

Vibration Shaker Table

Subjects: [Agricultural Economics & Policy](#)

Contributor: Kris zhang

vibration table testing is a type of test equipment widely used in the engineering field to simulate the vibration in a real environment to evaluate the reliability and durability of a product. The following are the most commonly used application areas of vibration shaker table including but not limited to: Automotive industry: Used to test the durability and reliability of automotive components, body structures and complete vehicles. Aerospace industry: Used to test the vibration performance of aerospace components, aircraft engines and aerospace spacecraft. Electronic products industry: Used to test the vibration performance of electronic products, such as mobile phones, tablets and computer hard drives. Construction engineering: Used to test the vibration performance of building materials, structures and equipment to ensure that they meet safety standards.

vibration test table

vibration test system

vibration testing

1. What is a vibration shaker table

vibration table testing is a type of test equipment widely used in the engineering field to simulate the vibration in a real environment to evaluate the reliability and durability of a product. The following are the most commonly used application areas of vibration shaker table including but not limited to:

Automotive industry: Used to test the durability and reliability of automotive components, body structures and complete vehicles.

Aerospace industry: Used to test the vibration performance of aerospace components, aircraft engines and aerospace spacecraft.

Electronic products industry: Used to test the vibration performance of electronic products, such as mobile phones, tablets and computer hard drives.

Construction engineering: Used to test the vibration performance of building materials, structures and equipment to ensure that they meet safety standards.

2. Components of a vibration shaker table

Testing and measurement is a key component of engineering design, and many devices are tested to recreate the environment they experienced when in use. vibration table testing is one of the environmental tests that is critical to

the design process, and all closed-loop vibration testing consists of four main components:

Vibration controller,

Amplifiers,

Shaking table,

Feedback sensor

These four components together constitute the vibration test system. From aerospace and defense to communications and transportation, thousands of devices have been vibrationally tested, not only on the vehicles themselves, but also on the packaging they carry.

You may have noticed that some vehicles are more comfortable than others. This is partly due to all vibration tests designed and completed.

| 3. Type of vibration table testing

Random vibration test

Random vibration test involves subjecting a product or system to a wide range of vibration frequencies simultaneously, mimicking real-world conditions. It allows engineers to evaluate the response and durability of equipment under unpredictable vibrations encountered during transportation or general use. By definition, the amplitude and phase of this signal are random, just like the vibrations around us, so this type of test can better simulate real-life noise effects.

In contrast to sinusoidal testing, with random testing we can obtain a representation of all frequencies of objects within a specified range. This representation is usually given in the form of PSD (Power spectral density) and frequency plots.

Typical setup for random vibration test

A typical setup for a random vibration test is no different from a standard vibration test device and includes a controller, a shaker or motorized shaker, a power amplifier, and the device under test (DUT) mounted on it. Shaker table produces random vibration with intensity and spectrum control. The response of the DUT is measured using accelerometers or other strategically placed sensing devices to capture critical points of interest.

| 4. Sine vibration test

Sine vibration test exposes the device under test (DUT) to a single frequency sinusoidal tone of a specified amplitude for a period of time. There are several different ways to perform a sine test. Engineers can run a sinusoidal scan to expose the DUT to a single sinusoidal tone that varies in frequency within a specified range.

After performing a sine scan, engineers can determine the resonant frequency of the DUT. They can then expose the DUT to resonant frequencies until a failure occurs or until each resonance takes enough time to ensure that a failure does not occur in the real world.

In Figure 2, the drive waveform shows the individual sinusoidal tone applied to the DUT during a sinusoidal scan test. The acceleration curve in Figure 3 shows the peak amplitude in relation to frequency at two points on the DUT. The control point is the installation point of the DUT, and the response point is the second point on the DUT.

The signal at the resonance _ response point is easy to identify, which is the main purpose of sine testing. The amplification factor of the resonance is usually the cause of DUT failure. Engineers can also design the sinusoidal test to stay at the first large resonance (192.6 Hz) until the DUT fails or until enough time is spent at the resonance to ensure that the DUT does not fail.

The signal driving the oscillator is a clean sinusoidal tone. The signal measured at the DUT is not always so clean. The measured signal contains harmonics and other sources of mechanical and electrical noise. Sinusoidal testing requires the measurement and control of energy at a single frequency. The tracking filter also needs to remove energy from the measurement except for a single frequency.

5. Shock vibration test

Shock vibration testing is the third component of the essential kit for vibration test engineers, which includes sinusoidal, random and shock testing

Compared to the other two types of testing, shock vibration testing is better at assessing a product's ability to withstand sudden and violent mechanical shocks, including drops, earthquakes, and explosions. By exposing equipment to controlled shock events, engineers can assess its structural integrity, performance under extreme conditions, and vulnerability to failure. This test method is especially important in industries such as automotive, aerospace, defense, electronics, and packaging, where products must withstand harsh environments and sudden mechanical shocks.

Classical impulse

Classical impulse is the simplest way to generate impulse. Classical pulses have a predefined shape, amplitude, direction, and duration. The basic pulse shape library is derived from previous drop tests. Examples of classical pulse shapes include half-sine, initial peak, terminal peak, square, triangle, sawtooth, trapezoid, and half-sine.

Complex impulse

Some vibration tests require a user-defined transient or shock response spectrum to handle more complex shock pulses. There are specialized software packages designed to recreate these complex pulses.

Test engineers can use complex shock pulses to better represent real-world conditions. There are many synthetic computational pulses that can simulate complex transient waveforms with a frequency response comparable to the real environment.

Retrieved from <https://encyclopedia.pub/entry/history/show/128671>