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Theory Sine Sweep Vs Random  
Sine vibration testing  
applies a single frequency  
to a test item and  
selectively excites resonant  
structures within the  
device. In a swept sine test  
a vibration sine tone is

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Vibration Testing  
ramped up and down through a range of frequencies and for a specified rate and duration.

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- The relative severity of a sine test and a random test will vary depending on the product's resonant frequencies and Qs. •In



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general, when sine and random tests have the same peak vibration levels at the control point, the product will see higher vibration levels with the sine test than with random due to the resonances of the product

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Sine vibration testing  
applies a single frequency  
to a test item and  
selectively excites resonant  
structures within the

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device. In a swept sine test a vibration sine tone is ramped up and down through a range of frequencies and for a specified rate and duration.

*Sine Vibration vs. Random*

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*Vibration Testing. Which  
Should ...*

Random vs. Sine. Sinusoidal vibration tests typically are not as helpful as random testing in certain condition since a sine test focuses on single frequency

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consistently. A random vibration test, however, always excites all the frequencies within a defined spectrum. Wayne Tustin's had a good lay person's description of random vibration:

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*Understanding Random  
Vibration Testing and Sine  
Testing*

That's precisely why a sine sweep test exists in the first place. In other words, a 2-g rms random has its



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Vibration Testing  
energy statistically distributed across the entire spectrum, so the amount energy available for exciting any mode is statistically low. Contrast with even a 0.1-g sine sweep where the entire 0.1-g

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acceleration is applied  
directly into a mode.

*Sine sweep vs Random -  
Mechanical*

*Acoustics/Vibration ...*

Sine-on-Random (SoR)

vibration testing contains

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Vibration Testing  
sine tones that are superimposed on a low level of broadband random vibration. The sine tones can be fixed frequency or sweeping. If they are sweeping, they are normally very narrow frequency bands.

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Some examples of SoR vibration are from helicopters, propeller driven airplanes and aircraft rapid gun-fire events. All aircraft have some levels of random vibration. In helicopters

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Vibration Testing  
and propeller driven  
airplanes, the sine tones  
are produced by the ...

*Mixed Mode: Sine on Random  
Vibration Testing, RoR,  
SoRoR ...*

Random vs. Sine. Sinusoidal

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Vibration tests are not as help-ful as random testing, because a sine test focusses upon a single frequency at any one time. A random vibration test, on the other hand, excites all the frequencies in a defined

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Vibration Testing  
spectrum at any given time.  
Consider Tustin's  
description of random  
vibration - "I've

*What is Random Vibration  
Testing?*

Sweep Rate: The rate at

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Vibration Testing  
which the frequency range is traversed. The units for sweep rate are usually Octave/minute or Hz/minute. Octave per minute is a logarithmic sweep rate while Hz/minute is a linear sweep rate. Random Vibration



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Vibration Testing. Random Vibration is a varying waveform.

*Sinusoidal and Random  
Vibration Testing Primer -  
Delserro ...*

An endurance test of one  
hour at a frequency of 16Hz

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Vibration Testing  
is equivalent to  $3600 \times 16 = 57,600$  changes, which is significantly more than with the sine sweep test.

Conversion of a sine sweep test into a random vibration test The frequently used MIL-STD-810 standard states that

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a 1-to-1 conversion of a sine sweep test to a random vibration test is not possible and that a measured vibration level is the best basis for formulation of vibration requirements.

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*Effects of shock and  
vibrations*

An electrodynamic shaker running a full force random profile can be as loud as a jet engine. While performing a sine sweep to find a resonance point, the

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shaker can start out as a low-pitched hum and rise to an ear piercing scream. It is for these reasons that a sound enclosure should house the shaker system.

*Fundamentals of*  
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## *Electrodynamic Vibration Testing Handbook*

The sine vibration is measured in G peak, while the random vibration is measured as G rms, with the peak G levels typically left to a statistical assumption.

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Vibration Testing  
A quick calculation tells us that the random test, which can have peak values up to 4 or even 5 times the RMS level, will apply  $4 \times 1.05 \text{ G rms}$ , or  $4.20 \text{ G peak}$  to our product.

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*Test My Product Using Sine  
or Random? - Vibration  
Research*

Structures and components may be mounted on shaker tables, similar to those in Figure 4.9 and Figure 4.10, and subjected to sine sweep



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The essence of a sine sweep test is that the base excitation input consists of a single frequency at any given time. The frequency itself, however, is varied with time.

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*Sine Sweep Testing / enDAQ*

fore be larger when used with random than with sine excitation. The random spectrum is described by its power spectral density or acceleration spectral

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density. ASD  $(\text{m/s}^2)^2/\text{HZ}$ . To shape and control this. the vibration must be analyzed by a narrow band analyzer and compressor loops applied to each bandwidth. Digital tech-

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## Vibration Testing (br0227)

The sine-sweep apparent mass magnitude values from 10 Hz to 50 Hz are much lower than the broadband random apparent-mass magnitudes for all the excitation amplitudes (e.g., 130 g vs.

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500 g) but the differences reduce with the frequency and slowly converge.

*The importance of harmonic versus random excitation for a ...*

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*Correlation of Sinusoidal  
Sweep Test to Field Random*

...

Sine-on-random (SoR) control

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Vibration Testing  
simulates complex vibration environments with a combination of broadband random excitation and sinusoids or 'tones'.

Generally, both signal types are present simultaneously and the tones may either



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Vibration Testing  
appear at fixed frequencies  
or sweep over a frequency  
range.

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