

# lab3 analysis

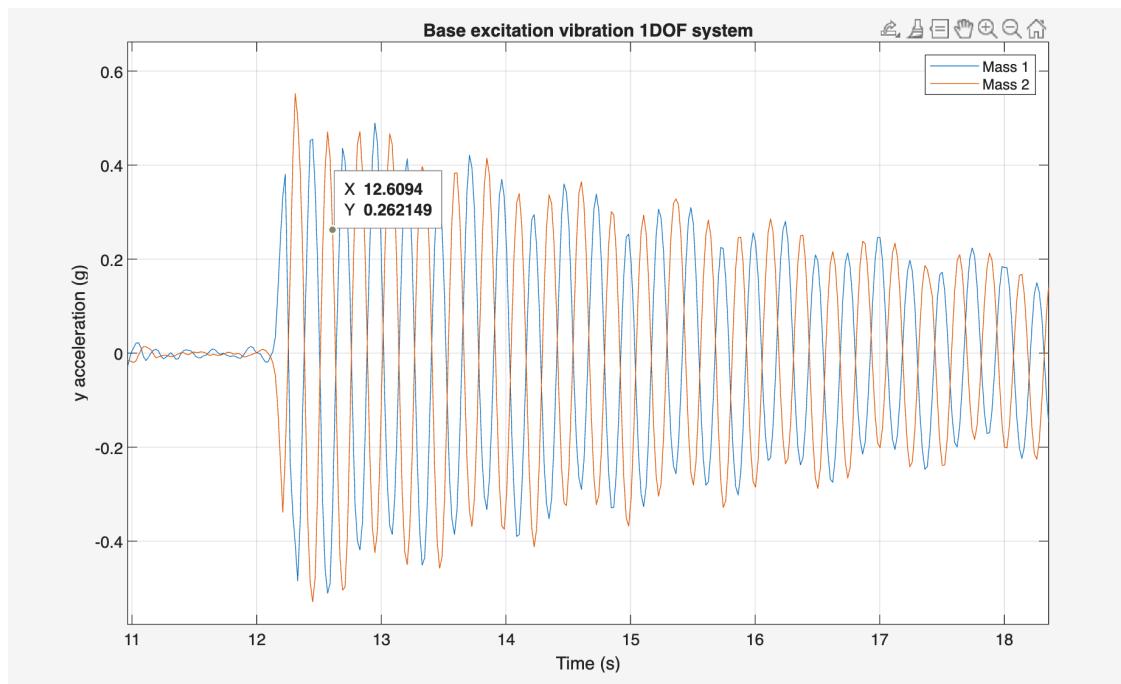
December 11, 2025

## 1 LAB 3

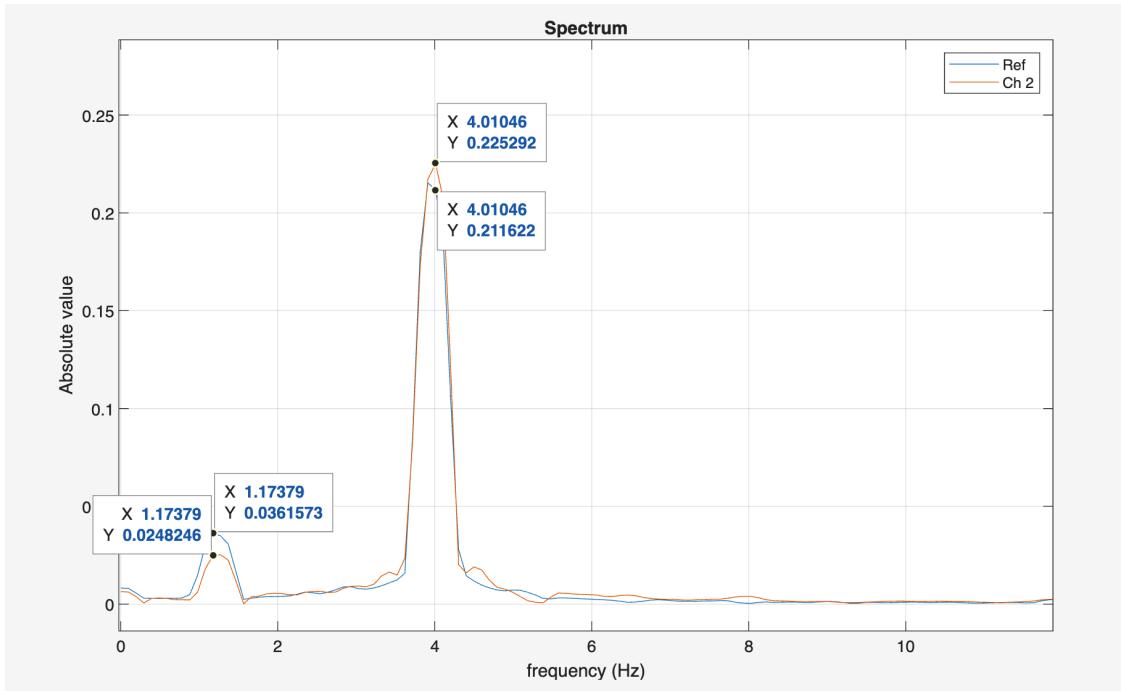
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### 1.1 Attempt primarily higher natural frequency

