Lab 3D assignment slides

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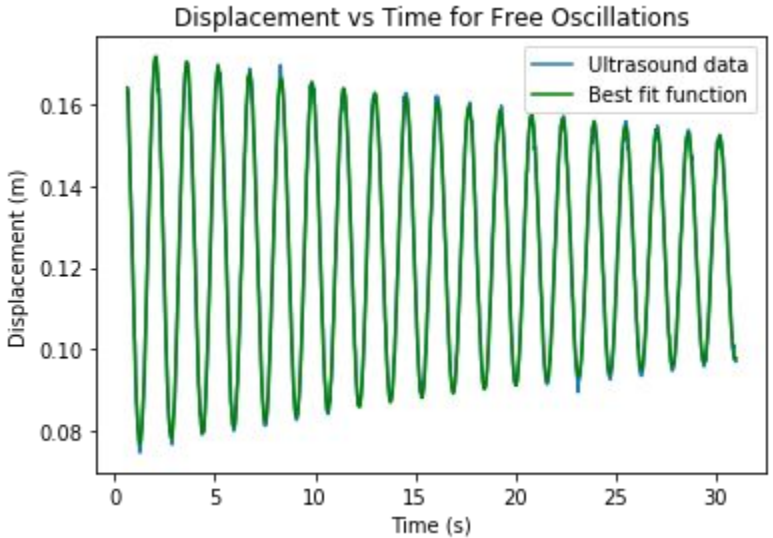
Frequencies

- Time for 20 oscillations in unforced state: 29.99 s
- Natural frequency f in Hz from unforced state: .6669 Hz
- Natural forceHalfPeriod: 0.7498 s

Plot ultrasound data of free oscillations

Even though this is supposed to be an undamped system, it has some damping. Plot the ultrasound data and find the value of “alpha” from the plot.



α = 0.0191019442724487

Find Q factor

$$Q = \frac{\omega_0}{2\alpha}$$

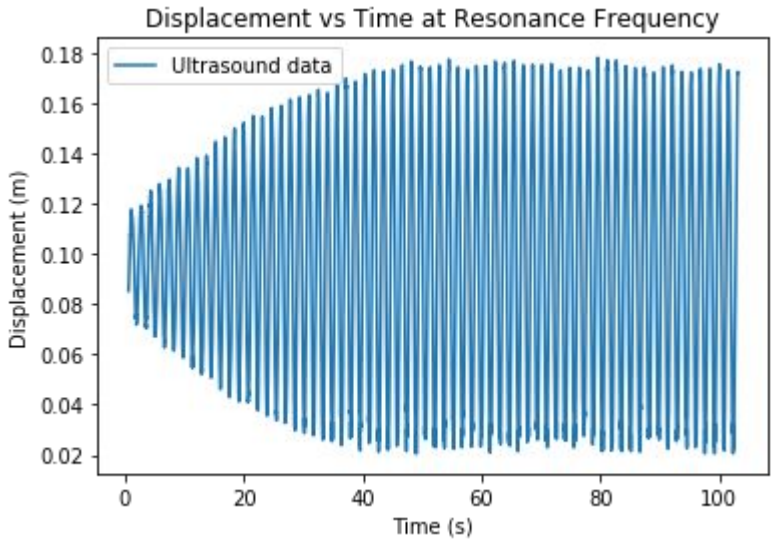
$$\omega_0 = \sqrt{\frac{k}{m}}$$

$$x(t) = Ae^{-\alpha t} sin(\omega t + \phi)$$

Q = 104.55

Resonance ultrasound plot

Plot the ultrasound data at resonance. Find the amplitude of oscillations.



Amplitude of oscillations = 0.075m

Find Q factor

$$Q = \frac{A_R k}{F_{max}}$$

$where$

$A_R = Resonance\ amplitude$

$F_{max} = mg$

Q = 43.1

Q factor from frequency-amplitude plot

$$Q = \frac{F_0}{\Delta F}$$

Q factor = 13.08
Delta F = 0.06