SHOCK AND VIBRATION RESPONSE SPECTRA COURSE   Unit 13.
Synthesizing a Time History to Satisfy a Power Spectral Density using Random Vibration

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Introduction

Recall that white noise is a random time history that has constant power spectral density amplitude.

White noise can be manipulated to yield a time history that satisfies a given power spectral density specification. The purpose of thus Unit is to present a method for this process. Note that the method alters the time history so that it is no longer white, unless the specification amplitude is constant. Nevertheless, the resulting time history is random.

The white noise approach has several advantages over a series of sinusoids. One advantage is that the derived signal has a continuous frequency spectrum. Another is that it is random.

The main text for this Unit is given in tutorial: psdsyn.pdf. Please read this tutorial before performing the homework.

Homework

This homework assignment is essentially a repeat of the Unit 12 homework except that the synthesis for the Unit 13 homework is based on white noise.

1. Calculate the overall GRMS level of the power spectral density Table 1 using program psdint.exe. Plot the power spectral density.

Table 1.	
Power Spectral Density	
Frequency (Hz)	Level (G^2/Hz)
10	0.001
40	0.2
60	0.2
100	0.01
200	0.01

2. Use program psd_syn.exe to synthesize a time history to satisfy the power spectral density in Table 1.   Use the parameters in Table 2. Plot the time history.

Table 2. Synthesis Parameters	
Duration	4 seconds
Sampling Rate	Selected by psd_syn program to be 10x highest input frequency.
Frequency Resolution	Continuous

3. Use program maxfind.exe to calculate the GRMS and kurtosis of the time history. Compare the GRMS value of the time history with the GRMS value of the power spectral density.

4. Calculate and plot the power spectral density of the synthesized time history. Use program poweri.exe. Superimpose this time history against the level in Table 1.

5. Calculate and plot the histogram of the synthesized time history using program histogra.exe. Use a delta x value of 2.