Lab 2 Assessment Questions

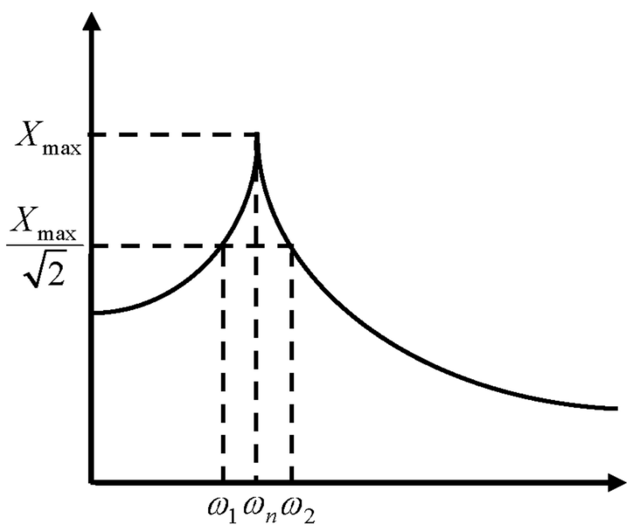
Please type your submission and submit your answers as a PDF with the Excel data file separately.

Use your vertical acceleration data (in the z direction) to estimate the frequency of the motor ω and the corresponding **displacement amplitude $\mathbb{X}$** of the platform for each motor speed.

1. **(1 pt)** Estimate the natural frequency of the system by determining the motor frequency that results in the largest measured displacement amplitude.

2. **(2 pts)** Plot $\mathbb{X}$ vs. ω/p to obtain the frequency response curve of the system.

While the logarithmic decrement can be used to estimate the damping ratio for damped free vibrations, the half-power bandwidth method can be used to estimate the damping of a forced system, as shown below:



The damping ratio can be estimated using:

$$\zeta = \frac{\omega_2 - \omega_1}{2\omega_n}$$

Where ω_n is the natural frequency (ie. $\omega_n = p$), and ω_1 and ω_2 correspond to the frequencies that result in an amplitude that is $1/\sqrt{2}$ times the amplitude at resonance.

3. **(3 pts)** Using your plot of $\mathbb{X}$ vs. ω/p, estimate the damping ratio using the half-power bandwidth method. ω_1 and ω_2 can be determined using linear interpolation.

4. **(2 pts)** Using your calculated damping ratio, estimate the mass of a single imbalance (remember that there are two imbalances, not one), if they each have an eccentricity of 25 mm. Assume the total mass of the system is 13 kg.

5. **(2 pts)** Estimate the natural frequency of the system using the vertical acceleration data recorded during beating of the platform and the motor frequency measured with the stroboscope.