EXPERIMENTAL MECHANICS COURSEWORK (6E5Z0005_2122_1)

NAME – ***ADITYA NAIK***

STUDENT ID – ***20025377***

TASK 1

1.

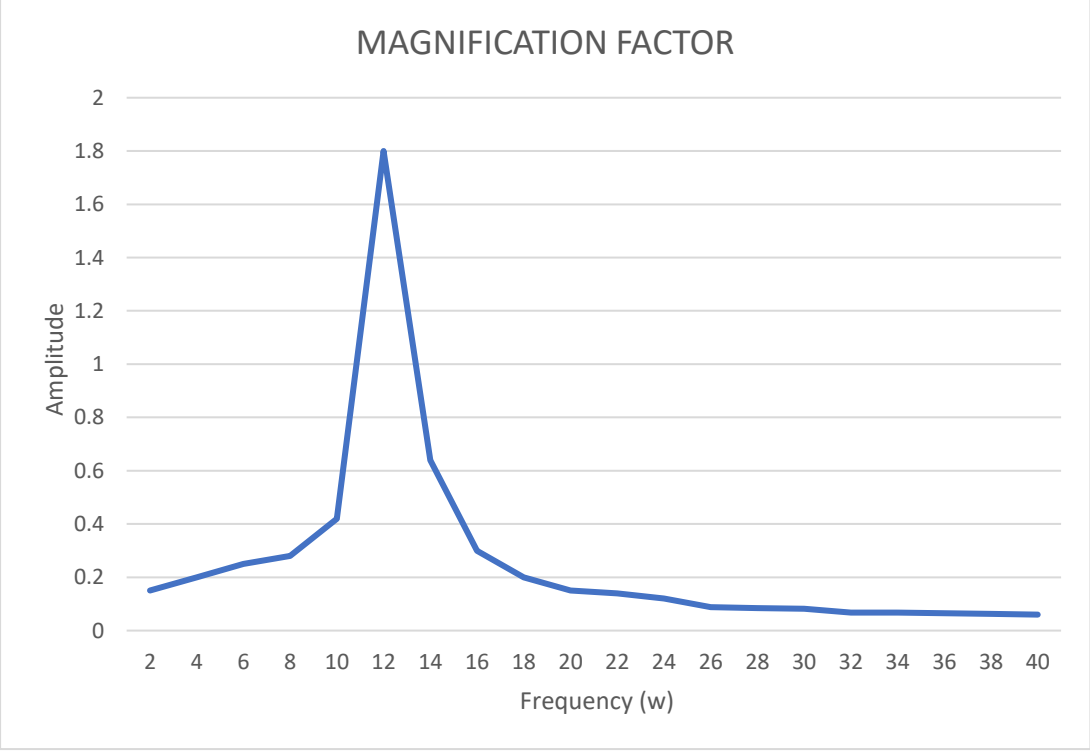
(i) Cantilever beam with mass

beam_with_mass.txt

