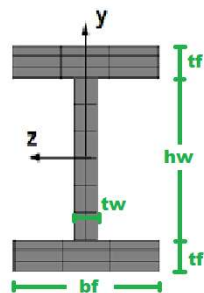
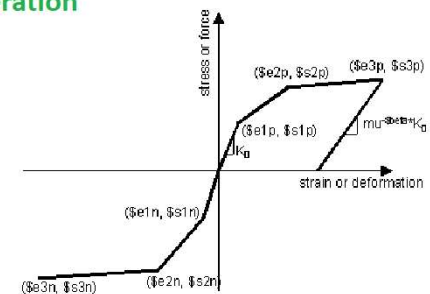
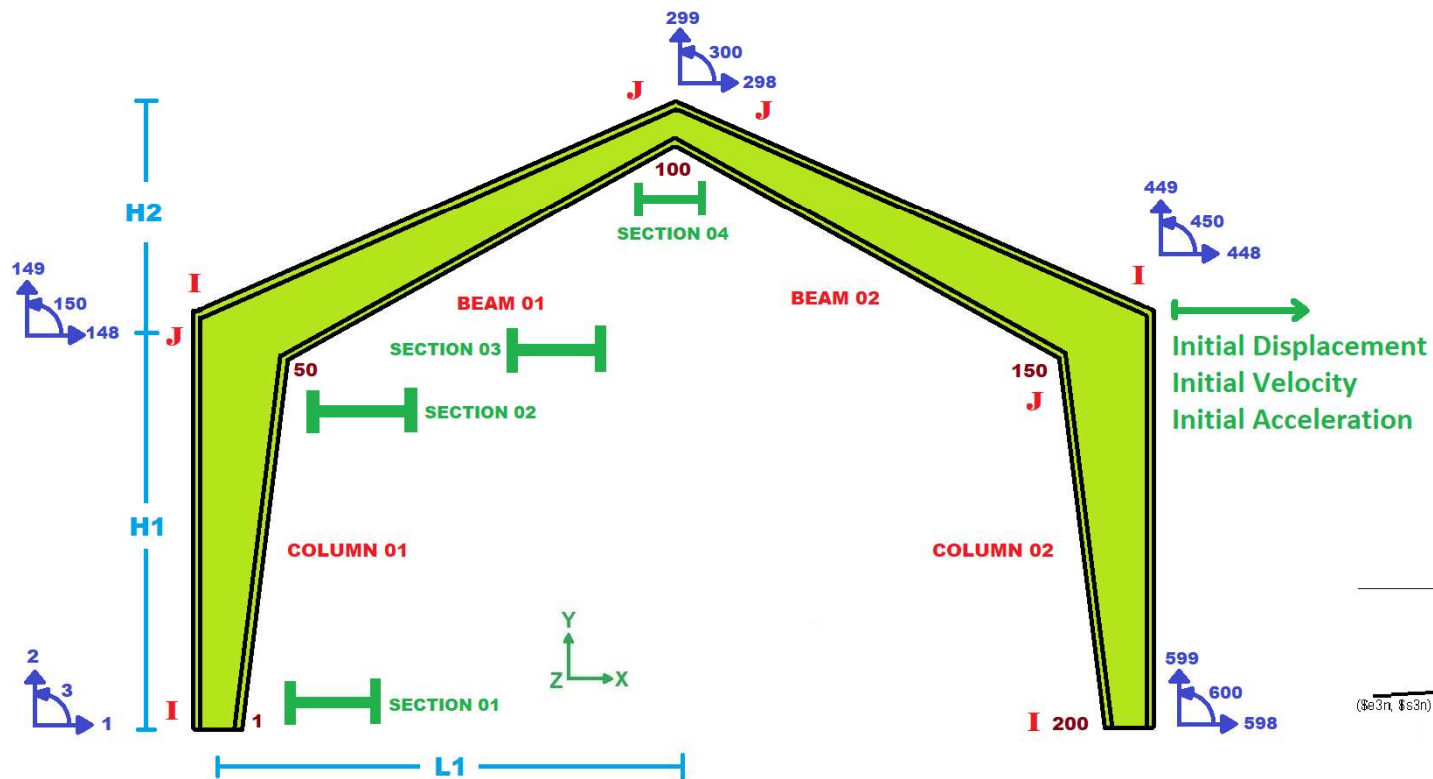


>> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<

**COMPARATIVE FREE-VIBRATION
ANALYSIS OF A MDOF STRUCTURE:
ELASTIC VS INELASTIC RESPONSE
USING OPENSEES. NONLINEAR
DYNAMIC ANALYSIS OF A
NONPRISMATIC STEEL GABLE FRAME I
SECTION COLUMN WITH FINITE
PRISMATIC COLUMN**

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)





Spyder (Python 3.12)

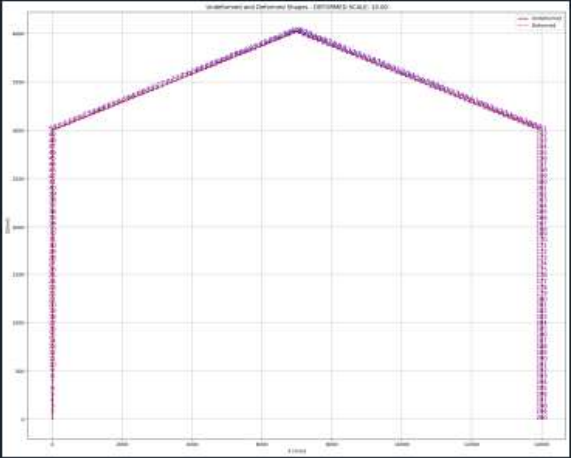
File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\Dell\Desktop\OPENSEES_FILES\STEEL_GABLE_...REE-VIBRATION\STEEL_GABLE_FRAME_FREE-VIBRATION.py

STEEL_GABLE_FRAME_FREE-VIBRATION.py

```
17 import os
18 import time as TI
19 import numpy as np
20 import openseespy.opensees as op
21 import ANALYSIS_FUNCTION as S01
22 import PLOT_2D as S02
23 import DAMPING_RATIO_FUN as S03
24 import EIGENVALUE_ANALYSIS_FUN as S04
25
26 import matplotlib.pyplot as plt
27 import matplotlib.image as mpimg
28
29 # Load the image
30 image_path = 'STEEL_GABLE_FRAME_FREE-VIBRATION.PNG'
31 image = mpimg.imread(image_path)
32
33 # Display the image
34 plt.figure(figsize=(30, 16))
35 plt.imshow(image)
36 plt.axis('off') # Hide axes
37 plt.show()
38
39 # Create a directory at specified path with name 'directory_path'
40 import os
41 directory_path = 'C:\\OPENSEESPY_SALAR'
42
43 # Check if the directory already exists
44 if not os.path.exists(directory_path):
45     os.mkdir(directory_path)
46     print(f"Directory '{directory_path}' created successfully.")
47 else:
48     print(f"Directory '{directory_path}' already exists. Skipping creation.")
49 #
50 # Create folder name
```

16 %



IPython Console Files Help Variable Explorer Debugger Plots History

Inline Conda: anaconda3 (Python 3.12.7) ✓ LSP: Python Line 648, Col 77 UTF-8 CRLF RW Mem 59%

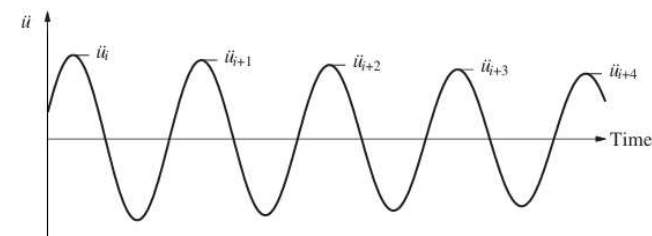
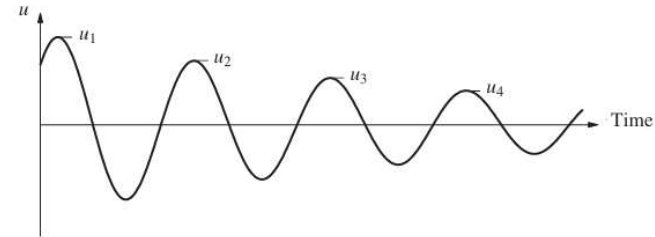
VISCOUSLY DAMPED FREE VIBRATION

