SHOCK AND VIBRATION RESPONSE SPECTRA COURSE
Unit 7D. Level Difference in Decibels

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Introduction

Power density levels are often scaled upward or downward in terms of decibels (dB).

G or GRMS

Assume that A and B each has an amplitude either in G or GRMS. The difference in dB between A and B is

$$\Delta dB = 20 \log \left[\frac{A}{B} \right] \tag{1}$$

Note that the log function is base ten.

Furthermore,

$$A = B \left\lfloor 10^{\Delta dB / 20} \right\rfloor \tag{2}$$

G^2 or G^2/Hz

Assume that C and D each has an amplitude either in G^2 or G^2/Hz. The difference in dB between C and D is

$$\Delta dB = 10 \log \left[\frac{C}{D} \right] \tag{3}$$

Furthermore,

$$C = D \left\lfloor 10^{\Delta dB / 10} \right\rfloor \tag{4}$$

Example

The level in Table 1 is to be raised by 6 dB. Calculate the new level both in terms of GRMS and G^2/Hz.

Table 1. Original Power Spectral Density, 8.09 GRMS Overall	
Freq (Hz)	Level (G^2/Hz)
10	0.002
100	0.04
1000	0.04
2000	0.02

A 6 dB increase causes the overall GRMS level to increase by a factor of 2.0, per equation (2). This same increase causes the G^2/Hz amplitudes to increase by a factor of 4.0, per equation (4). The resulting level is shown in Table 2.

Table 2. New Power Spectral Density, 16.2 GRMS Overall	
Freq (Hz)	Level (G^2/Hz)
10	0.008
100	0.16
1000	0.16
2000	0.08

Homework

1. Calculate a new level for Table 3 based on a 3 dB increase.

Table 3. Power Spectral Density, 9.3 GRMS Overall	
Freq (Hz)	Level (G^2/Hz)
10	0.001
200	0.08
500	0.08
2000	0.02

2. What is the dB difference between 6 GRMS and 10.5 GRMS? Use hand calculations. Then verify your answer using program dboct.exe. (Use the coordinates at same frequency option).