fundamentals of fixture design.

Types of Materials
Methods of Construction
Do's and Don'ts
Calculating the resonant frequencies
Determining the mass
Get it wrong and you can severely over test your product!

Course Description

This course provides a practical introduction to the subject of vibration testing. Designed around the needs of engineers new to the subject of vibration testing and yet offering a useful refresher/booster course for the more experienced users, this course explains how to interpret vibration test specifications and apply them to a vibration test system. Subjects covered are sinusoidal vibration, random vibration, and shock/bump testing together with a background to the equipment required for each type of test, methods of control and simple practical fixturing. The course emphasises the practical aspects of vibration testing - the realities, the problems encountered and the common mistakes which can be made. The course removes the mystery and mystique of vibration testing and replaces it with facts and common sense.

Course “Fixtures, Software and Specifications for Vibration”

This course aims to give more insight knowledge to the attendees in:

- developing and modelling fixtures and working with fixtures
- the pro's and con's of fixtures
- explanation of things like cross axial stiffness, over-turning moment and centre of gravitation (CoG)
- detailed information of accelerometers and how to use them correctly
- the sense and non-sense about specifications
- dealing with different kind of tests:
 - sine
 - random
 - classical shock
 - resonance search track & dwell (RSTD)
 - sine on random (SoR)
 - random on random (RoR)
 - shock response spectrum (SRS)
- reading a theoretical test and the practical use of it
- This course is meant for persons:
 - who has attended the course 'Introduction to Vibration' and want to extend their knowledge
 - who develop fixtures
 - who meet problems while testing with shakers



The attendees are kindly invited to bring along their fixtures, about which they want to know more in detail and why they may be wrong.