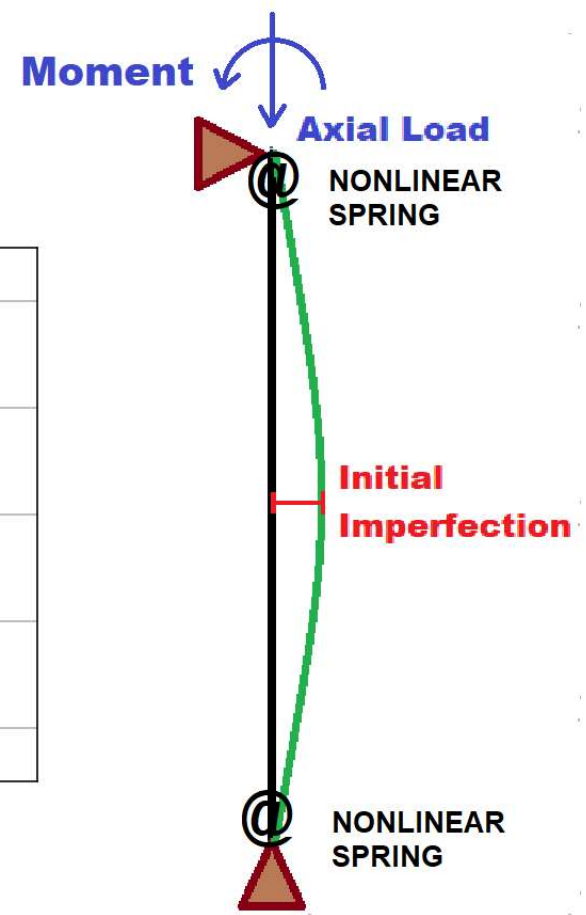
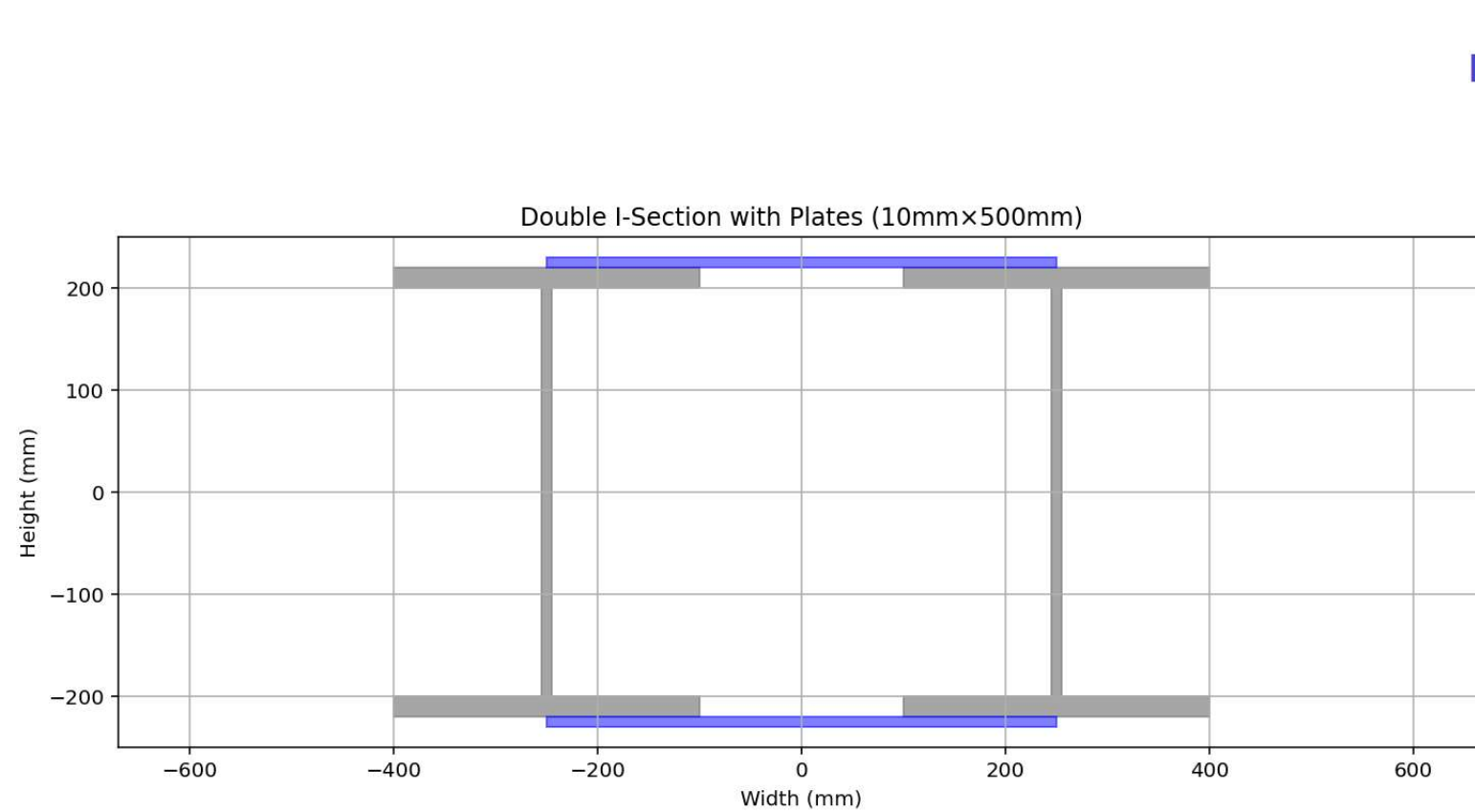
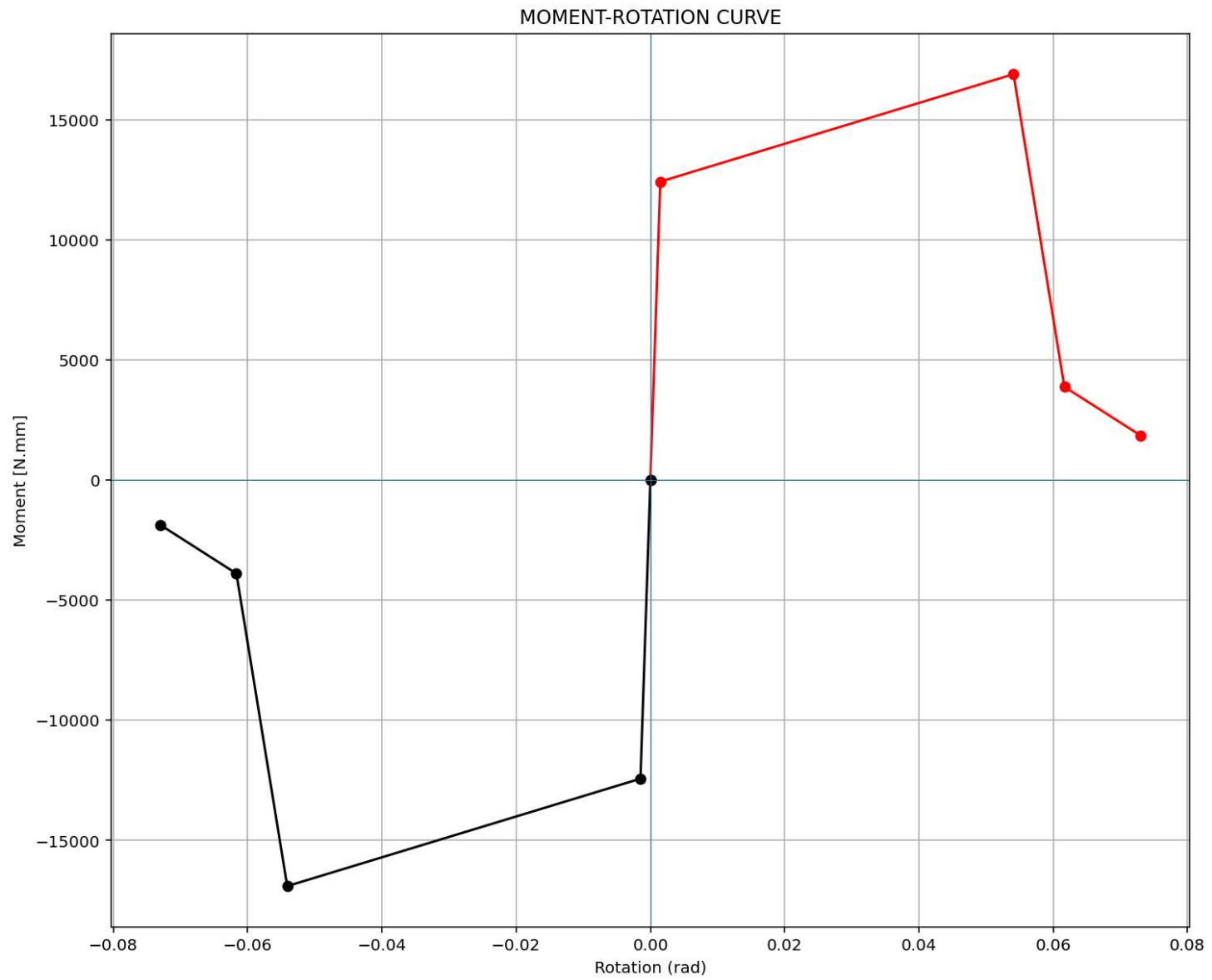


>> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<

INVESTIGATION OF FREE-VIBRATION ANALYSIS WITH AXIAL DISPLACEMENT OF MULTI-MODE POST-BUCKLING PHENOMENA IN SEMI-RIGID STEEL COLUMNS USING OPENSEES CONSIDERING THE GEOMETRIC AND MATERIAL PROPERTIES NONLINEARITY

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)





Spyder (Python 3.12)

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C:\Users\Dell\Desktop\OPENSEES_FILES\MULTI-MODE-POST-BUCKLING_STEEL_COLUMN_SEMI-RIGID_NONLINEAR_FV_AXIAL.py

MULTI-MODE-POST-BUCKLING_STEEL_COLUMN_SEMI-RIGID_NONLINEAR_FV_AXIAL.py

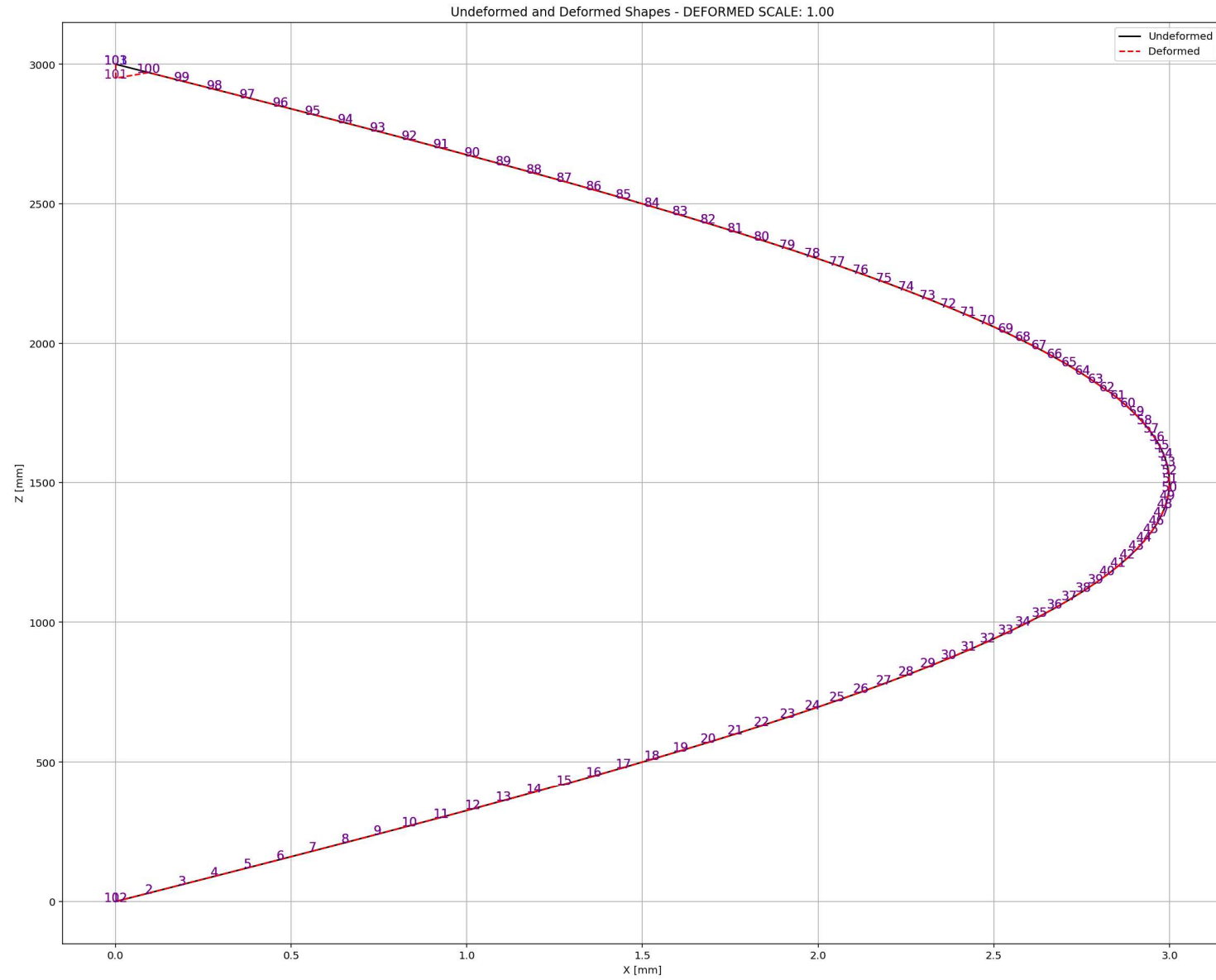
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1 #####