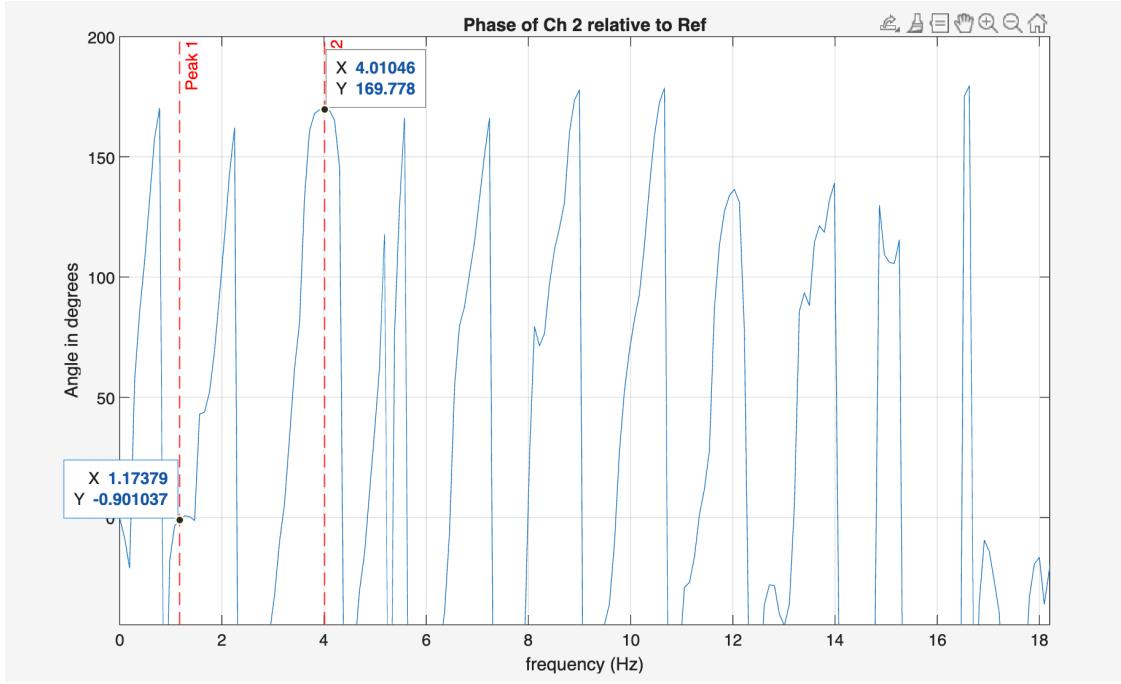
- Objective: To primarily excite higher natural frequencies (the second mode  $f_2$ ).
- Phenomenon: The accelerations of Ref and ch2 are opposite.



From spectrum plot, we pick our natural frequency  $f_1 = 1.17379\text{Hz}$  and  $f_2 = 4.01046\text{Hz}$



we get their phase difference



Mode	natural frequency $f_n(\text{Hz})$	Phase difference ( $^\circ$ )
1 <sup>st</sup> mode	1.17379	-0.901037
2 <sup>nd</sup> mode	4.01046	169.788