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

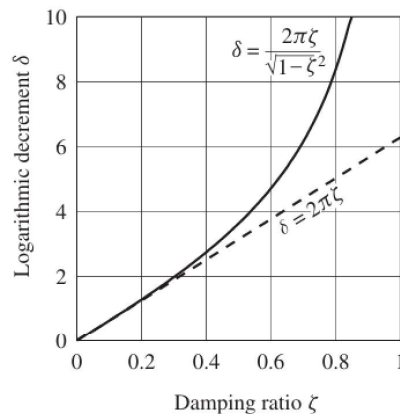
$$\ddot{u} + 2\zeta\omega_n\dot{u} + \omega_n^2 u = 0$$

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

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



Exact Damping Ratio: 1.50494054e-04



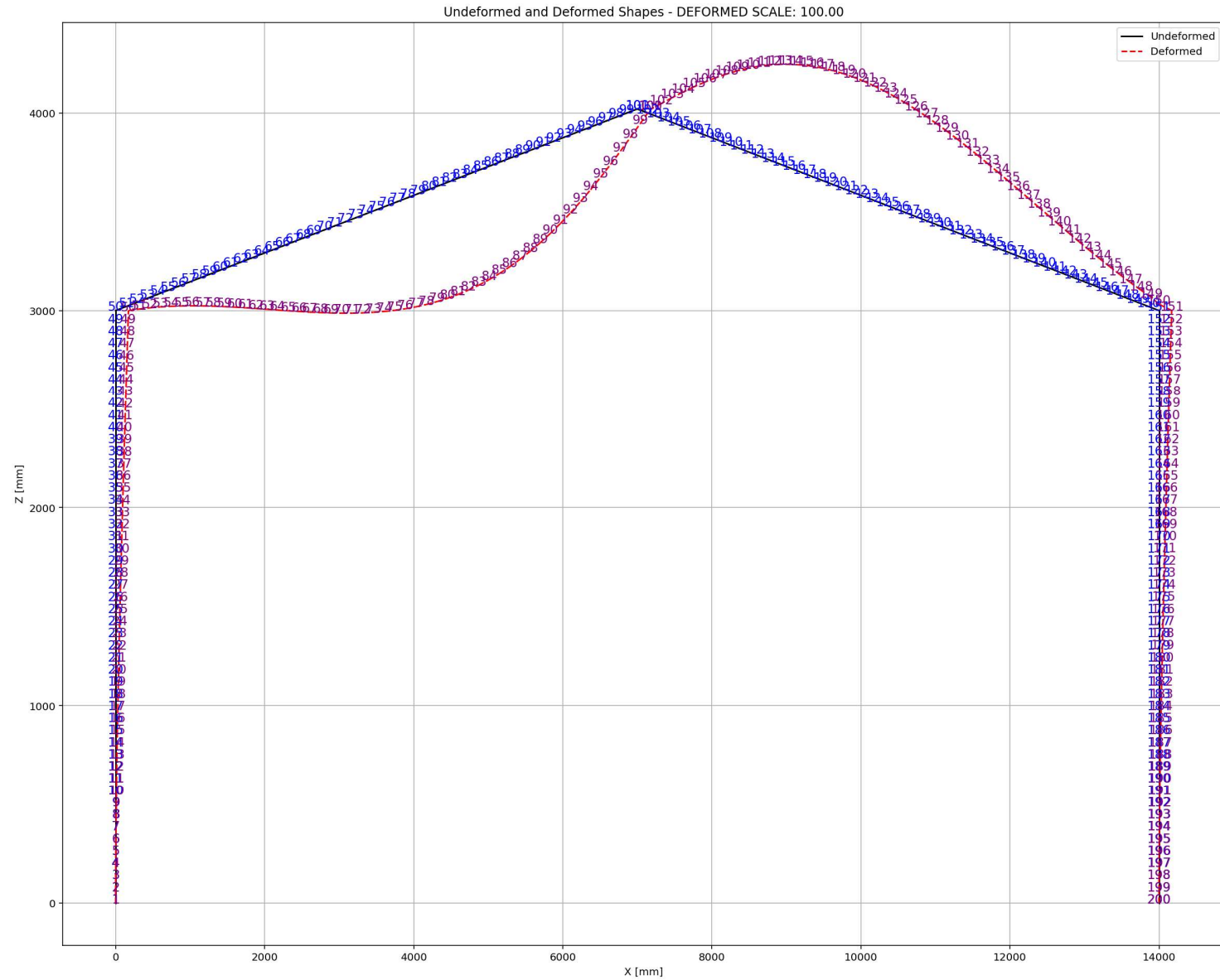
Decay of Motion