2 # >> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<
3 # INVESTIGATION OF FREE-VIBRATION ANALYSIS WITH AXIAL DISPLACEMENT OF MULTI-MODE POST-BUCKLING PHENOMENON
4 # IN SEMI-RIGID STEEL COLUMNS USING OPENSEES CONSIDERING THE GEOMETRIC AND MATERIAL PROPERTIES NONLINEAR
5 #
6 # IT MODELS A 2D INELASTIC BEAM-COLUMN WITH AN INITIAL IMPERFECTION (FOUR DIFFERENT SHAPES)
7 # AND APPLIES AN AXIAL COMPRESSIVE LOAD TO ANALYZE LARGE DISPLACEMENTS.
8 # 1. MODEL SETUP: A COLUMN OF LENGTH L IS DEFINED WITH N ELEMENTS, INCORPORATING A SMALL INITIAL
9 # IMPERFECTION (HALF-SINE WAVE).
10 # 2. NODES & BOUNDARY CONDITIONS: NODES ARE CREATED, WITH THE BOTTOM FIXED IN X, Y AND THE TOP FIXED IN X
11 # BUT FREE IN Y AND ROTATION.
12 # 3. ELEMENT DEFINITION: THE COLUMN IS MODELED USING ELASTIC BEAM-COLUMN ELEMENTS WITH COROTATIONAL