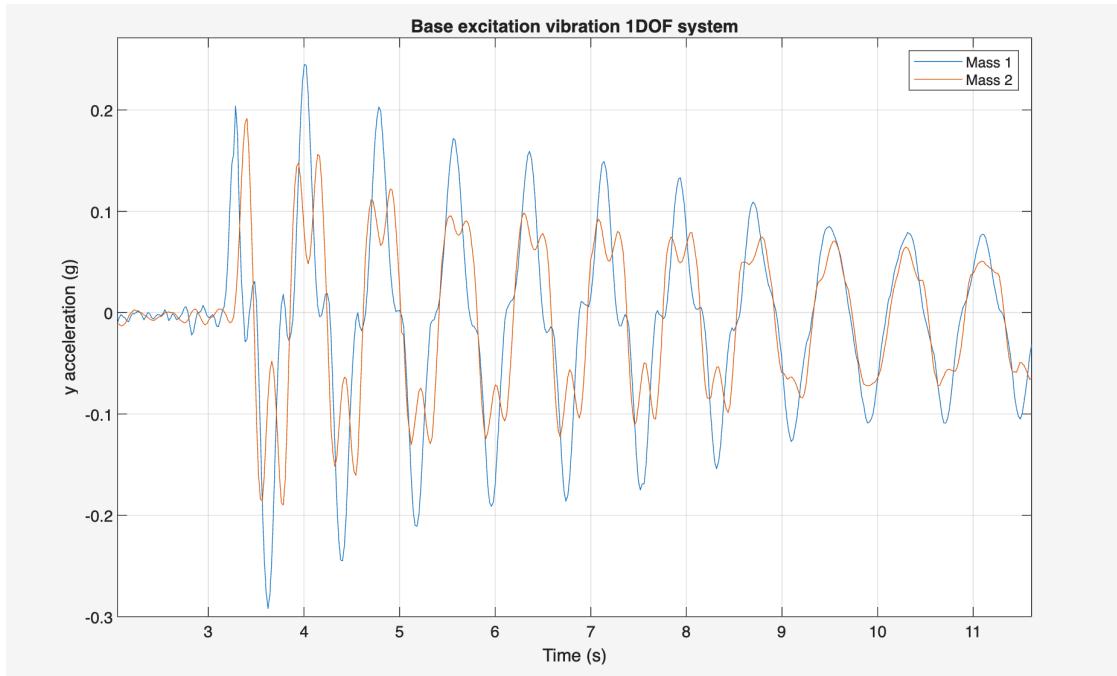
Note that Ref is mass 1, Ch2 is mass 2

```
[16]: import numpy
from numpy import array
f_1 = 1.17379
f_2 = 4.01046
# for mode 1
x_11 = 0.0362573
x_12 = 0.0252372
# for mode 2
x_21 = 0.211622
x_22 = 0.225292
x_1 = array([1, x_12/x_11])
x_2 = array([1, x_22/x_21])
x_1_column = x_1.reshape(-1, 1)
x_2_column = x_2.reshape(-1, 1)
print('For higher frequency is dominant:')
print("Mode 1 frequency: ", f_1)
print("Mode 2 frequency: ", f_2)
print("Mode 1 shape: ")
print(x_1_column)
print("Mode 2 shape: ")
print(x_2_column)
```

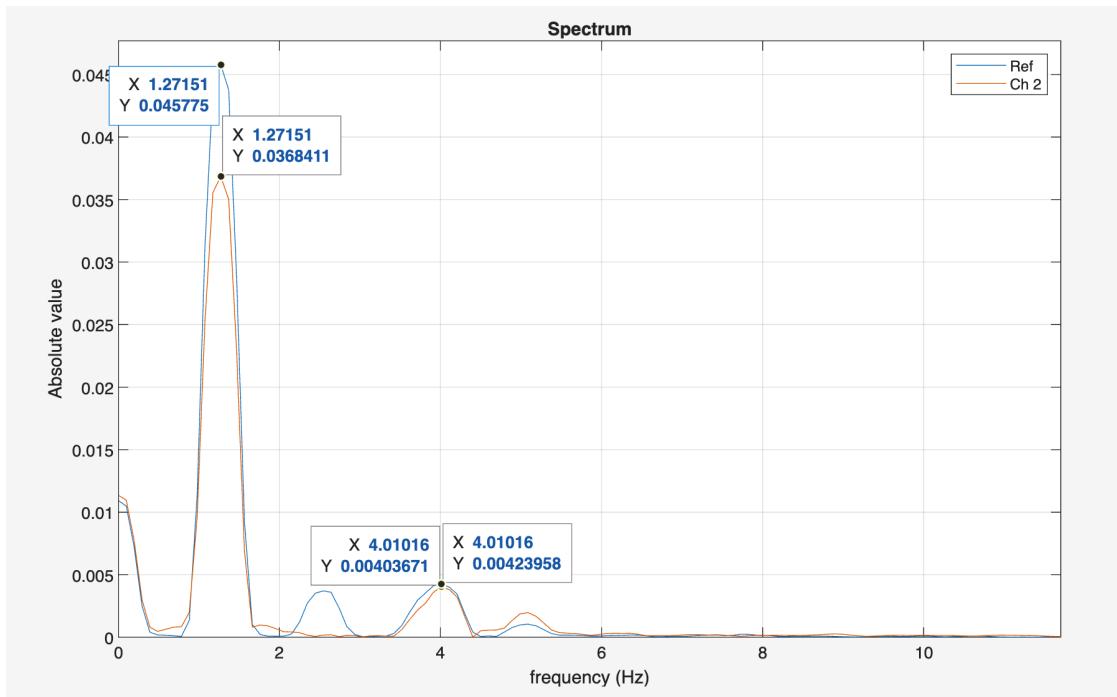
For higher frequency is dominant:  
Mode 1 frequency: 1.17379  
Mode 2 frequency: 4.01046  
Mode 1 shape:  
[[1.  
 [0.69605845]]  
Mode 2 shape:  
[[1.  
 [1.06459631]]]