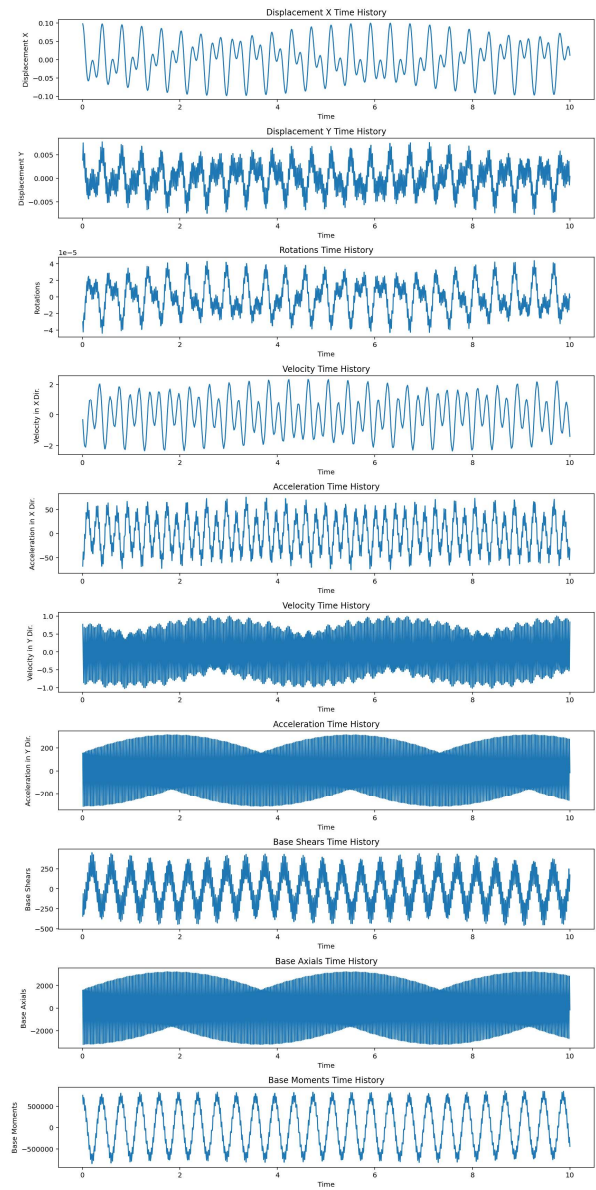
$$\delta = \ln \frac{u_i}{u_{i+1}} = 2\pi\zeta \quad (\text{APPROXIMATE RELATION})$$

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

EXACT AND APPROXIMATE RELATIONS BETWEEN LOGARITHMIC DECREMENT AND DAMPING RATIO

FREE-VIBRATION ANALYSIS FOR INELASTIC STRUCTURE





FREE-VIBRATION ANALYSIS FOR ELASTIC STRUCTURE