13 # TRANSFORMATION FOR GEOMETRIC NONLINEARITY.
14 # 4. LOAD APPLICATION: A STATIC AXIAL FORCE P IS APPLIED AT THE TOP NODE.
15 # 5. ANALYSIS SETUP: A DISPLACEMENT CONTROL INTEGRATOR IS USED TO INCREMENTALLY PUSH THE COLUMN DOWNWARD.
16 # 6. NONLINEAR SOLVER: THE NEWTON METHOD IS USED WITH A NORMDISPINC TEST FOR CONVERGENCE.
17 # 7. ANALYSIS EXECUTION: THE LOOP PERFORMS INCREMENTAL LOADING STEPS, RECORDING AXIAL DISPLACEMENT,
18 # LATERAL DISPLACEMENT, AND AXIAL FORCE.
19 # 8. BUCKLING BEHAVIOR CAPTURE: LATERAL DISPLACEMENTS AT THE MID-HEIGHT NODE INDICATE POST-BUCKLING
20 # DEFORMATION.
21 # 9. RESULTS EXTRACTION: REACTION FORCES AT THE BASE NODE PROVIDE THE AXIAL COMPRESSIVE LOAD.
22 # 10. PLOTTING: THE SCRIPT VISUALIZES AXIAL FORCE VS. LATERAL DISPLACEMENT, SHOWING THE POST-BUCKLING
23 # RESPONSE OF THE COLUMN.
