

Case Study

Multi-Input Multi-Output Vibration Testing

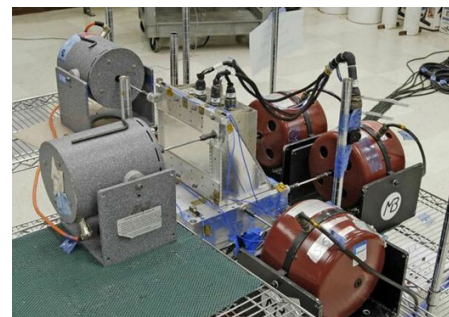
OVERVIEW

Vibration testing is used in many industries to qualify components and evaluate performance. ATA Engineering (ATA) has developed a portable multi-input multi-output (MIMO) shaker control system capable of controlling multiple degrees of freedom simultaneously using standard electrodynamic shakers, allowing test articles to be subjected to a diverse set of testing environments simultaneously in multiple degrees of freedom. Applications include matching specified vibration levels in multiple degrees of freedom using sinusoidal dwells, random excitation, and/or time waveform replication. This innovative technique has been used for sinusoidal qualification testing of an electronic component and successfully provided excitation levels up to 1.5 G at 17 discrete frequencies of interest from 80 to 1,600 Hz in all six degrees of freedom simultaneously.

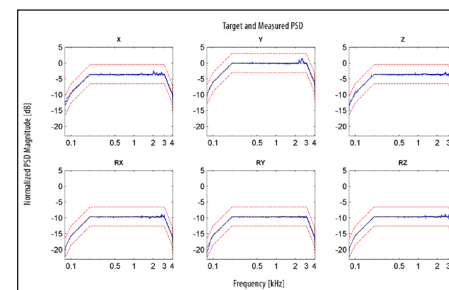
The technique can also be used to reproduce cross-power spectral density matrices across a broad frequency range. The same electronic component was subjected to vibration tests using target spectral densities from 80 to 4,000 Hz for each of the six degrees of freedom. The resulting spectra were well within ± 3 dB of the specifications throughout the frequency range of interest. Overall, the target spectral densities were matched with a mean error of only 0.2 dB and a maximum error of 1.75 dB at 3.3 kHz.

TASKS PERFORMED & KEY OUTCOMES

- Multiple degree of freedom vibration testing with standard electrodynamic shakers.
- Time waveform control for replicating transient events.
- Pseudo-random vibration testing environments with cross-spectral density matching.



Shaker setup



Target and Measured PSDs