(ii) Cantilever beam without mass

beam_without_mass.txt

2. Magnification factor graph –



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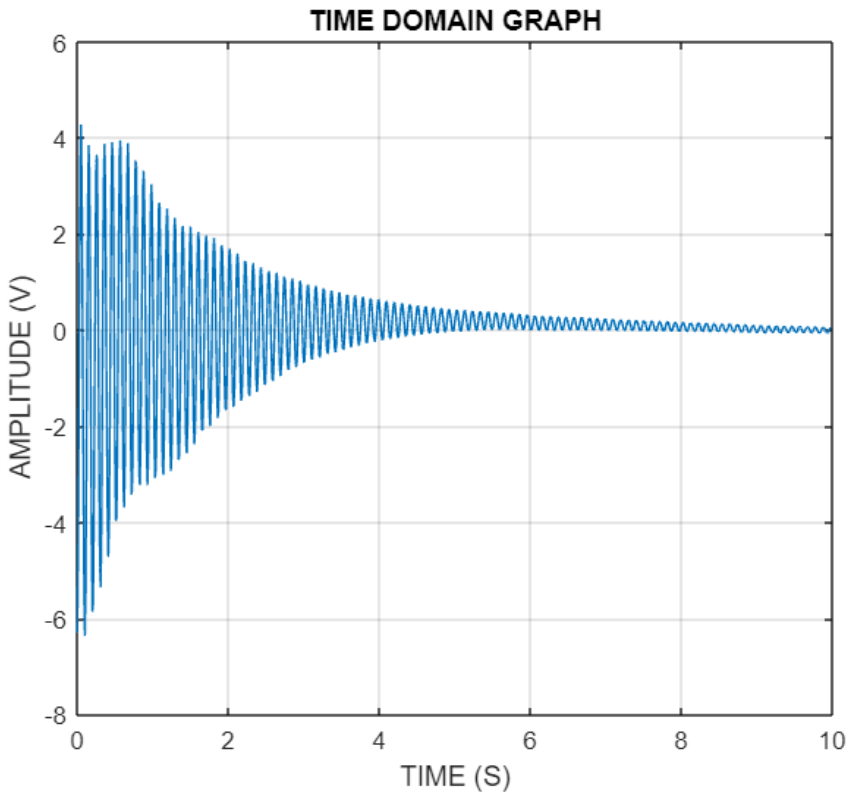
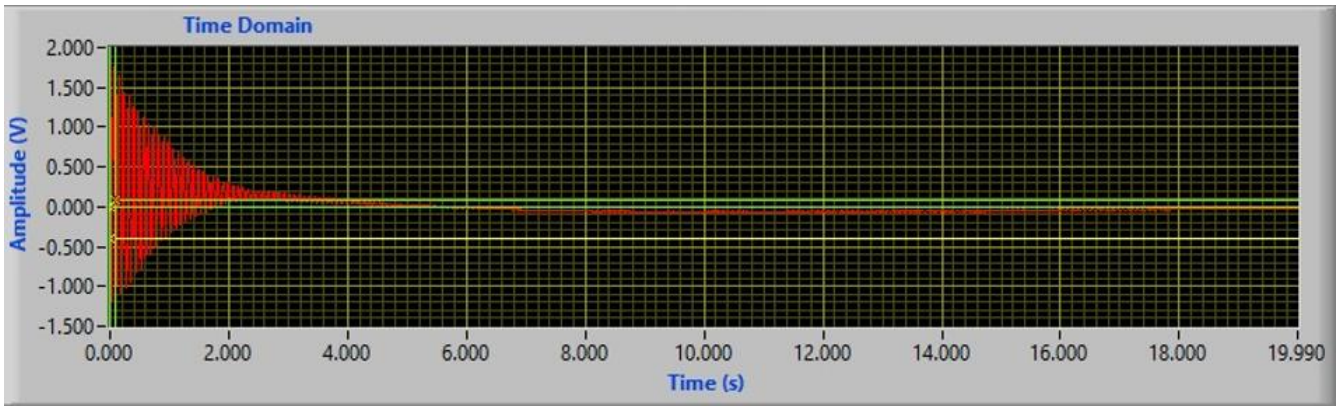
TASK 2 –

(i) Time domain with mass



Time domain without mass



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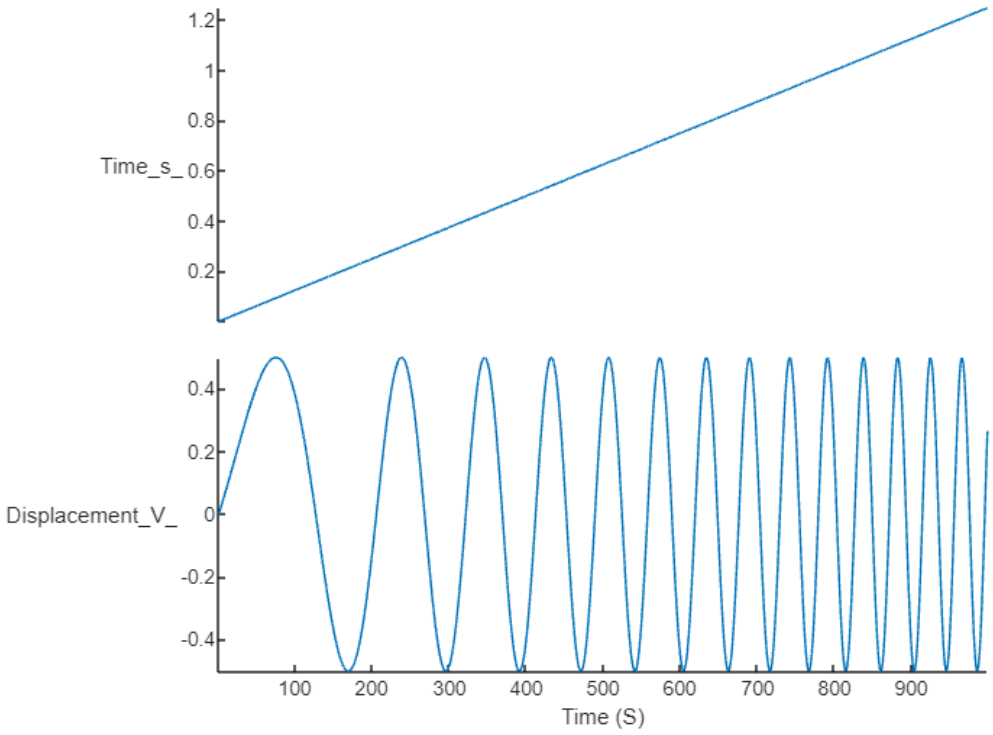
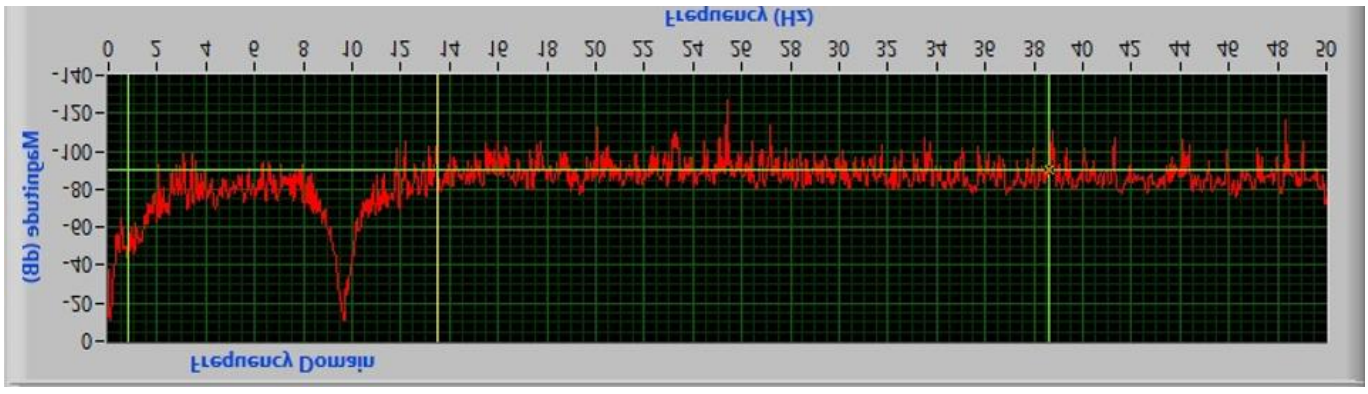
Frequency domain with mass



Frequency domain without mass



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(ii) DAMPING RATIO USING LOG DECREMENT METHOD –

x1 = 4

x2 = 3

$\ln \frac{4}{3} = \frac{2\pi\zeta}{\sqrt{1-\zeta^2}}$

$0.287 = \frac{2\pi\zeta}{\sqrt{1-\zeta^2}}$

$0.287^2 * \sqrt{1-\zeta^2} = 2\pi^2\zeta^2$

$(4\pi^2 + 0.287)^2)\zeta^2 = (0.287^2)$

$(39.47 + 0.082)\zeta^2 = 0.082$

$39.552\zeta^2 = 0.082$

$$\underline{\boldsymbol{\zeta = 0.044}}$$

TASK 3 –

(b)