24 #
25 # THIS PROGRAM WRITTEN BY SALAR DELAVAR GHASHGHAEE (QASHQAI)
26 # EMAIL: salar.d.ghashghaei@gmail.com
27 #####
28 import openseespy.opensees as ops
29 import numpy as np
30 import matplotlib.pyplot as plt
31 import STEEL_FIBER_SECTION as S01
32 import ANALYSIS_FUNCTION as S02
33 import OPENSEES_HYSTERETICSM_FORCE_DISP_FUN as S03
34 import RAYLEIGH DAMPING FUN as S04
```

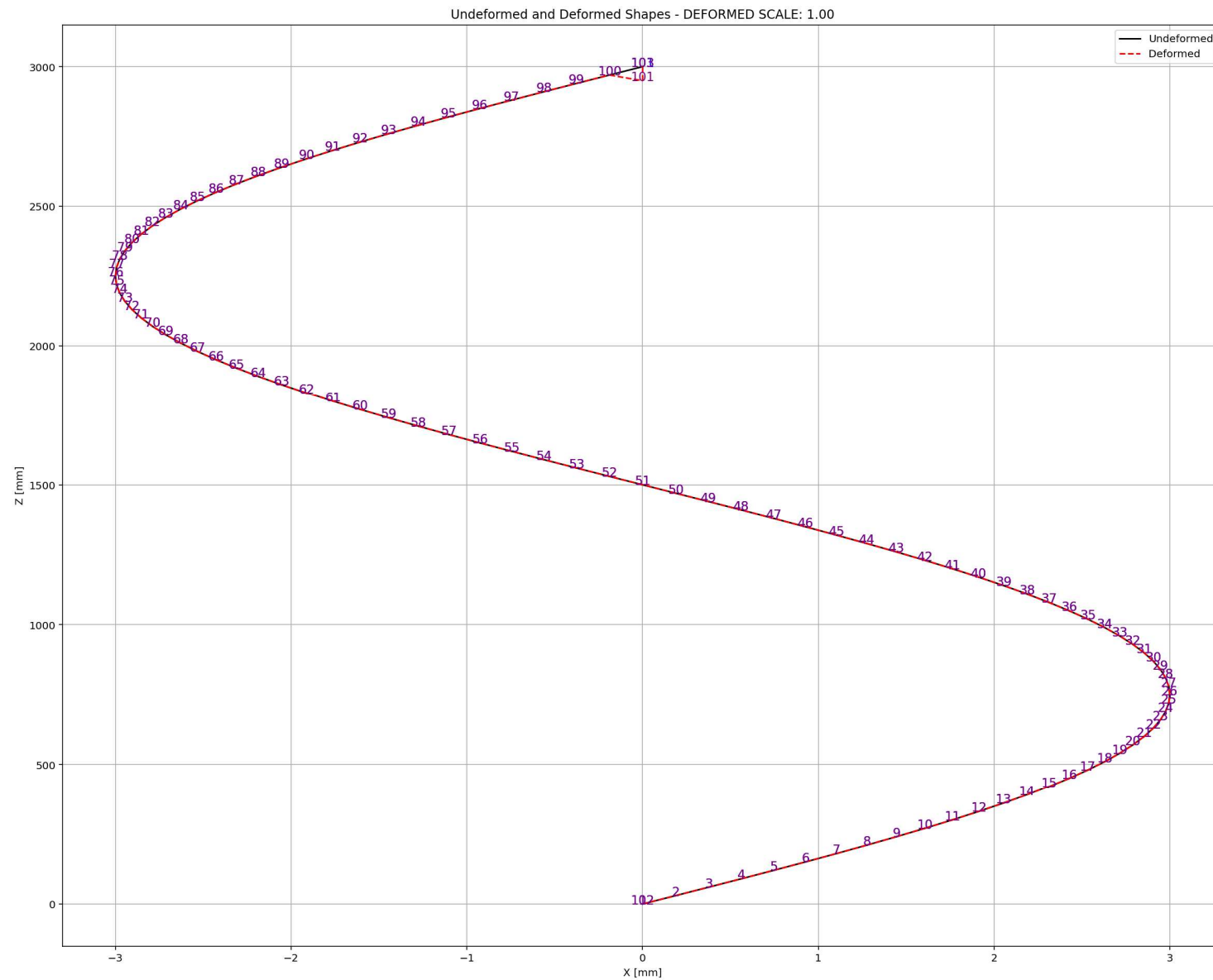
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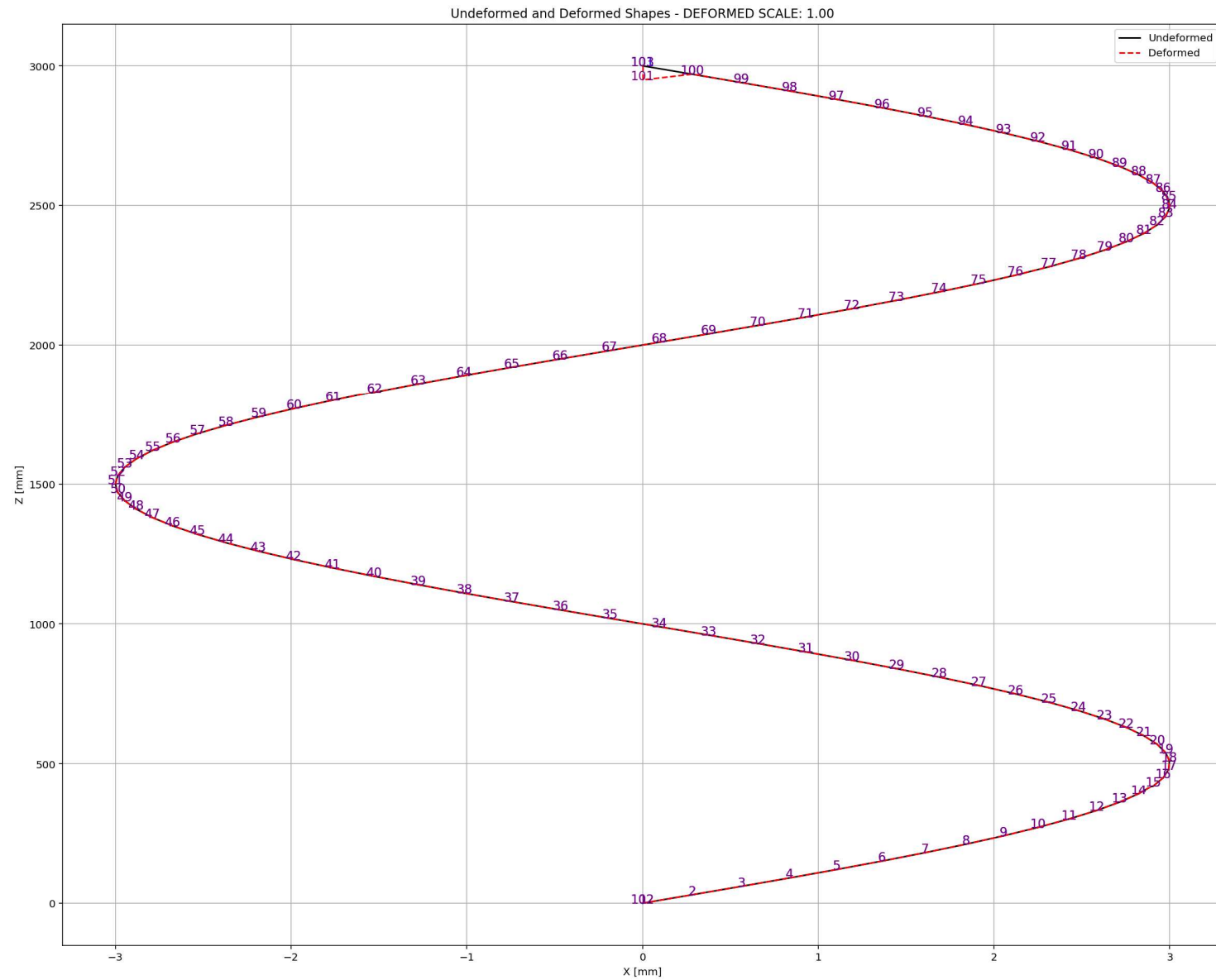
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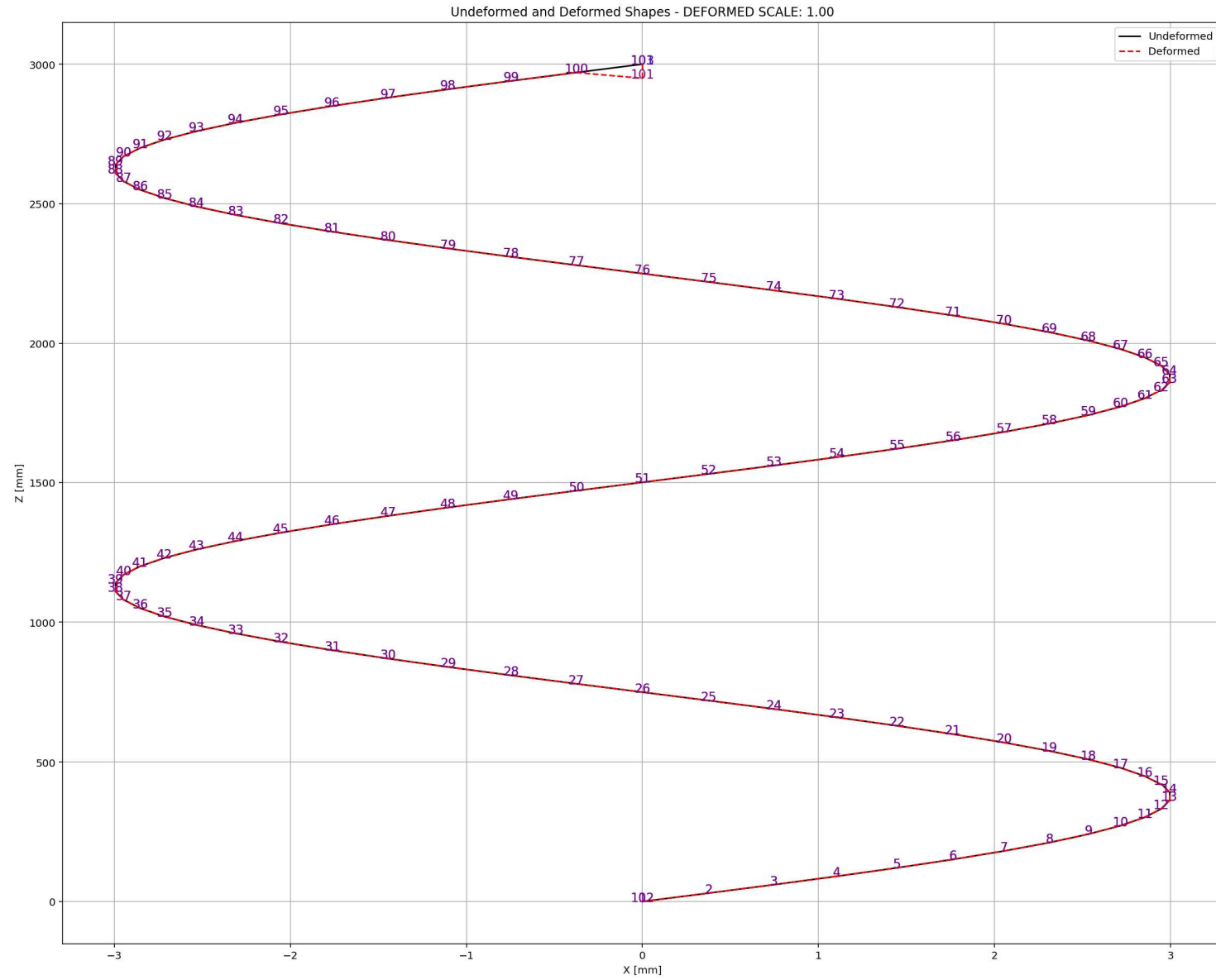
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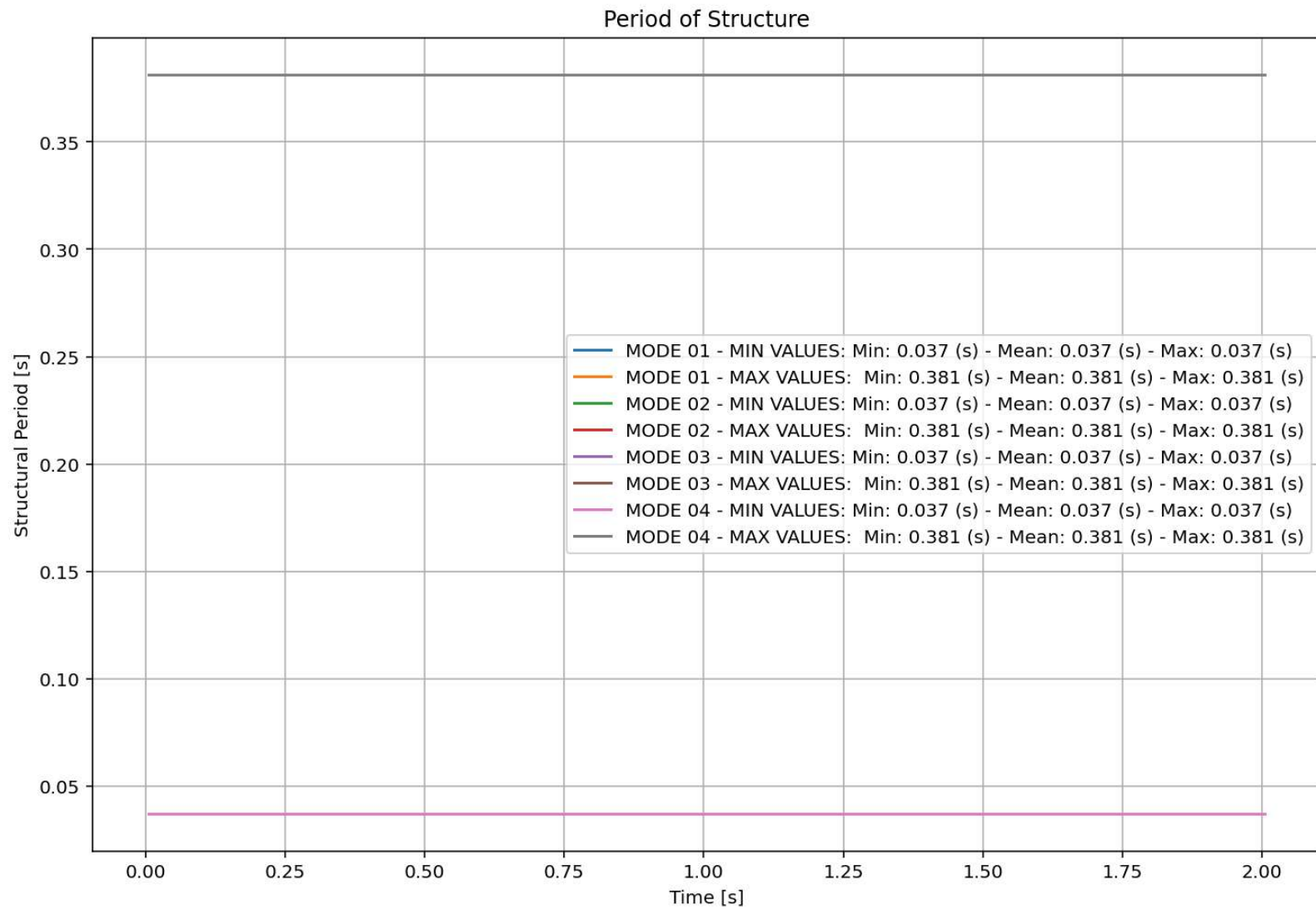
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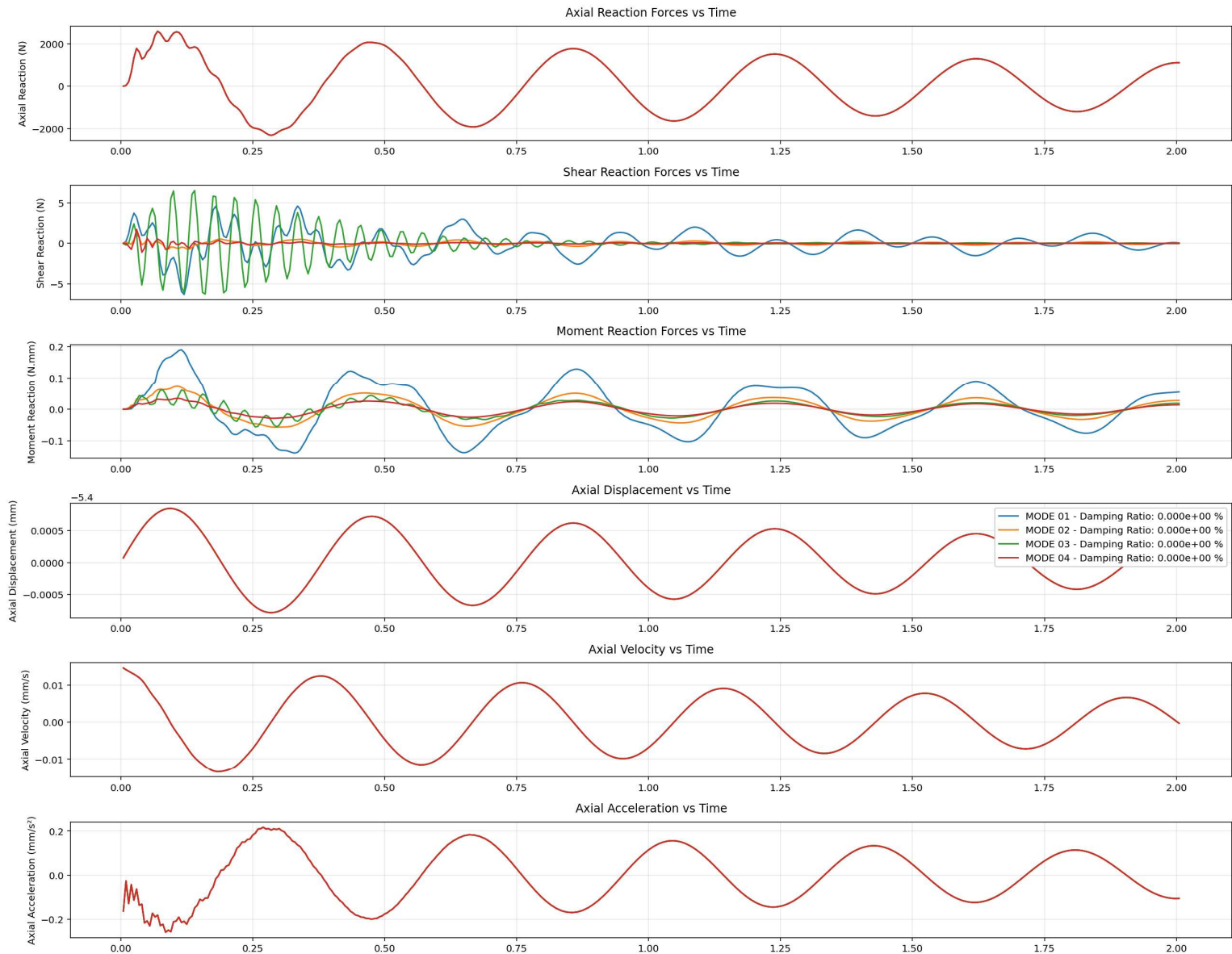




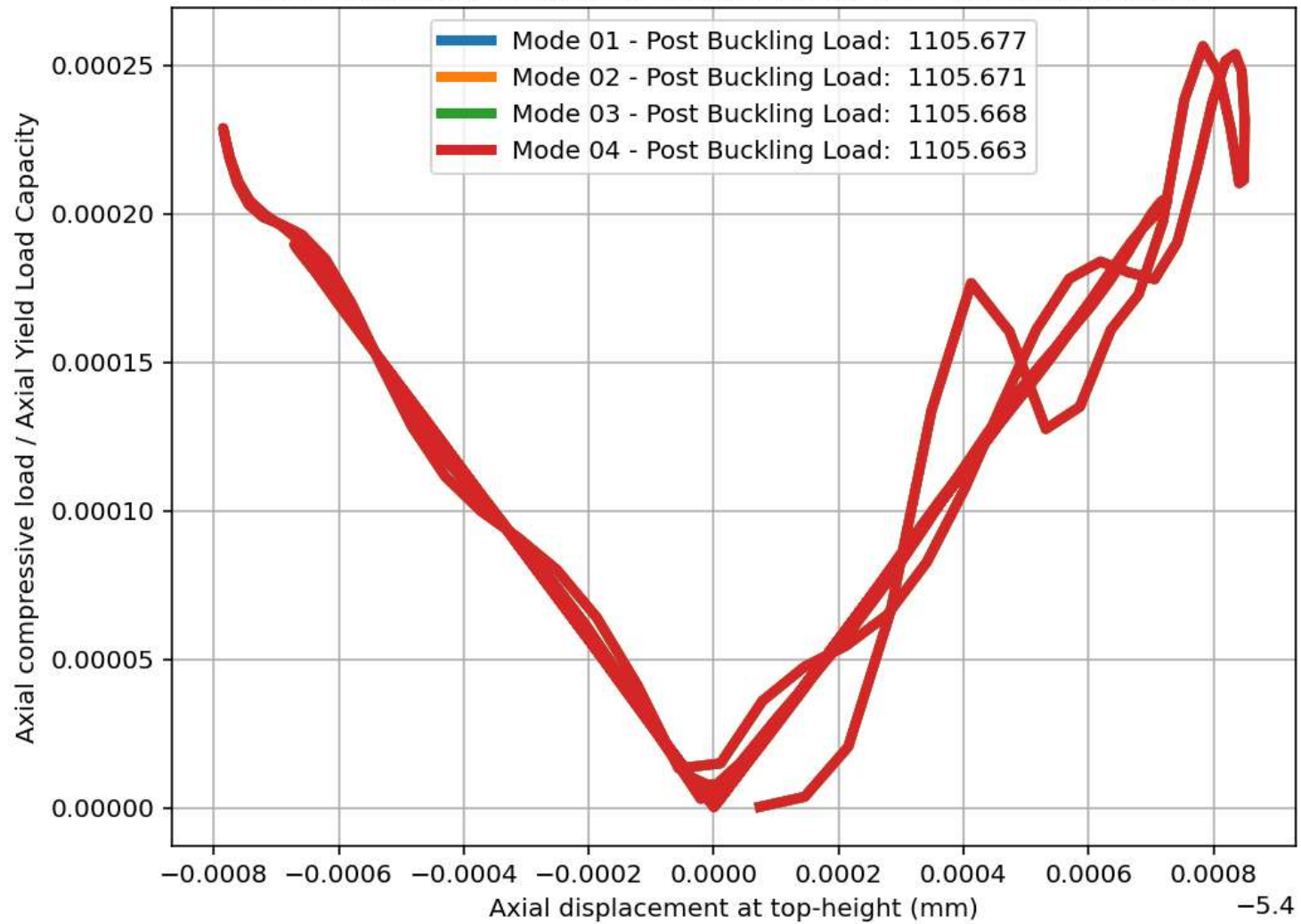




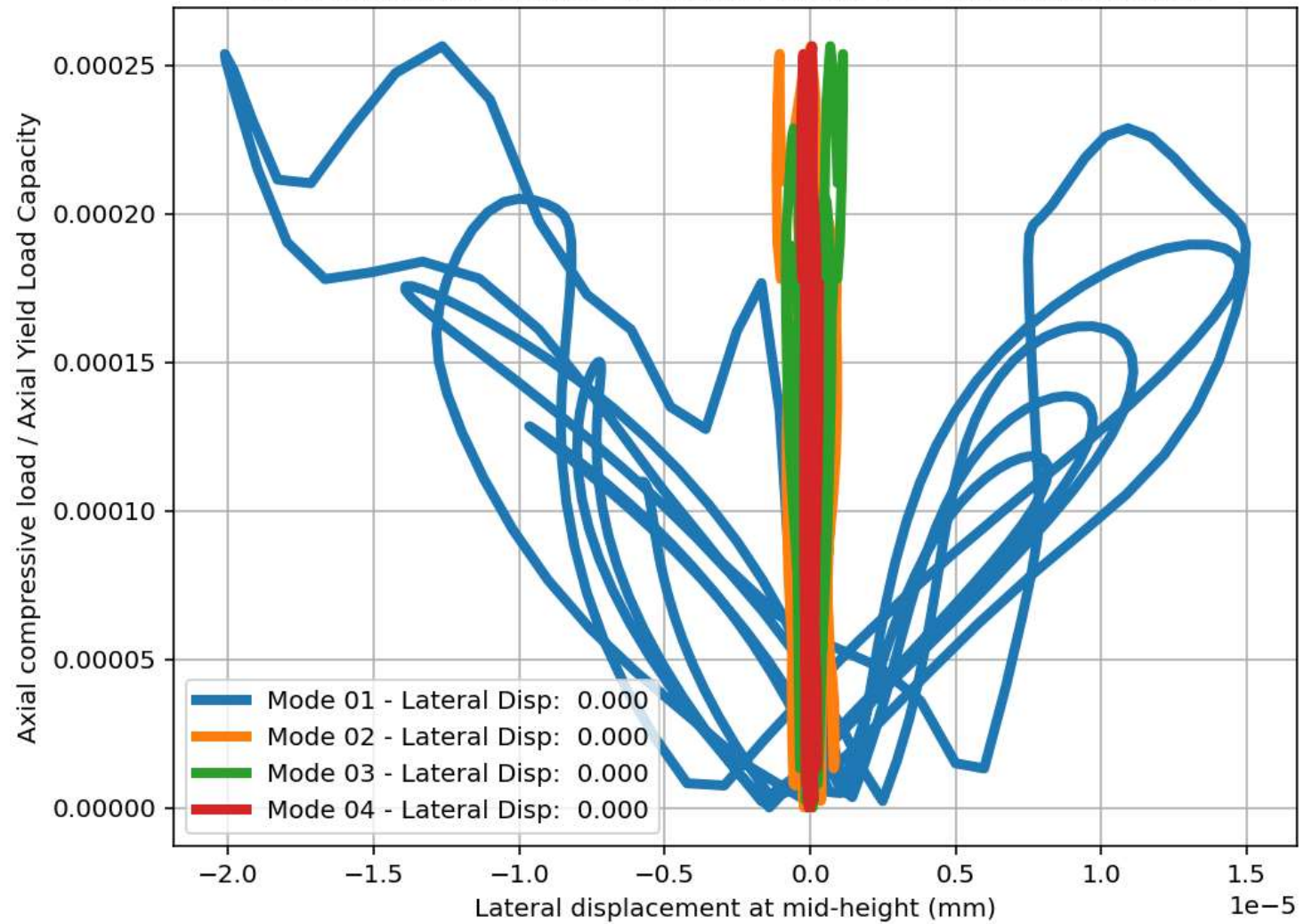




Post-buckling behavior of column during free-vibration analysis



Post-buckling behavior of column during free-vibration analysis



Post-buckling behavior of column during free-vibration analysis