## 1.2 Attempt primarily lower natural frequency

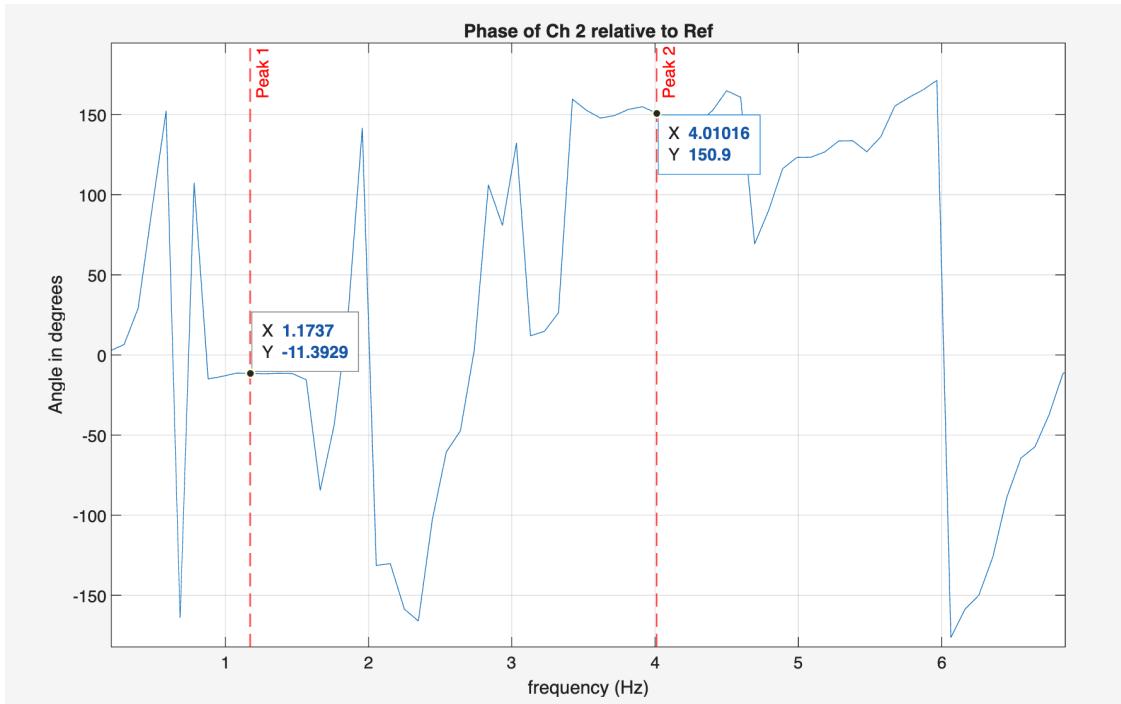
Objective: - To primarily excite lower natural frequencies (the second mode  $f_1$ ). - Phenomenon: The acceleration signal shows a “gap” at the crest



From spectrum plot, we pick our natural frequency  $f_1 = 1.27151\text{Hz}$  and  $f_2 = 4.01016\text{Hz}$



Then we can find the phase difference



Mode	natural frequency $f_n(Hz)$	Phase difference ( $^{\circ}$ )
1 <sup>st</sup> mode	1.27151	-11.3939
2 <sup>nd</sup> mode	4.01046	150.9

```
[17]: f_1 = 1.27151
f_2 = 4.01016
# for mode 1
x_11 = 0.0345775
x_12 = 0.0368411
# for mode 2
x_21 = 0.00423958
x_22 = 0.00403671
x_1 = array([1, x_12/x_11])
x_2 = array([1, x_22/x_21])
x_1_column = x_1.reshape(-1, 1)
x_2_column = x_2.reshape(-1, 1)
print('For Low frequency is dominant:')
print("Mode 1 frequency: ", f_1)
print("Mode 2 frequency: ", f_2)
print("Mode 1 shape: ")
print(x_1_column)
print("Mode 2 shape: ")
print(x_2_column)
```

For Low frequency is dominant:  
 Mode 1 frequency: 1.27151

Mode 2 frequency: 4.01016

Mode 1 shape:

[[1.  
[1.06546454]]

Mode 2 shape:

[[1.  
[0.95214856]]

[ ]: