

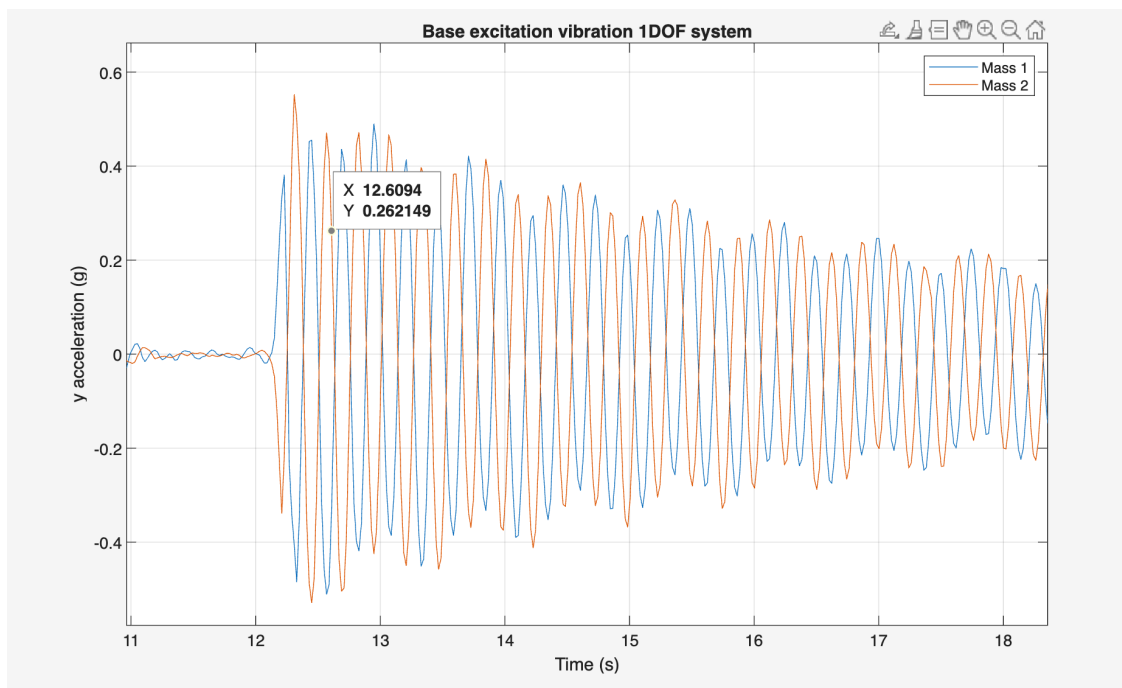
lab3 analysis

December 11, 2025

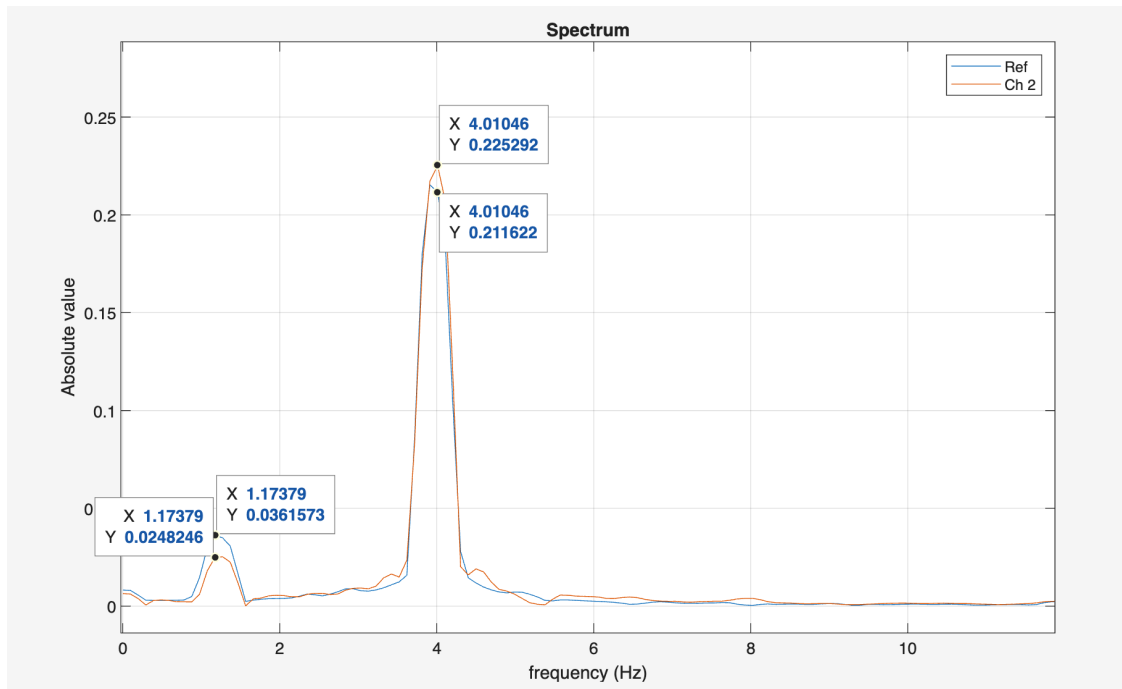
1 LAB 3

1.1 Attempt primarily higher natural frequency

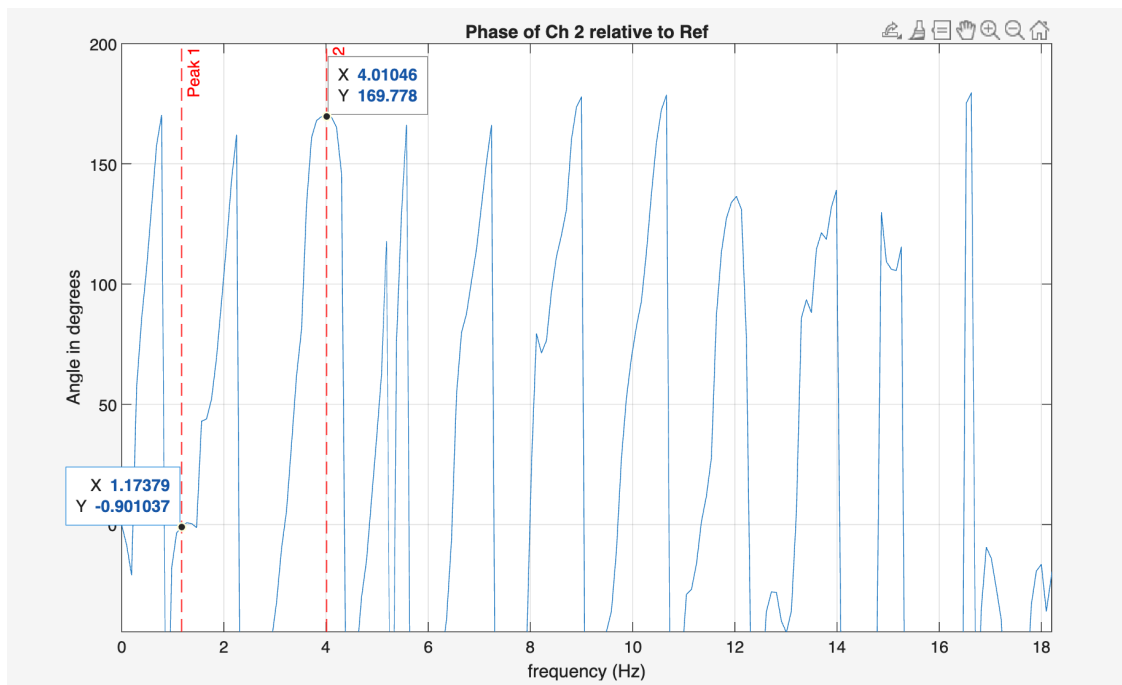
- Objective: To primarily excite higher natural frequencies (the second mode f_2).
- Phenomenon: The accelerations of Ref and ch2 are opposite.



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



we get their phase difference



Mode	natural frequency $f_n(Hz)$	Phase difference ($^{\circ}$)
1 st mode	1.17379	-0.901037
2 nd 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:

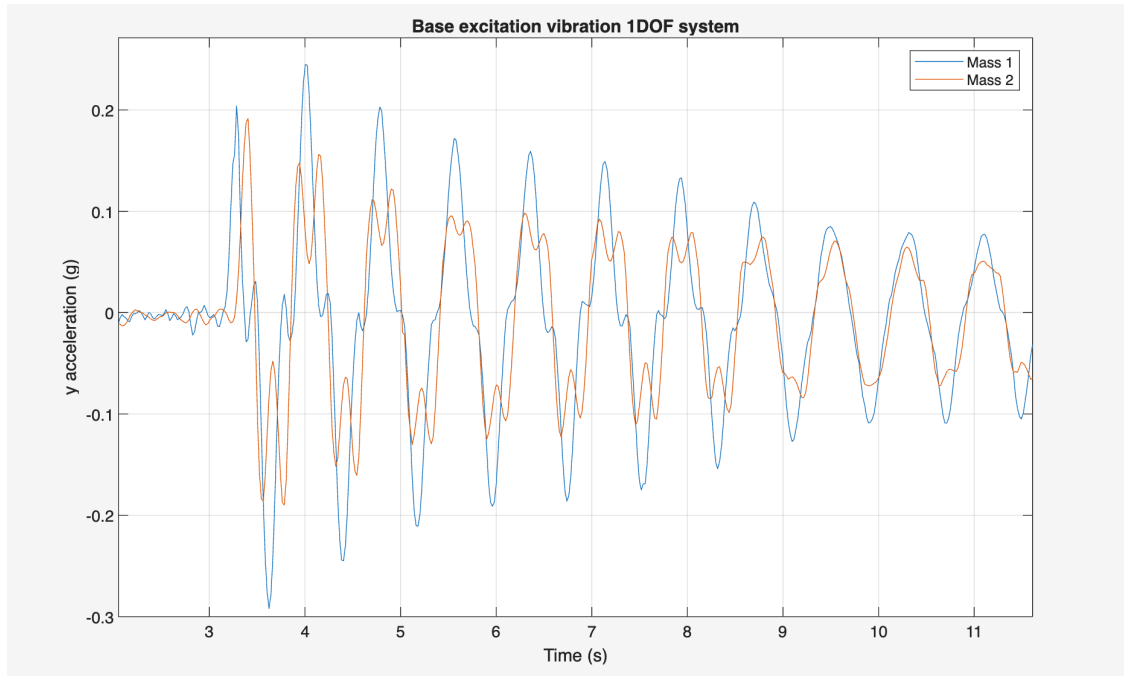
```
[[1.      ]
 [0.69605845]]
```

Mode 2 shape:

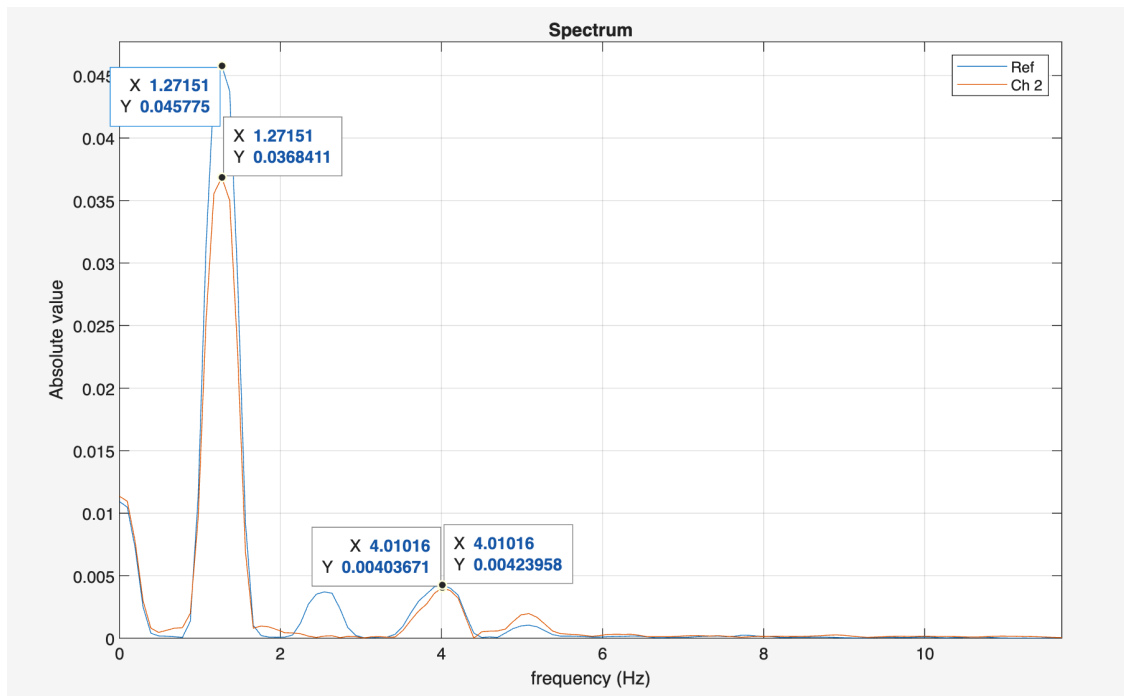
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[[1.      ]
 [1.06459631]]
```

1.2 Attempt primarily lower natural frequency

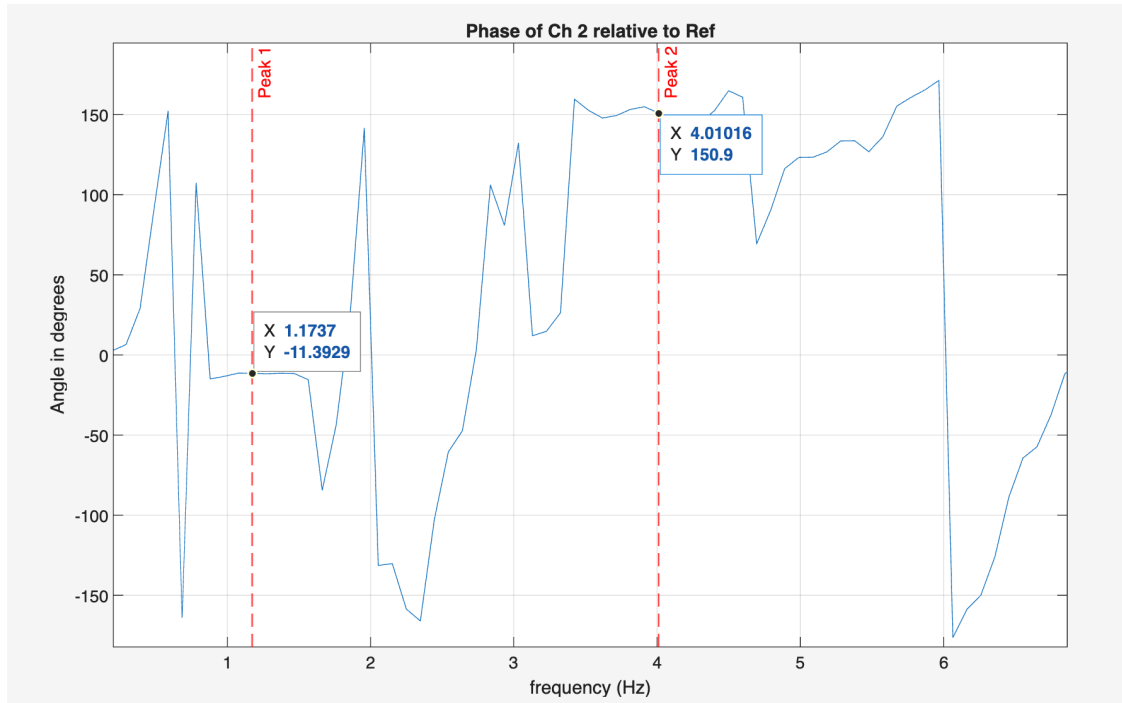
Objective: - To primarily excite lower natural frequencies (the second mode f_1). - Phenomenon:
The acceleration signal shows a “gap” at the crest



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



Then we can find the phase difference



Mode	natural frequency $f_n(Hz)$	Phase difference ($^{\circ}$)
1 st mode	1.27151	-11.3939
2 nd 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]]
```

[]: