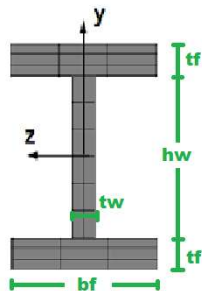
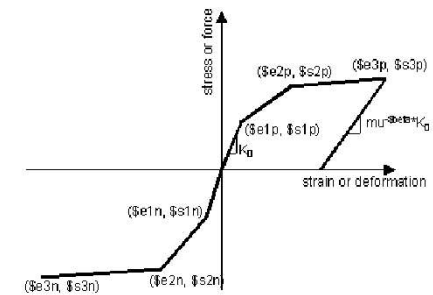
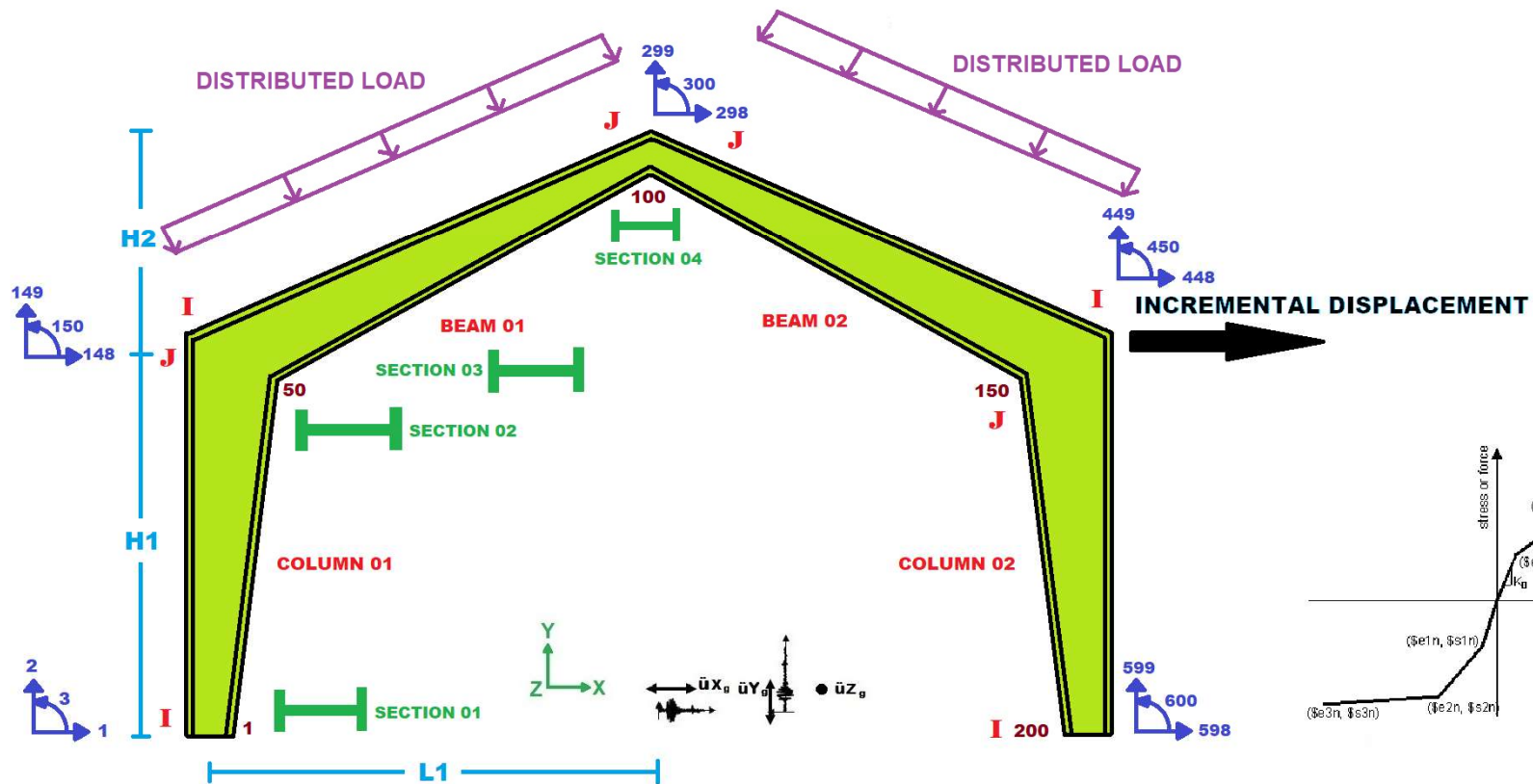


IN THE NAME OF ALLAH

**NONLINEAR PUSHOVER ANALYSIS OF A
NONPRISMATIC STEEL GABLE FRAME.
MODELING OF NONPRISMATIC ELEMENT
WITH MULTI PRISMATIC ELEMENTS.**

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)





NONLINEAR PUSHOVER ANALYSIS OF A NONPRISMATIC STEEL GABLE FRAME

Spyder (Python 3.12)

File Edit Search Source Run Debug Consoles Projects Tools View Help

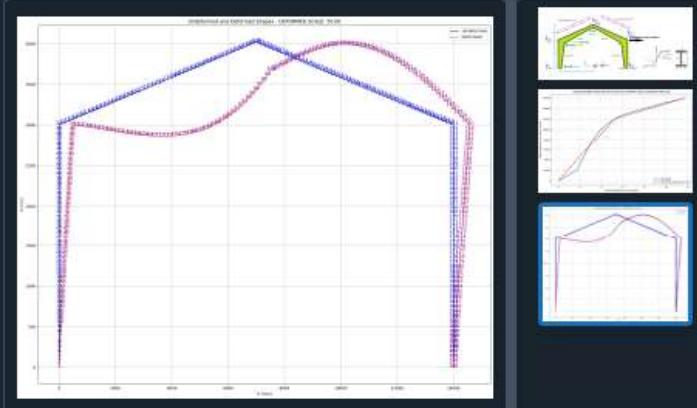
C:\Users\Del\\Desktop\OPENSEES_FILES\STEEL_GABLE_FRAME

C:\Users\Del\Desktop\OPENSEES_FILES\STEEL_GABLE_FRAME\STEEL_GABLE_FRAME_PUSHOVER.py

STEEL_GABLE_FRAME_DYNAMIC.py x STEEL_GABLE_FRAME_PUSHOVER.py x

```
1 #####
2 # IN THE NAME OF ALLAH #
3 # NONLINEAR PUSHOVER ANALYSIS OF A NONPRISMATIC STEEL GABLE FRAME #
4 # I SECTION COLUMN WITH FINITE PRISMATIC COLUMN #
5 # -----#
6 # MODELING OF NONPRISMATIC ELEMENT WITH MULTI PRISMATIC ELEMENTS #
7 # -----#
8 # THIS PROGRAM WRITTEN BY SALAR DELAVAR QASHQAI #
9 # EMAIL: salar.d.ghashghaei@gmail.com #
10 #####
11
12 #####-----
13 #import the os module
14 import os
15 import time as TI
16 import numpy as np
17 import openseespy.opensees as op
18 import ANALYSIS_FUNCTION as S03
19 import PLOT_2D as S04
20 import BILINEAR CURVE as S05
21
22 #####-----
23 import matplotlib.pyplot as plt
24 import matplotlib.image as mpimg
25
26 # Load the image
27 image_path = 'STEEL_GABLE_FRAME.PNG'
28 image = mpimg.imread(image_path)
29
30 # Display the image
31 plt.figure(figsize=(30, 16))
32 plt.imshow(image)
33 plt.axis('off') # Hide axes
34 plt.show()
35 #####-----
```

13 %



Help Variable Explorer Debugger Plots Files

Console 1/A x

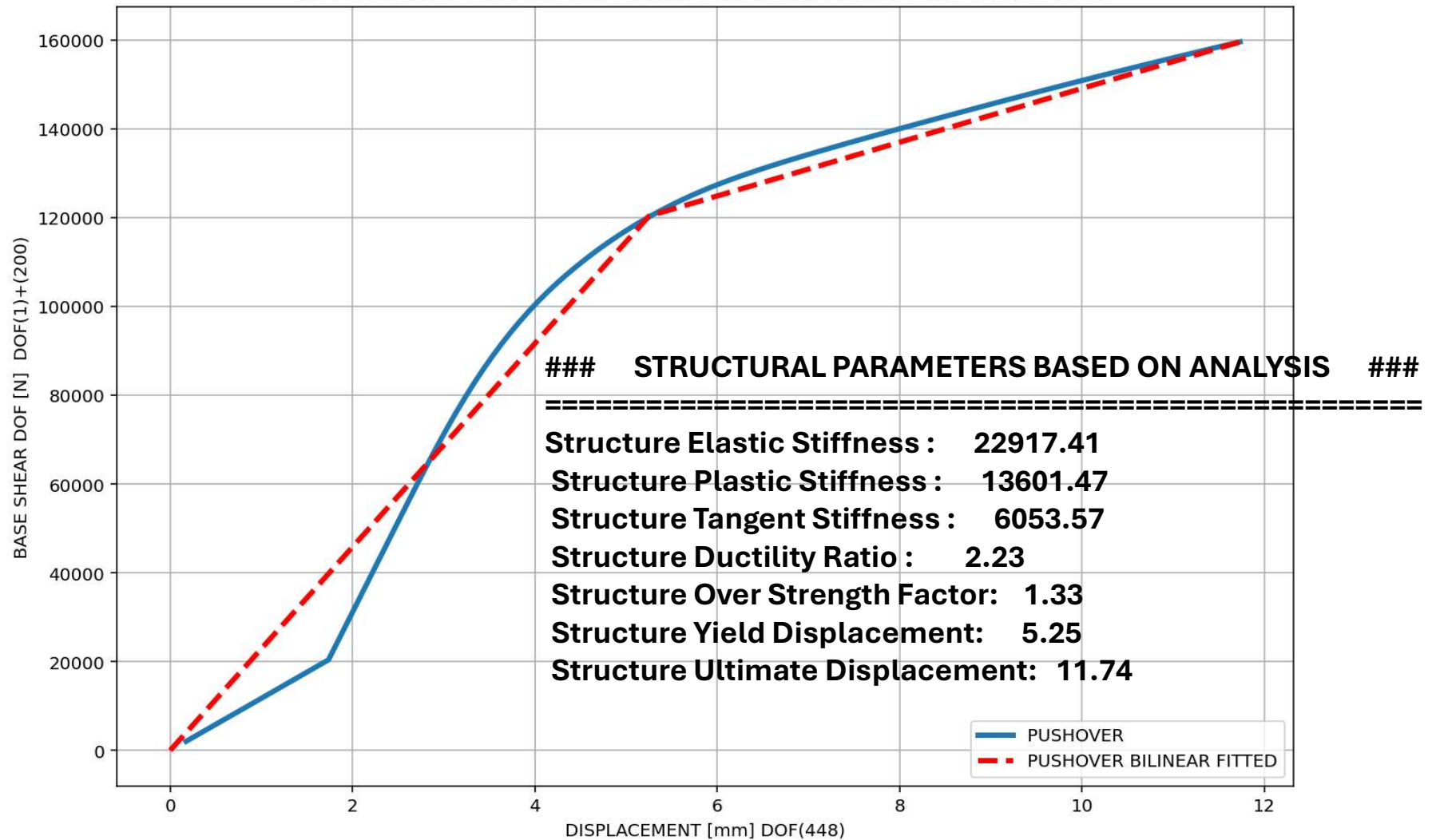
```
Structure Yield Displacement: 5.25
Structure Ultimate Displacement: 11.74
C:
\Users\Del\Desktop\OPENSEES_FILES\STEEL_GABLE_FRAME\PLOT_2D.
py:43: UserWarning: Legend does not support handles for Text
instances.
See: https://matplotlib.org/stable/tutorials/intermediate/
legend_guide.html#implementing-a-custom-legend-handler
ax.legend()

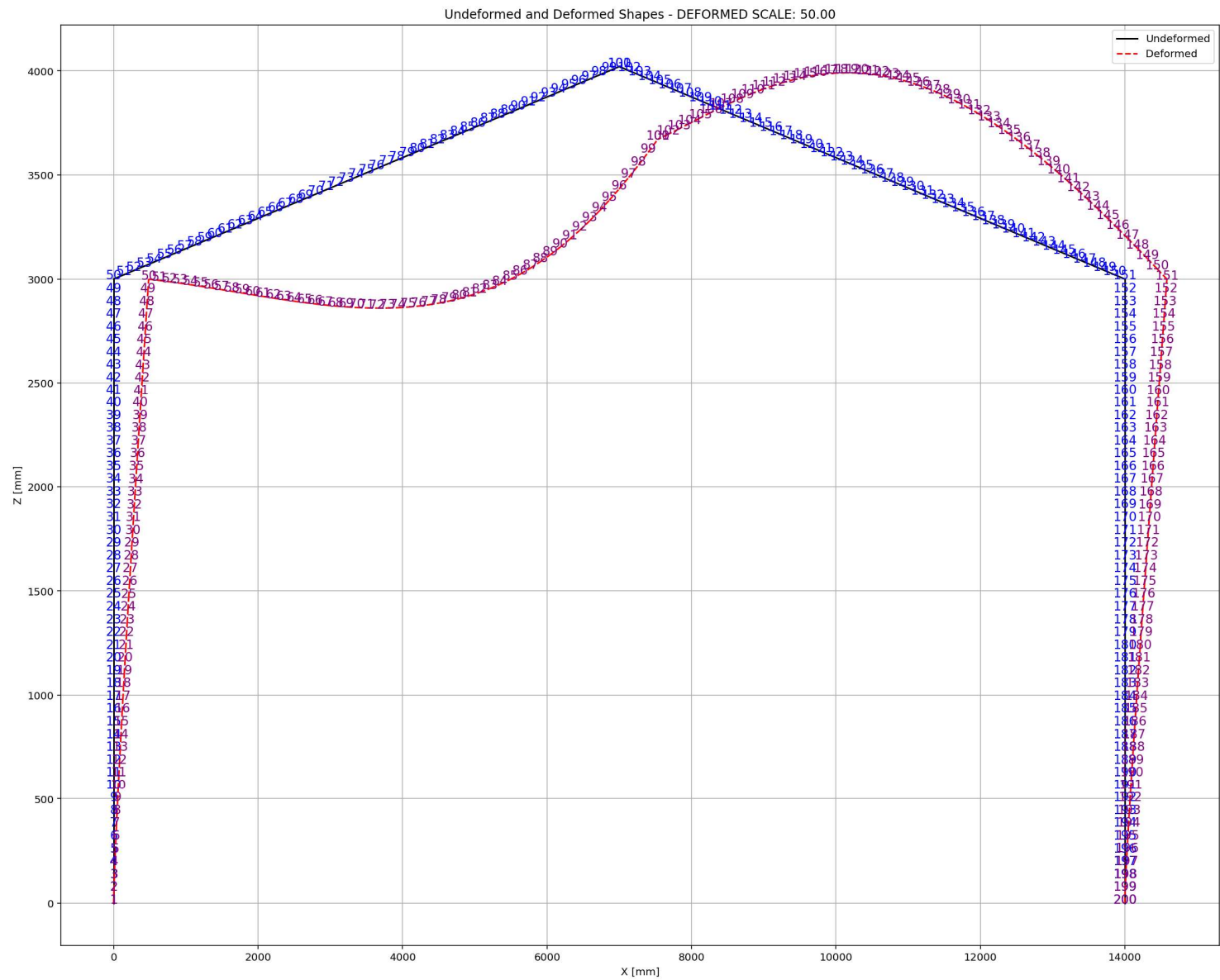
In [3]:
```

IPython Console History

Inline Conda: anaconda3 (Python 3.12.7) ✓ | SP: Python Line 1, Col 1 UTF-8 CRLF RW Mem 35%

DISPLACEMENT BASE-SHEAR CURVE FOR DYNAMIC AND PUSHOVER ANALYSIS





NONLINEAR DYNAMIC ANALYSIS OF A NONPRISMATIC STEEL GABLE FRAME

Spyder (Python 3.12)

File Edit Search Source Run Debug Consoles Projects Tools View Help

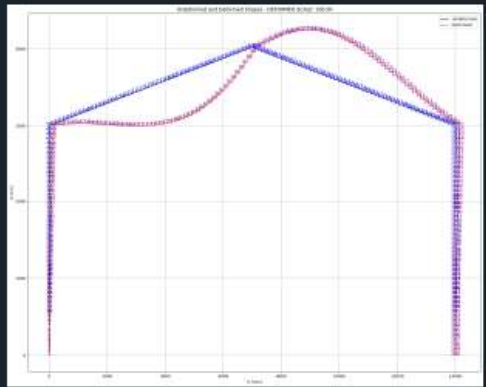
C:\Users\ DELL\Desktop\OPENSEES_FILES\STEEL_GABLE_FRAME

STEEL_GABLE_FRAME_DYNAMIC.py

STEEL_GABLE_FRAME_PUSHOVER.py

```
1  #####
2  #                               #
3  #   IN THE NAME OF ALLAH       #
4  #   NONLINEAR DYNAMIC ANALYSIS OF A NONPRISMATIC STEEL GABLE FRAME   #
5  #   I SECTION COLUMN WITH FINITE PRISMATIC COLUMN                     #
6  #   -----#
7  #   MODELING OF NONPRISMATIC ELEMENT WITH MULTI PRISMATIC ELEMENTS    #
8  #   -----#
9  #   THIS PROGRAM WRITTEN BY SALAR DELAVAR QASHQAI                     #
10 #   EMAIL: salar.d.ghashghaei@gmail.com                                #
11 #   #####
12 #%%-----#
13 #import the os module
14 import os
15 import time as TI
16 import numpy as np
17 import openseespy.opensees as op
18 import ANALYSIS_FUNCTION as S03
19 import PLOT_2D as S04
20 #%%-----#
21 import matplotlib.pyplot as plt
22 import matplotlib.image as mpimg
23
24 # Load the image
25 image_path = 'STEEL_GABLE_FRAME.PNG'
26 image = mpimg.imread(image_path)
27
28 # Display the image
29 plt.figure(figsize=(30, 16))
30 plt.imshow(image)
31 plt.axis('off') # Hide axes
32 plt.show()
33 #%%-----#
34 # Create a directory at specified path with name 'directory path'
```

13 %



Help Variable Explorer Debugger Plots Files

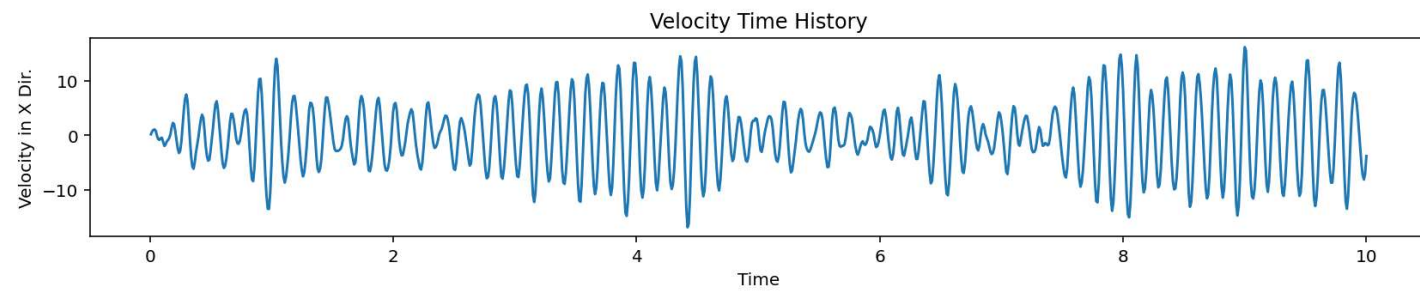
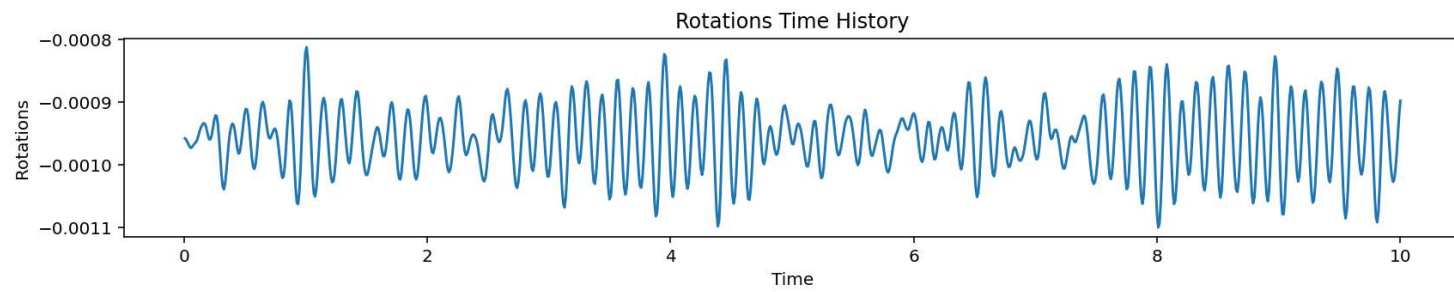
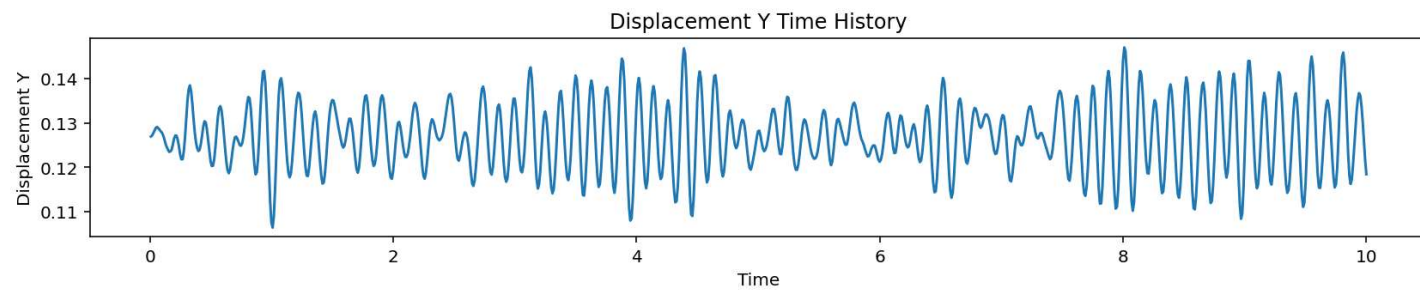
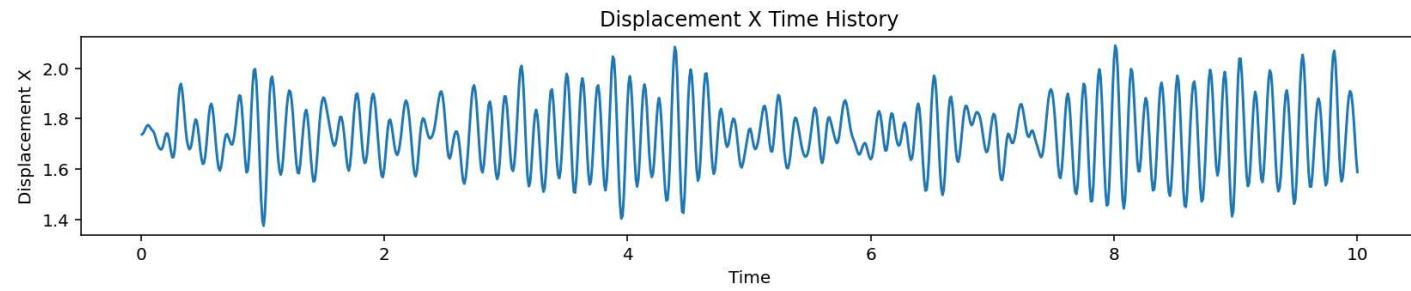
Console 1/A

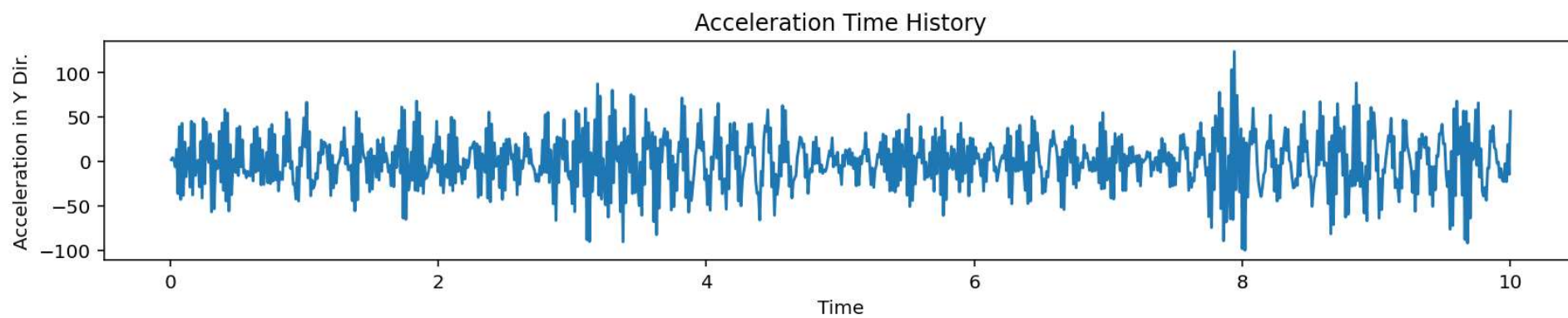
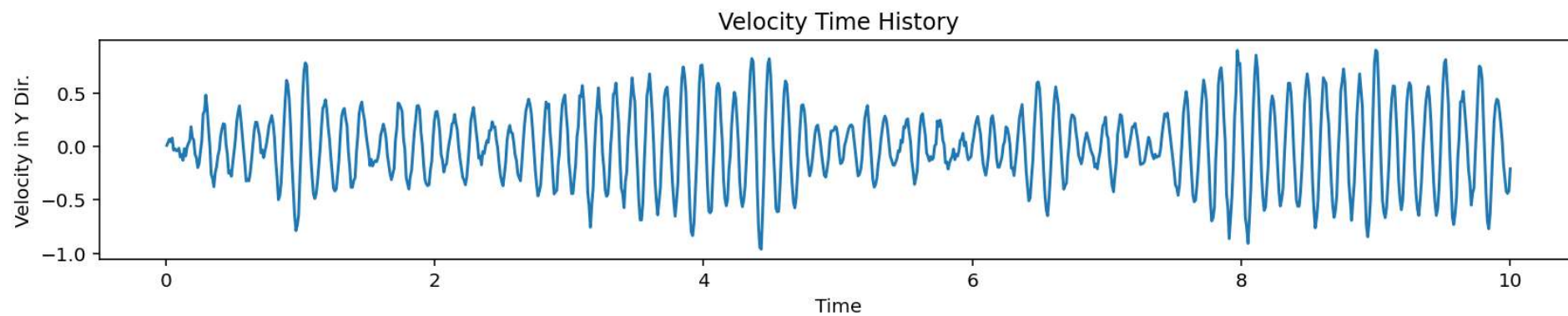
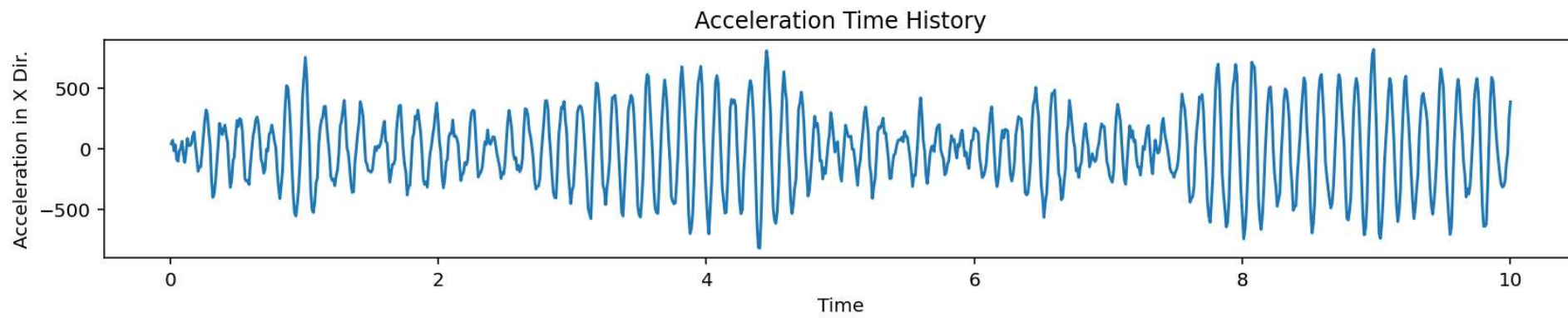
```
C:\Users\ DELL\Desktop\OPENSEES_FILES\STEEL_GABLE_FRAME\PLOT_2D.py:43: UserWarning: Legend does not support handles for Text instances.
See: https://matplotlib.org/stable/tutorials/intermediate/legend_guide.html#implementing-a-custom-legend-handler
ax.legend()

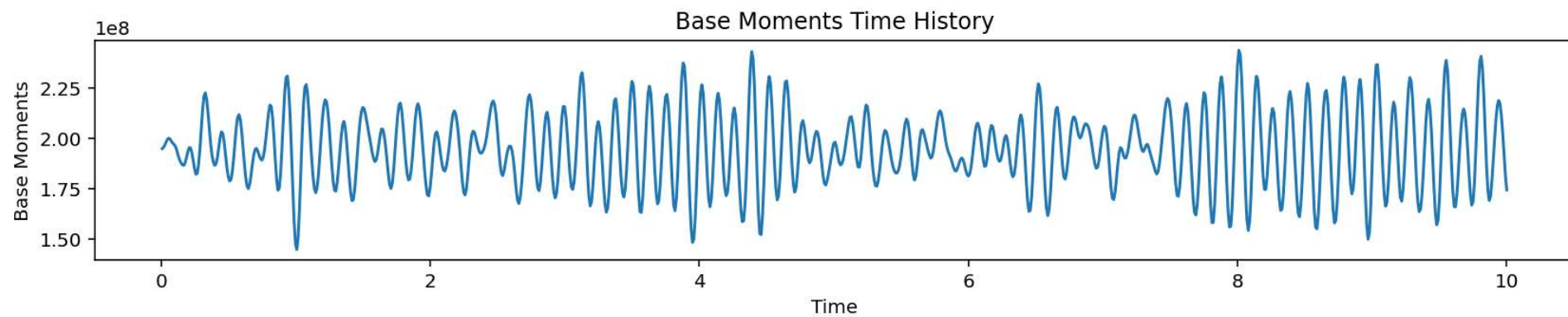
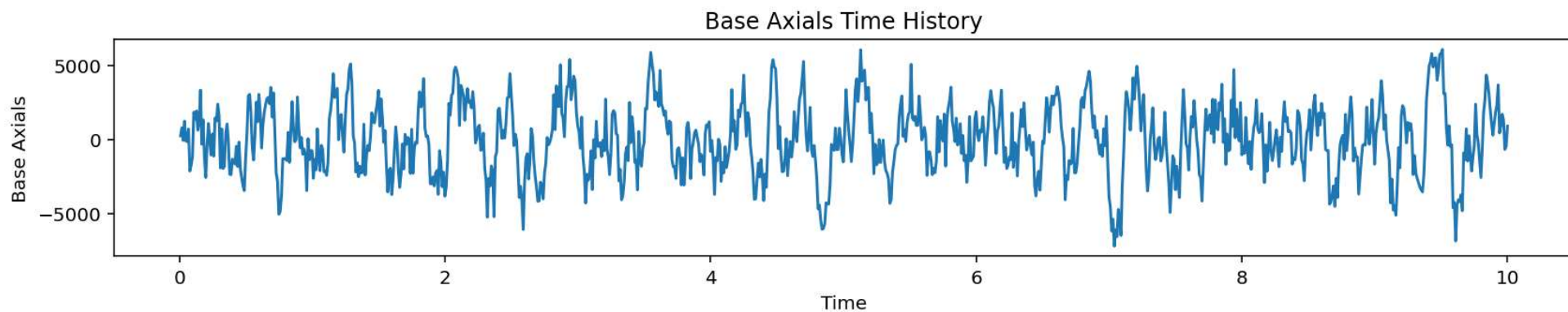
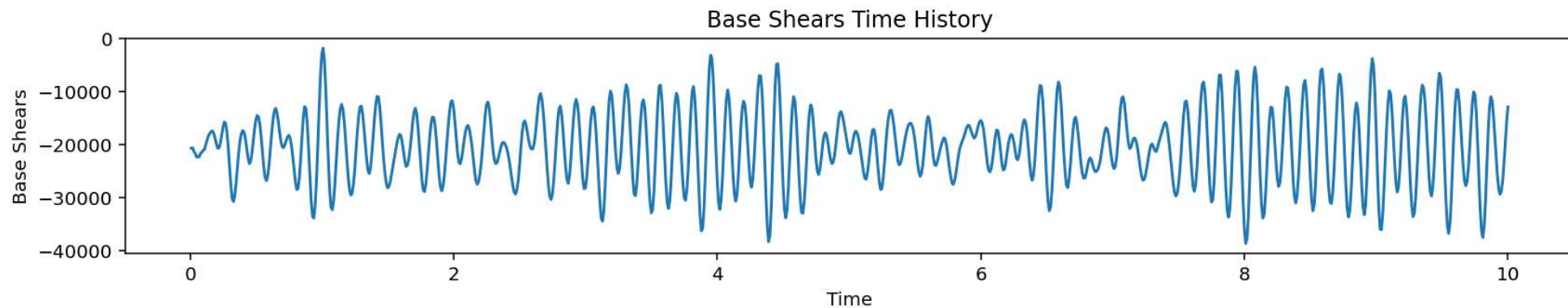
In [2]:
```

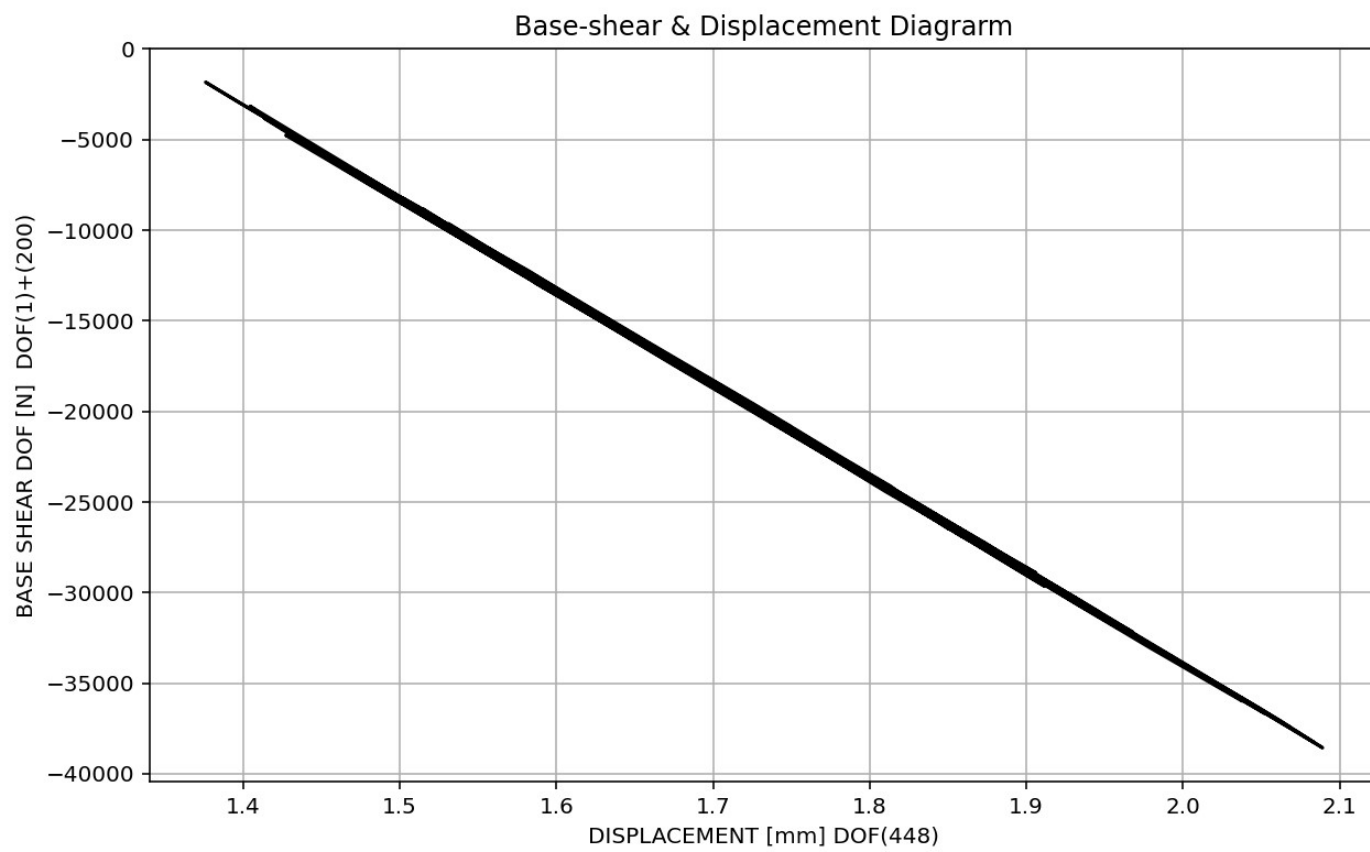
IPython Console History

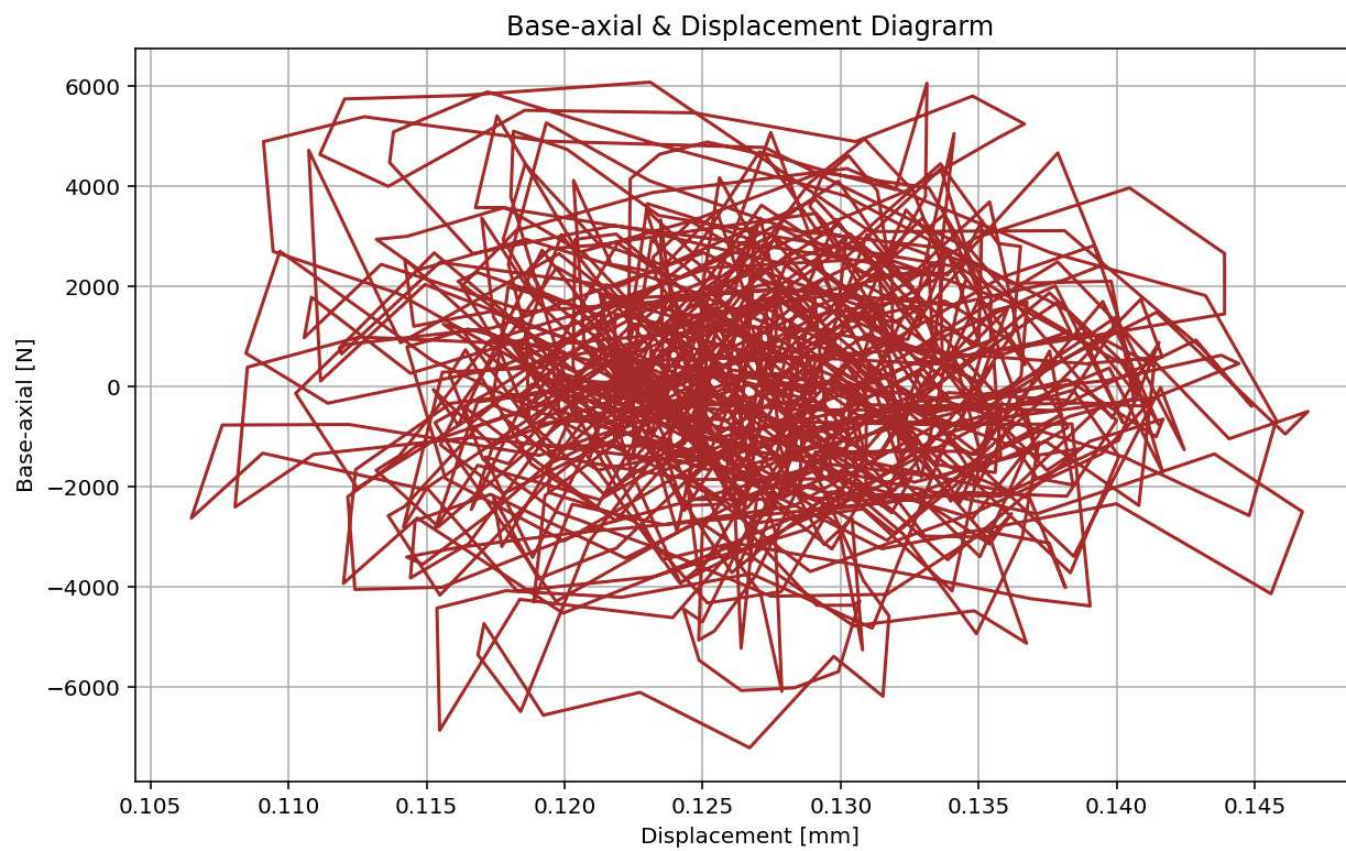
Inline Conda: anaconda3 (Python 3.12.7) LSP: Python Line 546, Col 1 UTF-8 CRLF RW Mem 34%

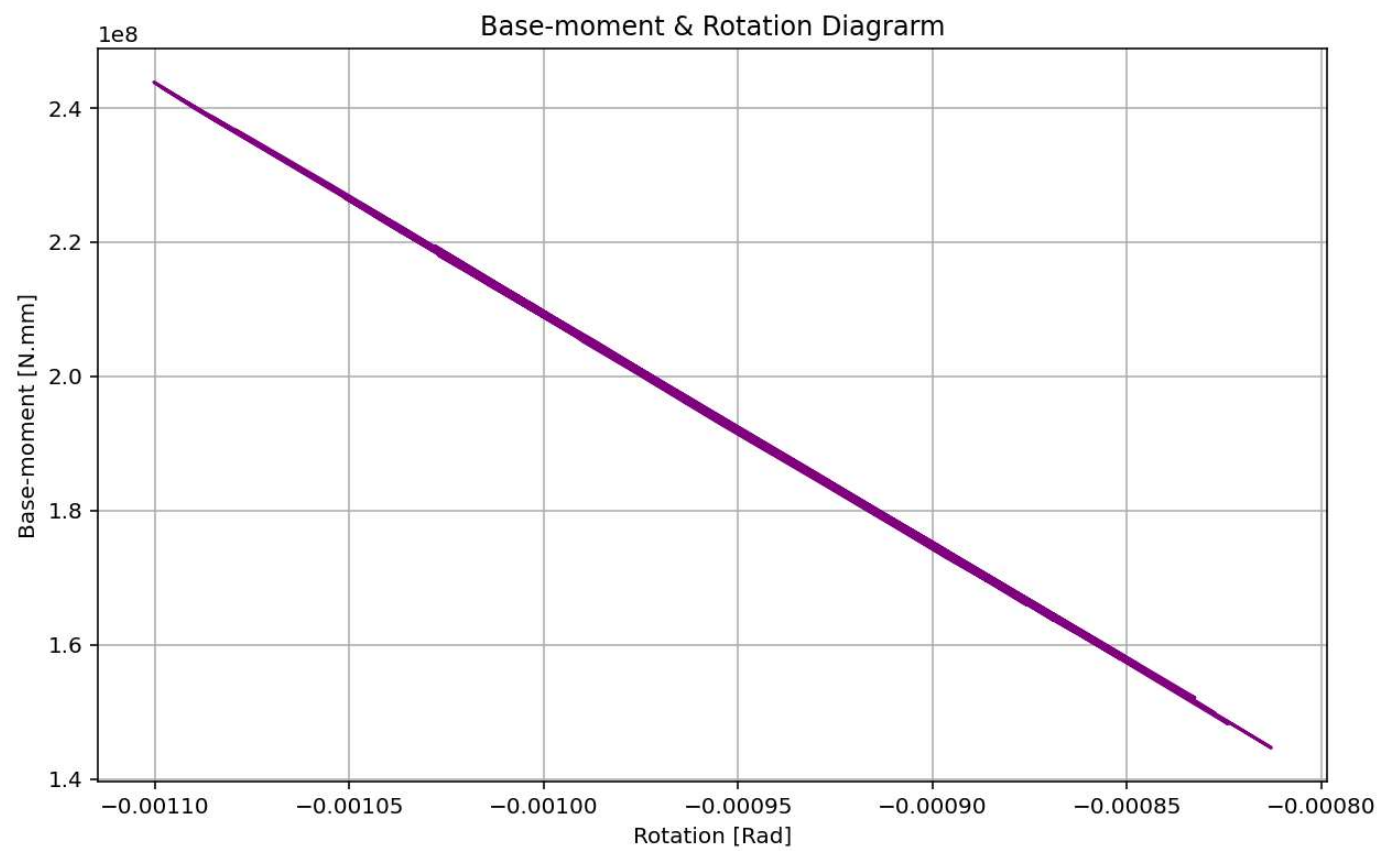


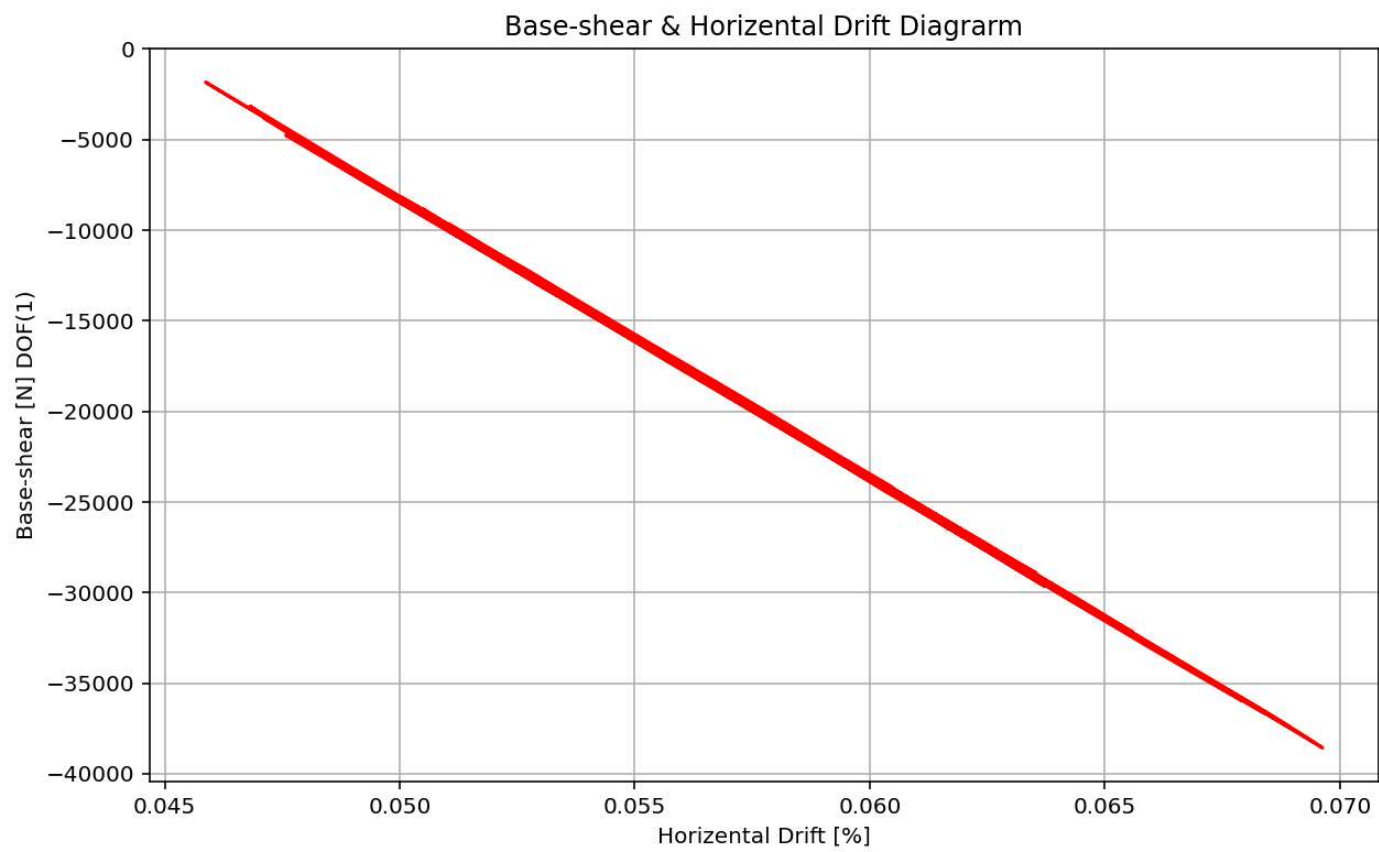












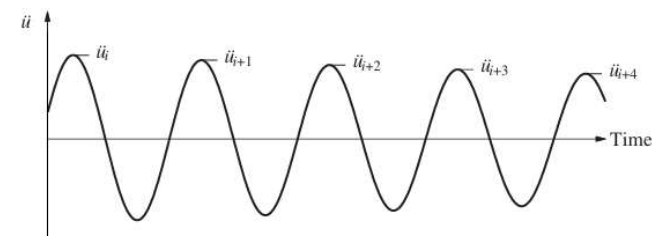
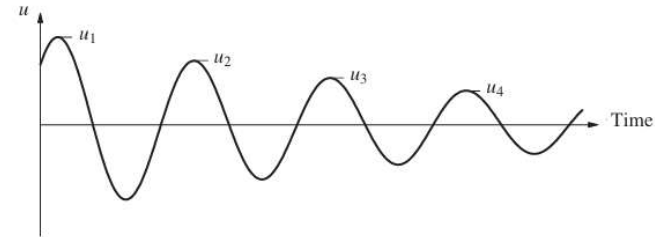
VISCOUSLY DAMPED FREE VIBRATION

$$m\ddot{u} + c\dot{u} + ku = 0$$

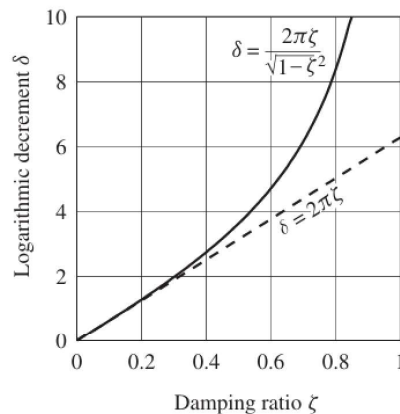
$$\ddot{u} + 2\zeta\omega_n\dot{u} + \omega_n^2 u = 0$$

$$\omega_n = \sqrt{k/m} \quad \zeta = \frac{c}{2m\omega_n} = \frac{c}{c_{cr}} \quad \omega_D = \omega_n \sqrt{1 - \zeta^2}$$

$$u(t) = e^{-\zeta\omega_n t} \left[u(0) \cos \omega_D t + \frac{\dot{u}(0) + \zeta\omega_n u(0)}{\omega_D} \sin \omega_D t \right]$$



Exact Damping Ratio: 1.50494054e-04



Decay of Motion

$$\delta = \ln \frac{u_i}{u_{i+1}} = 2\pi\zeta \quad (\text{APPROXIMATE RELATION})$$

$$\delta = \ln \frac{u_i}{u_{i+1}} = \frac{2\pi\zeta}{\sqrt{1-\zeta^2}} \quad (\text{EXACT RELATION})$$

EXACT AND APPROXIMATE RELATIONS BETWEEN LOGARITHMIC DECREMENT AND DAMPING RATIO

