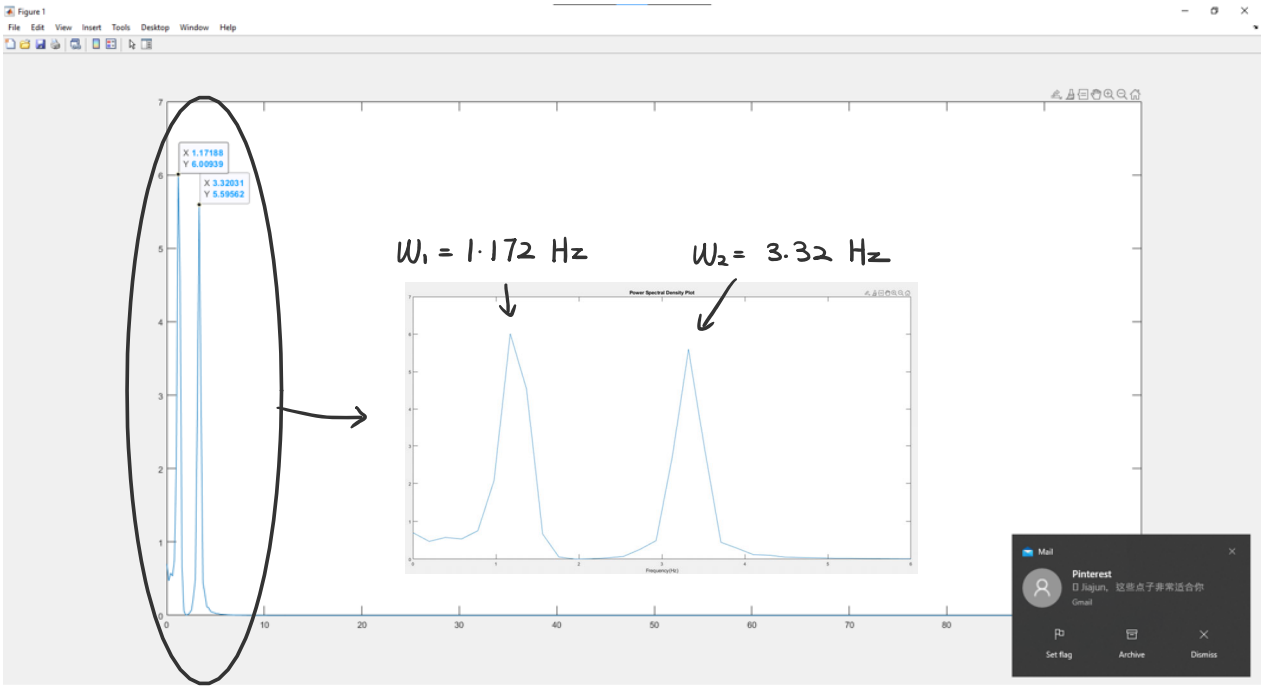
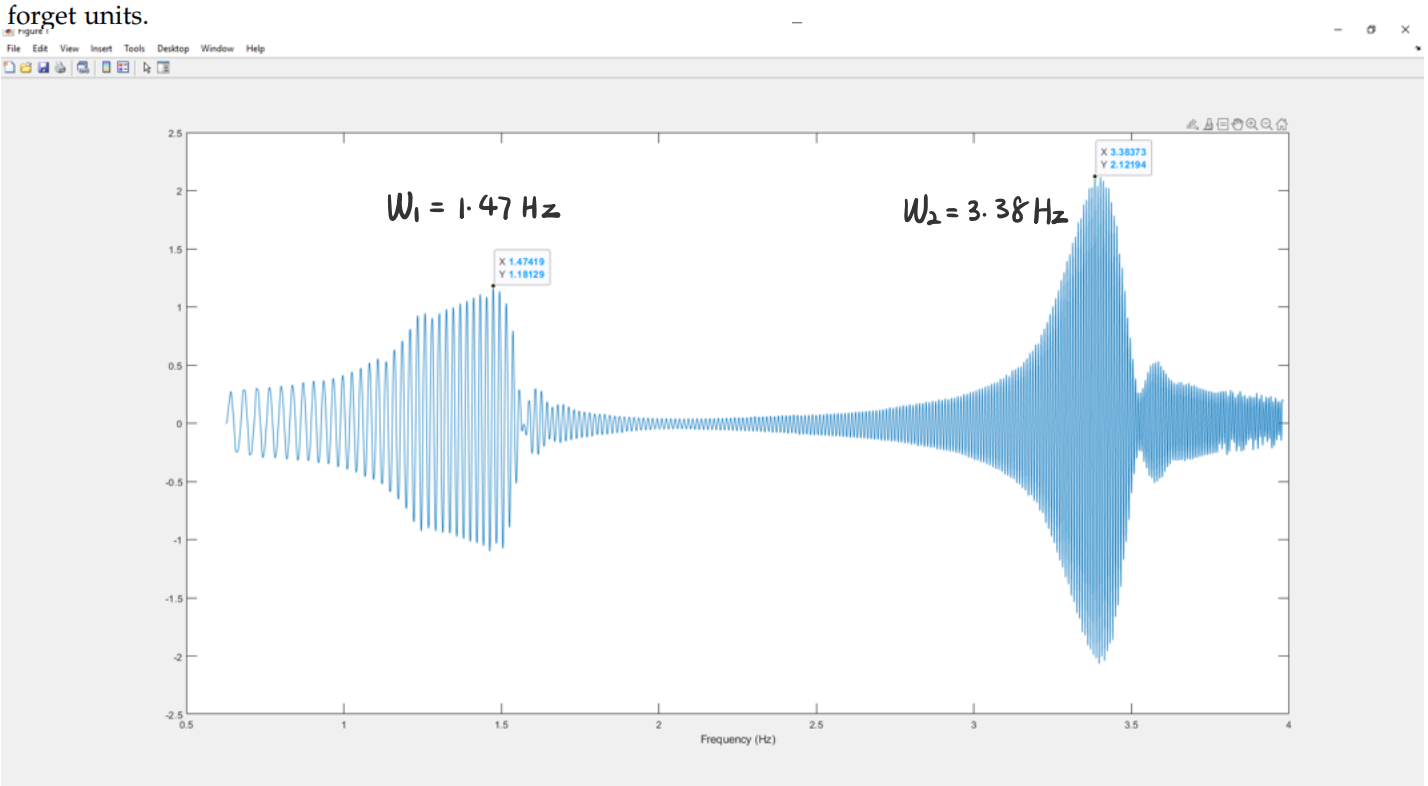
Lab 5 Post-Lab

1. Write down the natural frequencies found from the power spectral density plot of the free response in the first experiment. Don't forget units.



2. Write down the resonance frequencies found from the analysis of the harmonically forced response in the second experiment. Don't forget units.



3. Compare the frequencies obtained in the previous two cases to the values found in the last prelab assignment.

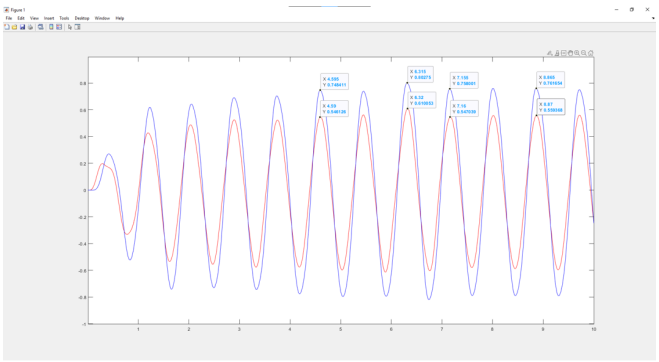
From prelab we know $\omega_1 = \frac{7.8175}{2\pi} = 1.2448\ Hz$, $\omega_2 = \frac{20.467}{2\pi} = 3.2591\ Hz$

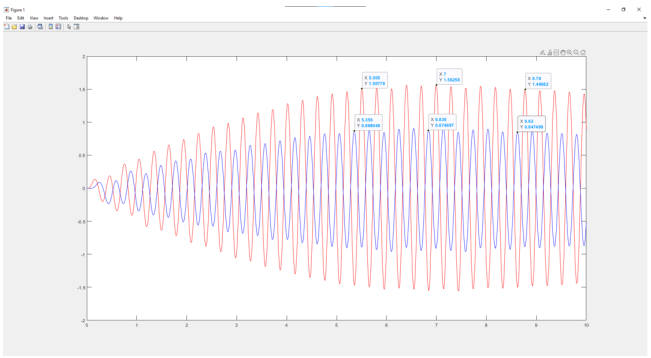
From Case 1 we know $\omega_1 = 1.172\ Hz$, $\omega_2 = 3.32\ Hz$

From Case 2 we know $\omega_1 = 1.47\ Hz$, $\omega_2 = 3.38\ Hz$

Therefore they are very close to each other

4. For each of the resonance frequencies, identify the forced response in the third experiment in terms of the observed ratio of amplitudes and phase difference between the two degrees of freedom.





For Experimental ω1

$$\frac{A_1}{A_2} = \frac{\left(\frac{0.748411}{0.546126} + \frac{0.80275}{0.610053} + \frac{0.758001}{0.547039}\right)}{3} = 1.372559$$

$\Delta\phi \approx 0$

For Experimental ω2

$$\frac{A_1}{A_2} = -\frac{\left(\frac{0.868048}{1.50778} + \frac{0.874897}{1.56258} + \frac{0.847499}{1.49682}\right)}{3} = -0.56727$$

$\Delta\phi \approx \pi$

5. Compare the observed ratios of amplitudes and phase differences to the mode shapes found in the last prelab assignment.

For Theoretical ω1

$$\frac{A_1}{A_2} = \frac{200 \cdot \sqrt{5} + 200}{400} = \frac{\sqrt{5}+1}{2} \approx 1.61803$$

$\Delta\phi \approx 0$

For Theoretical ω2

$$\frac{A_1}{A_2} = \frac{-200 \cdot \sqrt{5} + 200}{400} = -\frac{\sqrt{5}-1}{2} = -0.61803$$

$\Delta\phi \approx \pi$

Therefore there is a small difference between the experimental value an theoretical value. But they are very close.