(i) First three natural frequencies of the beam

wd1 = 12.30Hz

wd2 = 82.5Hz

wd3 = 230Hz

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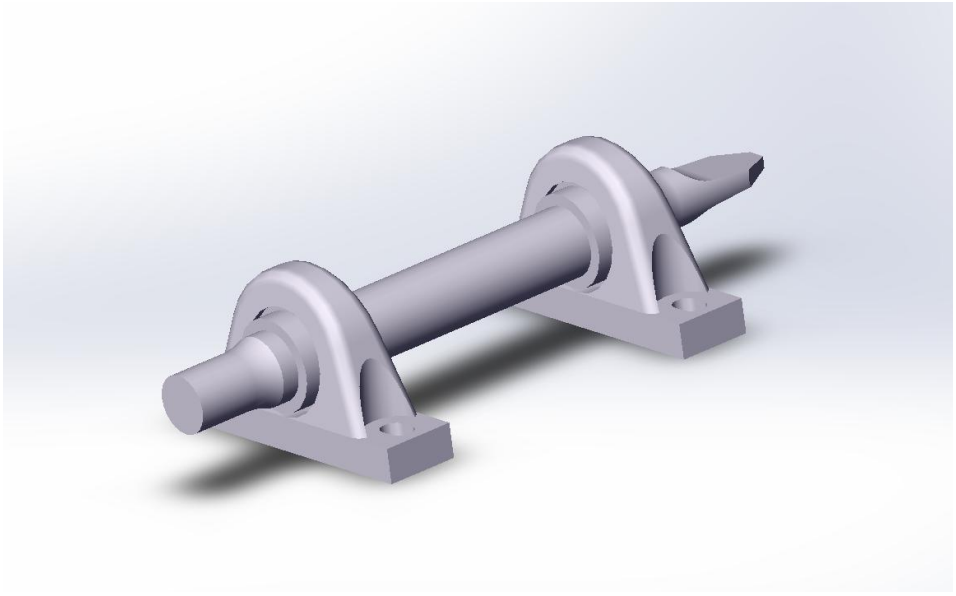
3. Solid works



First three natural frequency of modes –

Mode No.	Frequency
1	454.01
2	456.55
3	576.74

INTRODUCTION:

To analyse the with different methods that how cantilever beam functions with or without mass. So, to analyse we are going to graphs and solidworks.

AIM:

To see that how cantilever beam functions with or without mass through time domain and frequency domain graphs and with matlab software.

OBJECTIVES:

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- Investigate the free response of a vibrating system in the time and frequency domains using experimental method.
- Investigate the forced response of a vibrating system identifying natural frequencies and associated mode shapes.
- Analyse the response data of the vibrating systems utilising MATLAB software.
- Modelling the cantilever beam by mathematical formula and by finite element simulation using an industry standard software such as Solid works.

METHODLOGY:

- For TASK 1 we have to investigate the free response of a vibrating system in the time and frequency domain using experimental method using the magnification factor formula and record the results.

$$M = \frac{X}{\delta_{st}} = \frac{1}{\sqrt{(1-r^2)^2 + (2\zeta r)^2}}$$

And we have to investigate the forced response of a vibrating system identifying natural frequencies and associated mode shapes where we have to perform a frequency sweep using signal generator starting from 5Hz to 300Hz.

- For TASK 2 we need to analyse the response data of the vibrating systems while using matlab software where we have to have to identify the dominant damped natural frequencies of cantilever beam with or without mass.
- For TASK 3 we have to model the cantilever beam by mathematical formula and by finite element simulation using the solidworks. And research Euler Bernoulli Beam theory. Theoretically model the cantilever beam, which you have used in your experiment, as one degree of freedom system. You should consult your lecture notes and tutorial examples regarding one degree of freedom modelling. Model the cantilever beam with/without added mass using SolidWorks and extract the first three natural frequencies and their associated transverse mode shapes for the cantilever beam.

DISCUSSION & CONCLUSION:

Here we can say that using all the methods we satisfied our aim and got the desired result.

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