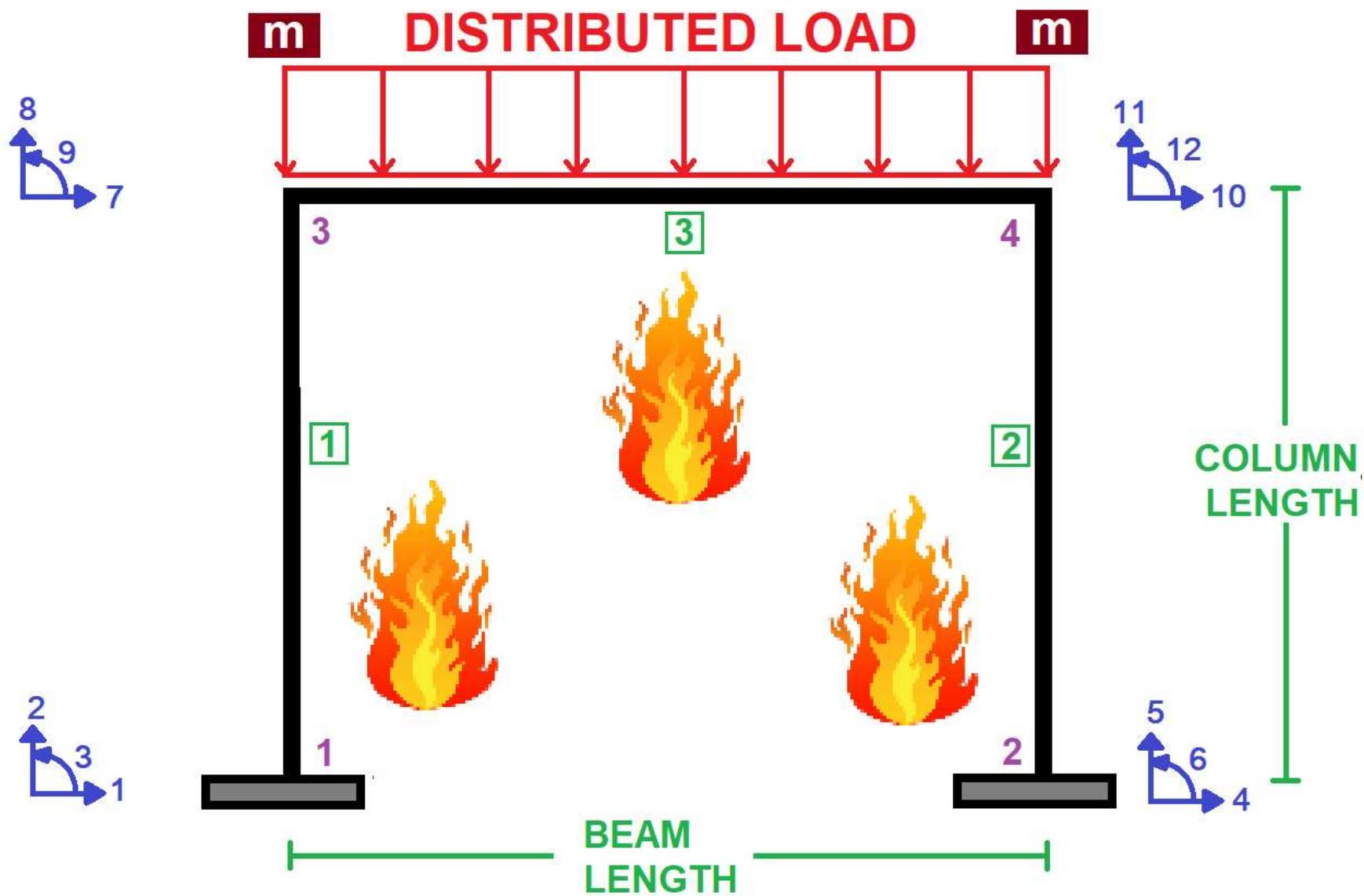
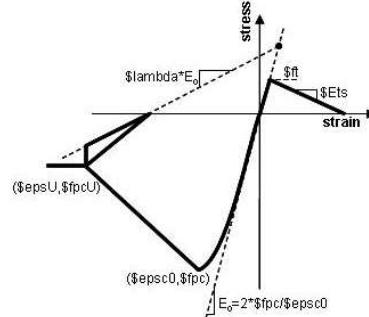


IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

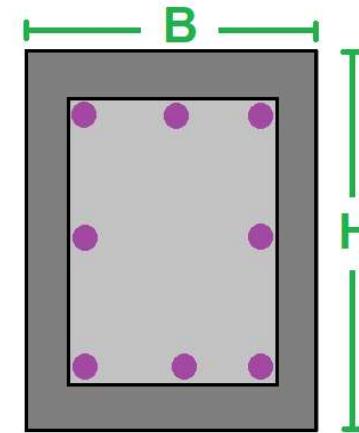
# **THERMAL ANALYSIS OF CONCRETE FRAME USING OPENSEES. EVALUATION OF THE STRUCTURAL PERIOD DURING THERMAL LOAD APPLIED TO ALL ELEMENTS**

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

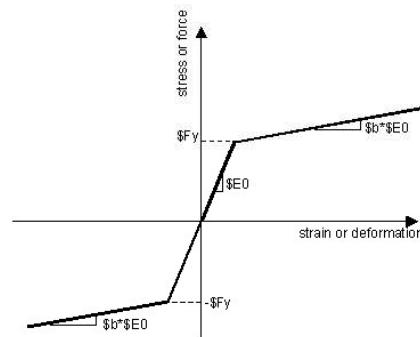




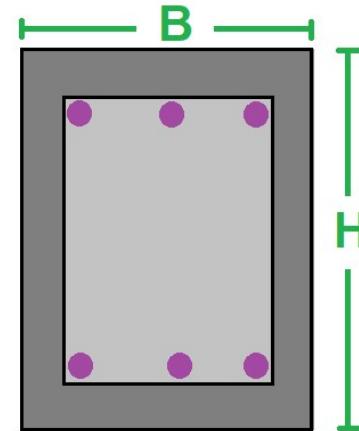
**Concrete02 Thermal Material - Linear Tension Softening**



**COLUMN SECTION**



**Steel01 Thermal Material**



**BEAM SECTION**

Spyder (Python 3.12)

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C:\Users\DELL\Desktop\OPENSEES\_FILES\CONCRETE\_FRAME\_ELEMENTS\_PERIOD\THERMAL\_LOAD\_ALL\_ELEMENTS\_PERIOD.py

THERMAL\_LOAD\_ALL\_ELEMENTS\_PERIOD.py

```

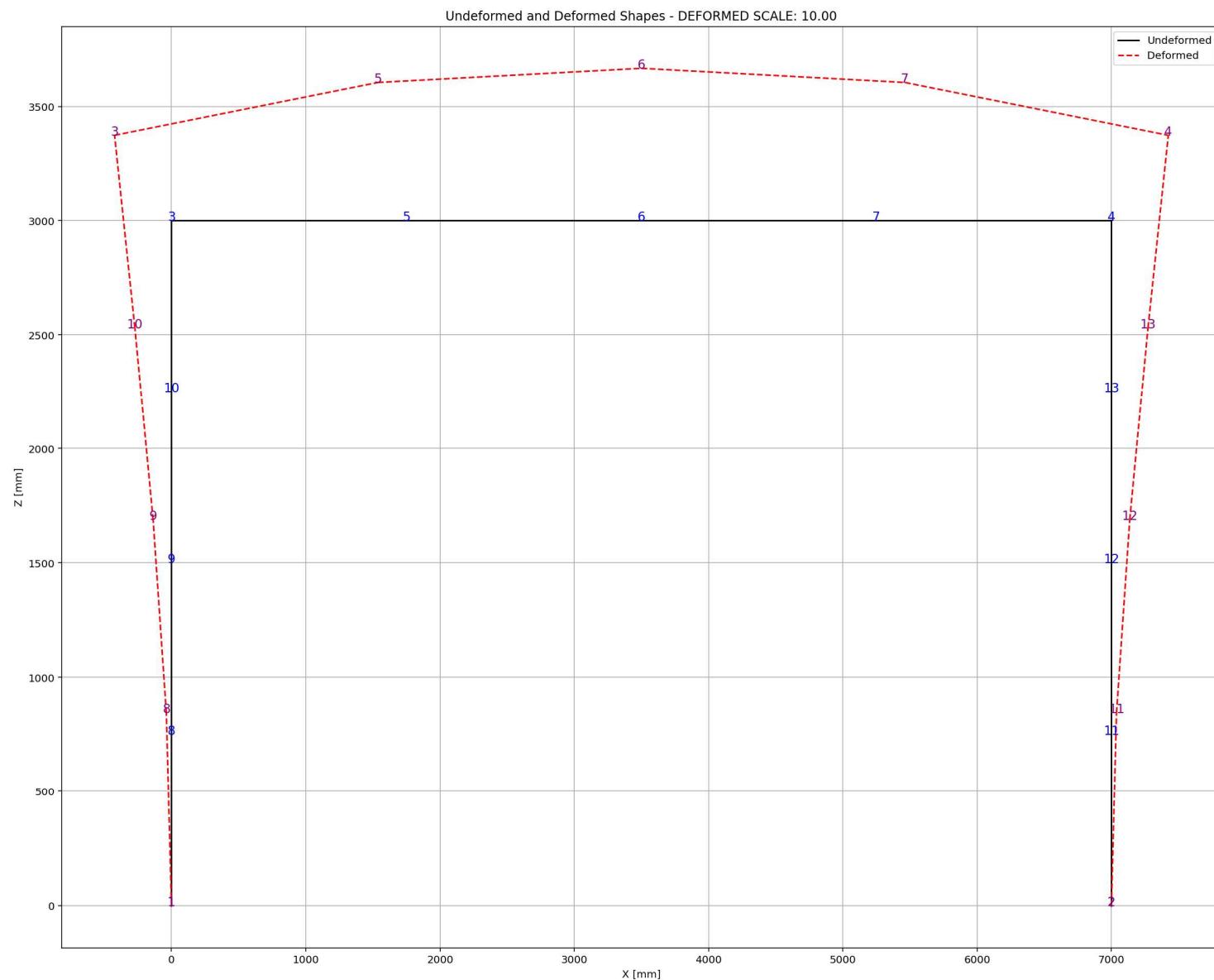
1 ##### IN THE NAME OF ALLAH #####
2 # THERMAL ANALYSIS OF CONCRETE FRAME USING OPENSEES
3 # EVALUATION OF THE STRUCTURAL PERIOD DURING THERMAL LOAD APPLIED TO ALL ELEMENTS
4 #
5 # THIS PROGRAM WRITTEN BY SALAR DELAVAR GHASHGHEI (QASHQAI)
6 # EMAIL: salar.d.ghashghei@gmail.com
7 #####
8
9 """
10 Models and Analyzes a 2D Concrete Frame subjected to Thermal and Distributed Loads using OpenSees.
11 Key points:
12 [1] Model Definition: The 2D frame has specified node coordinates for stories and bays, with fixed sup-
13 Material properties for concrete (with thermal effects) and concrete rectangular section geometries at
14 [2] Element and Load Setup: Beam-column elements with corotational geometric transformation and Lobatto
15 are created. Distributed loads are applied to beams, and a thermal gradient is applied to the first s
16 [3] Analysis Setup: The analysis uses static load control with thermal increments, and the Newton-Raph
17 Convergence tolerances and maximum iterations are defined.
18 [4] Output and Post-processing: Displacements, reactions, and deformations are recorded during the ana
19 Data is extracted from output files for plotting base reactions (axial, shear, moment) and node displa
20 against temperature or applied Load.
21 [5] Visualization: The frame's undeformed and deformed shapes are plotted, and results like temperatur
22 relationships and base reactions are visualized.
23 """
24
25 import openseespy.opensees as ops
26 import matplotlib.pyplot as plt
27 import numpy as np
28 import time as TI
29 import ANALYSIS_FUNCTION as S02
30 import CONCRETE_THERMAL_SECTION_FUN as S03
31 #import CONCRETE_FIBERTHERMAL_SECTION as S03
32 import PLOT_2D as S04
33 import EIGENVALUE_ANALYSIS_FUN as S05
34 #%%-
```

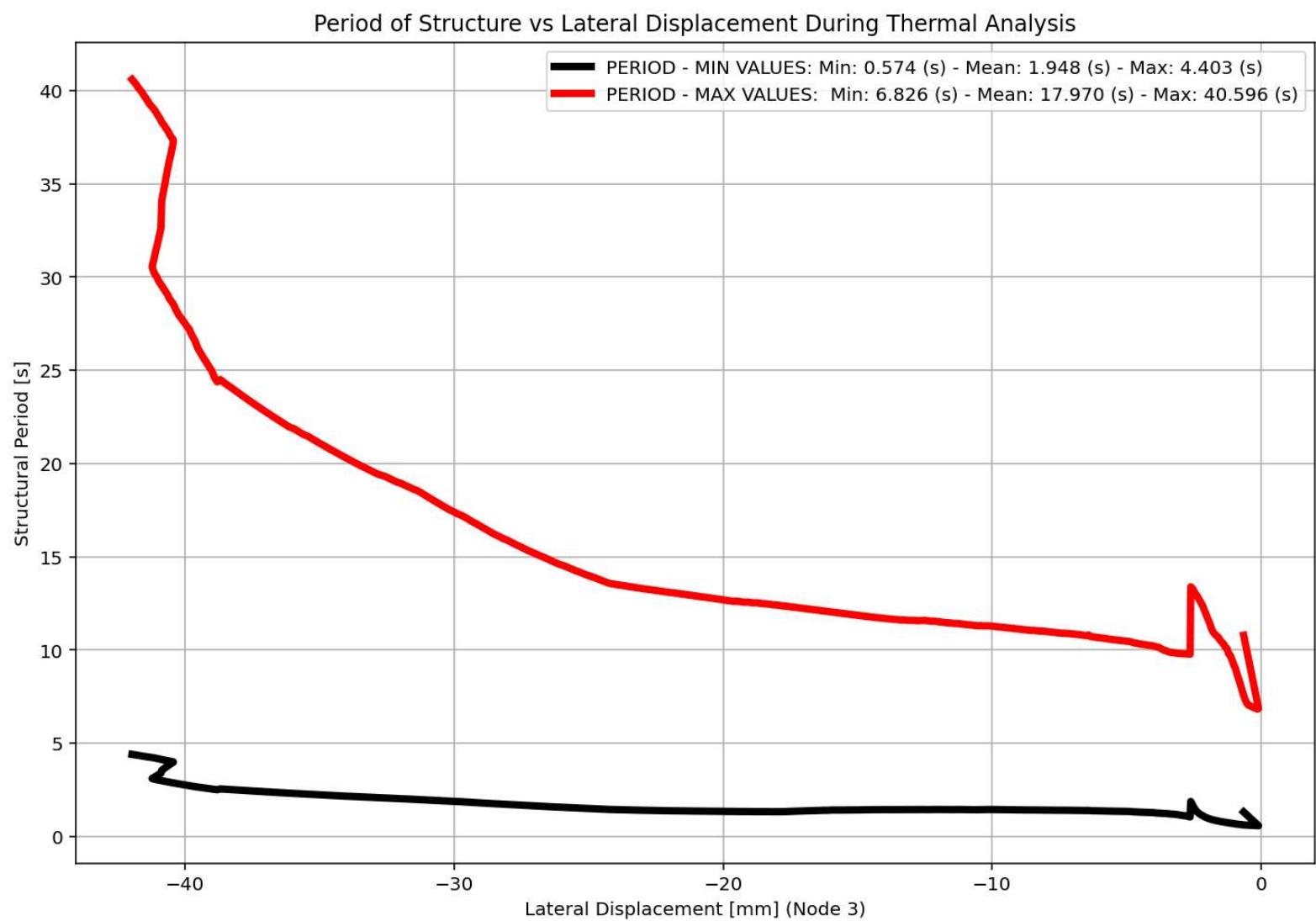
..ME\_EXAMPLES\THERMAL\_LOAD\THERMAL\_LOAD\_ALL\_ELEMENTS\_PERIOD

Period of Structure vs Lateral Displacement During Pushover Analysis

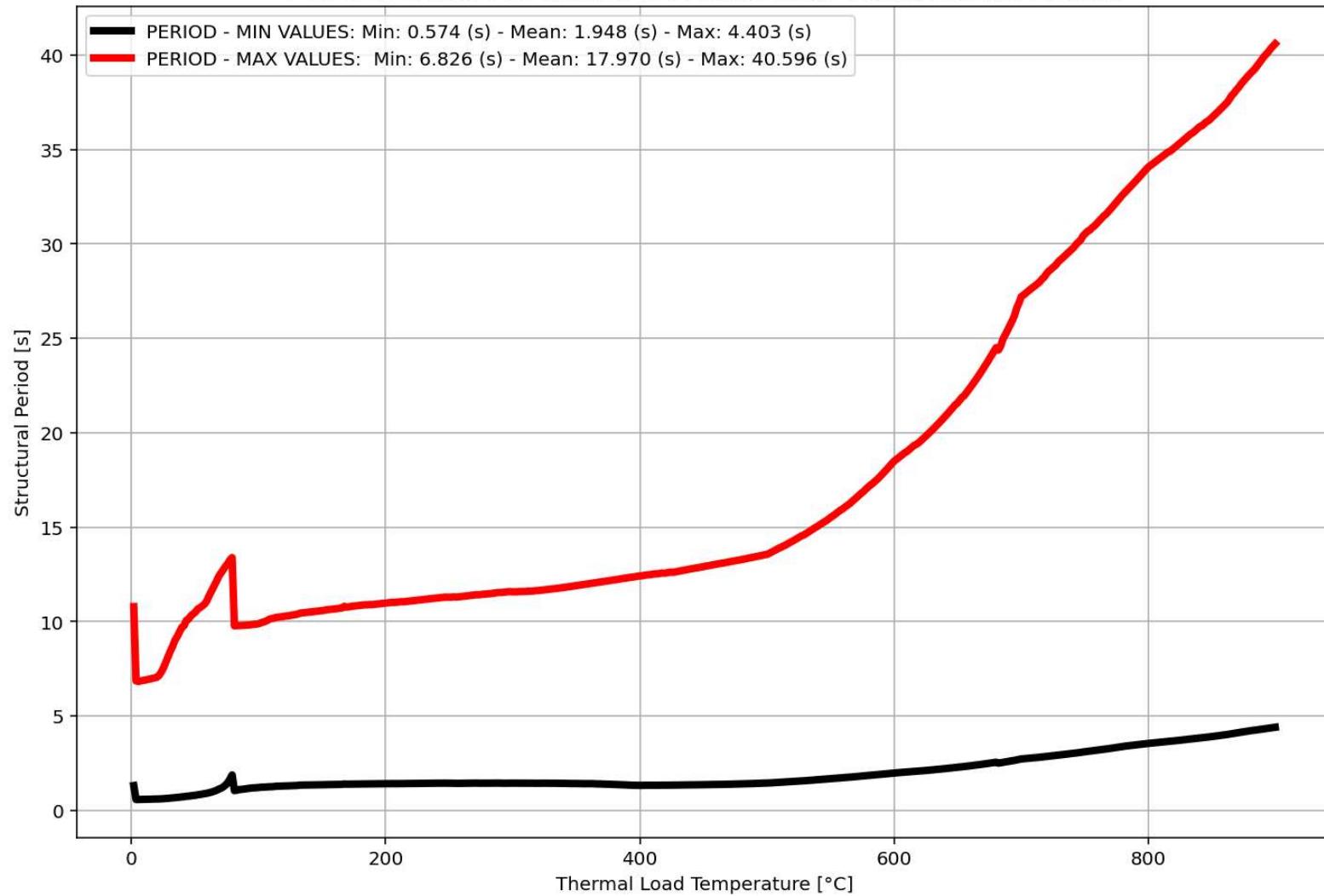
IPython Console Files Help Variable Explorer Debugger Plots History

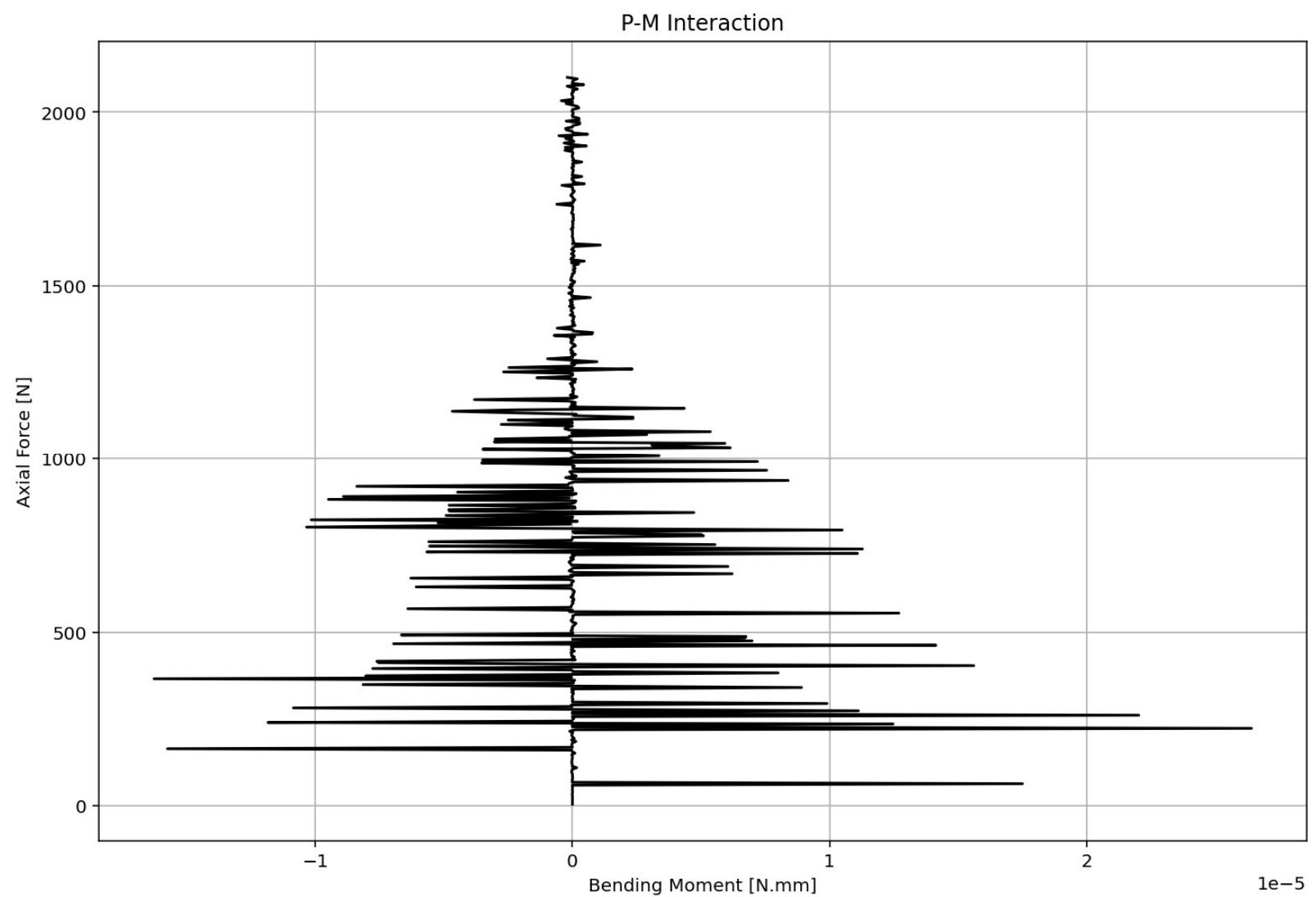
Inline Conda: anaconda3 (Python 3.12.7) ✓ LSP: Python Line 4, Col 17 UTF-8 CRLF RW Mem 40%

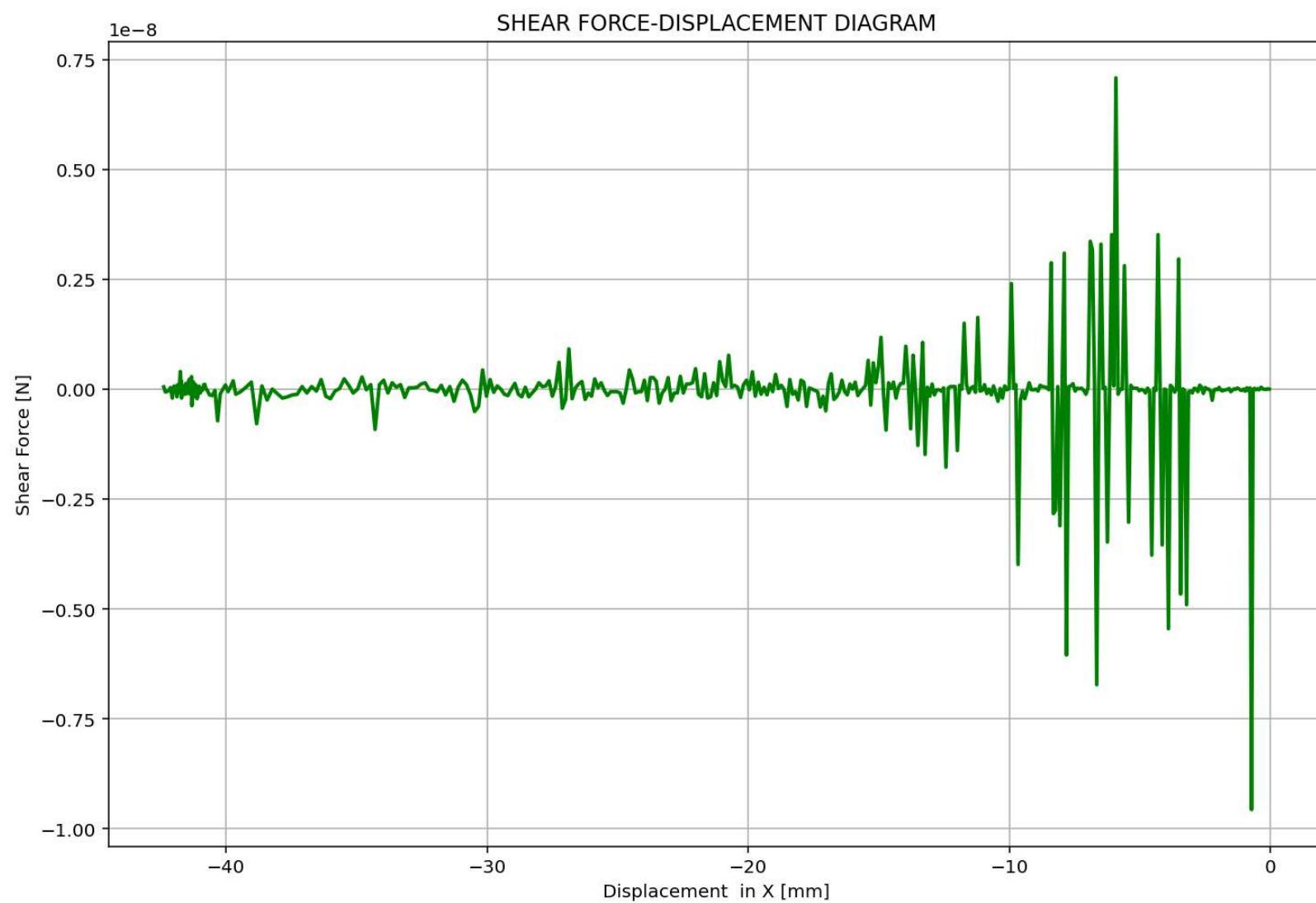




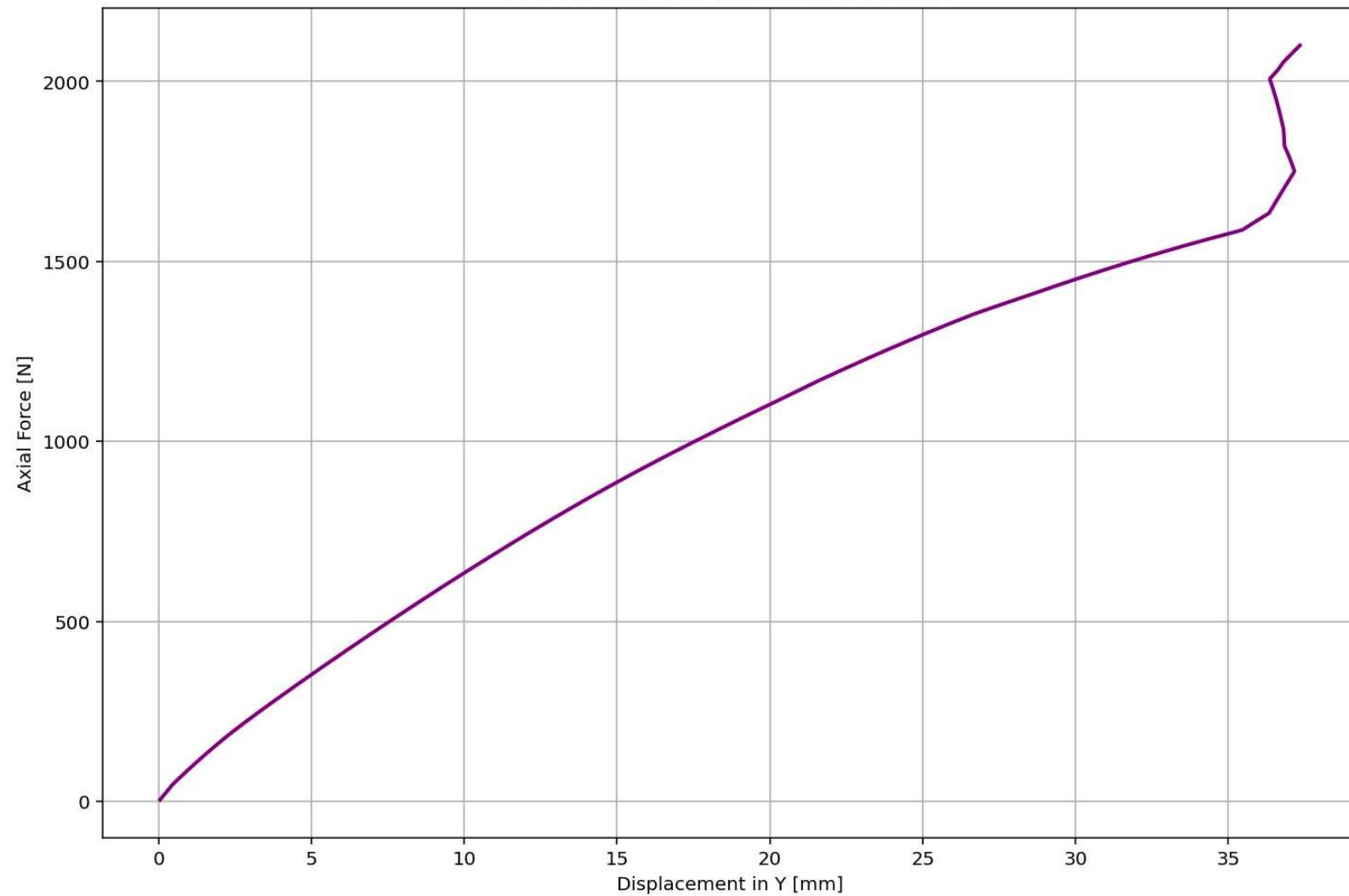
Period of Structure vs Thermal Load Temperature During Thermal Analysis



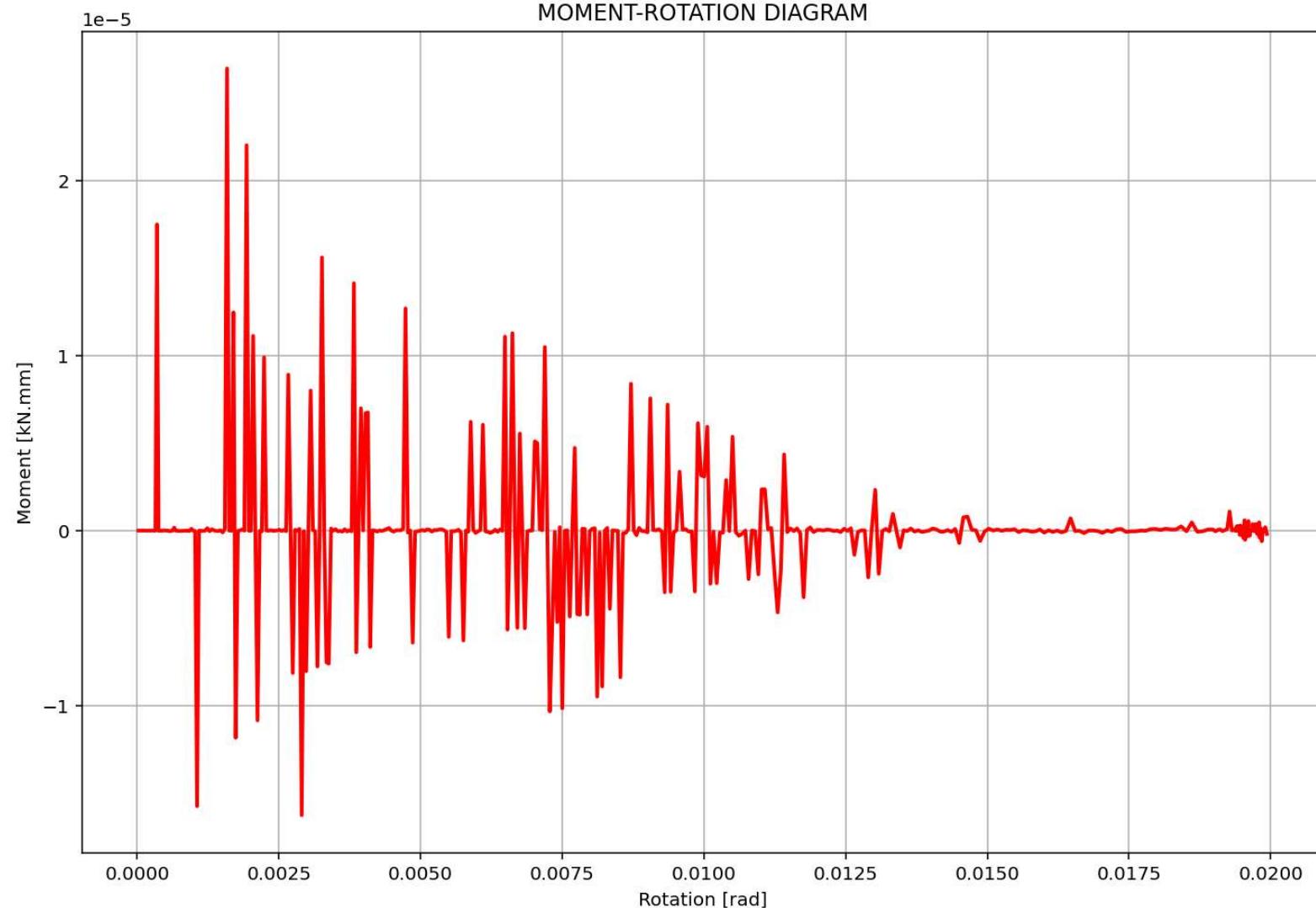




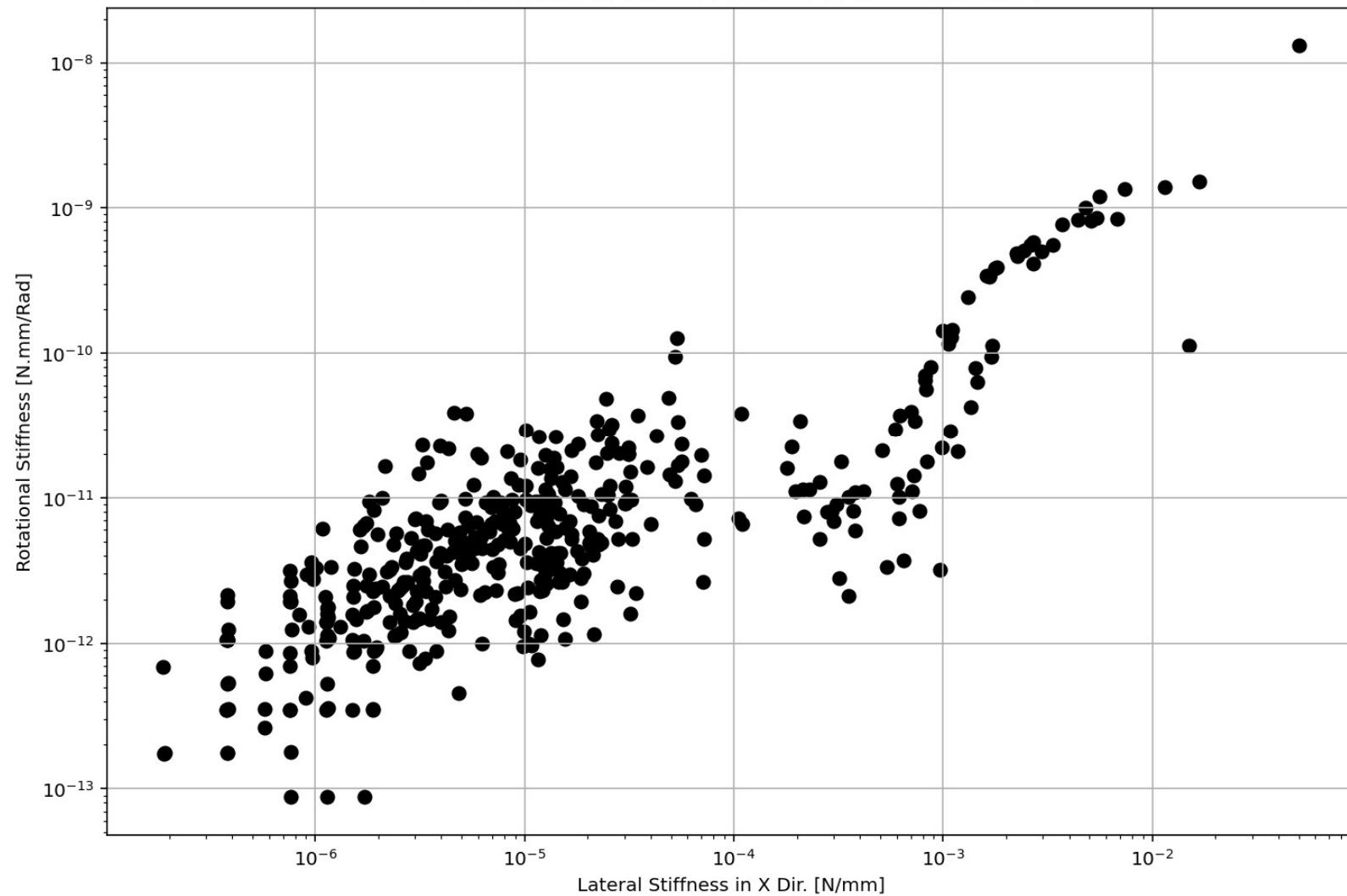
AXIAL FORCE-DISPLACEMENT DIAGRAM

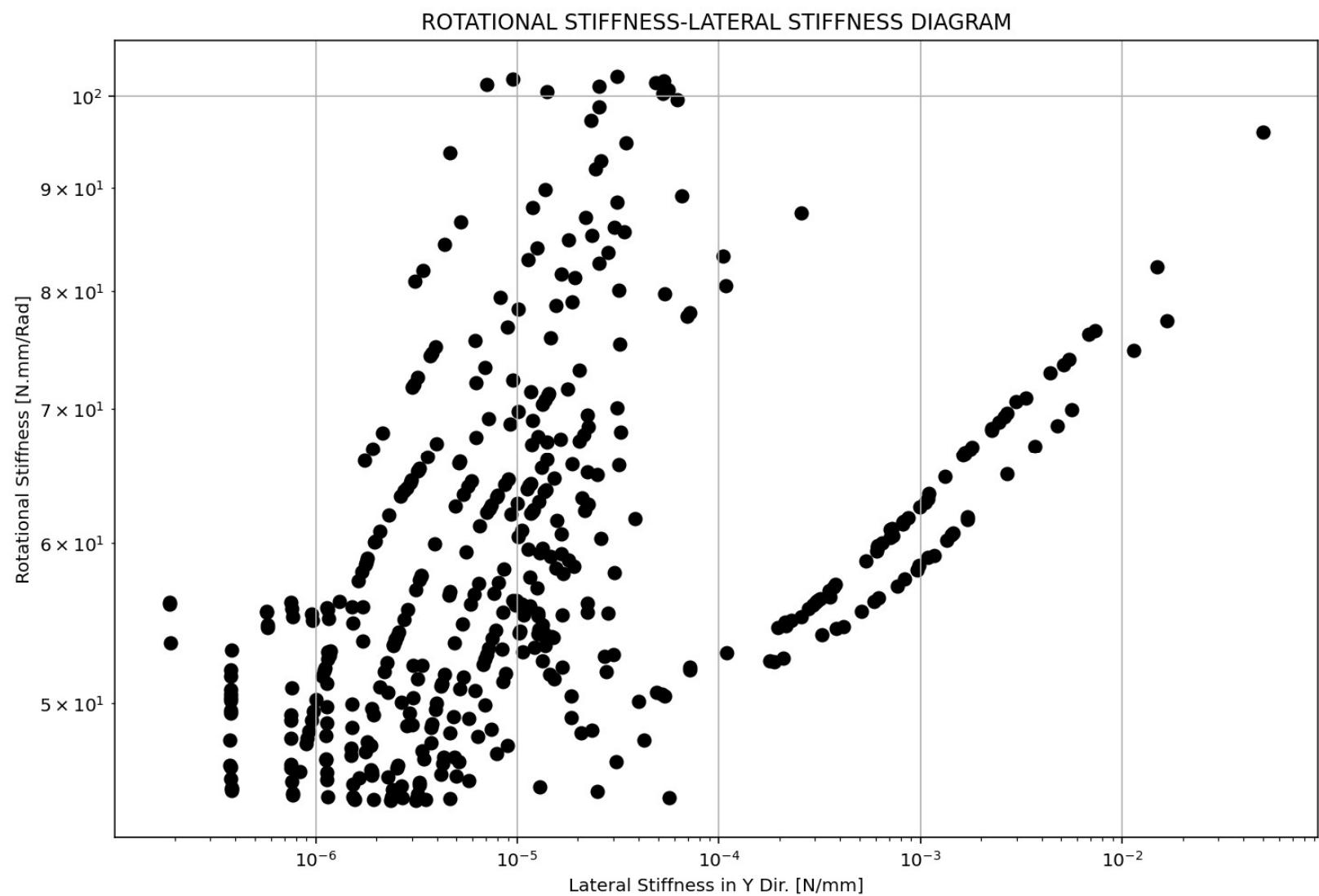


MOMENT-ROTATION DIAGRAM

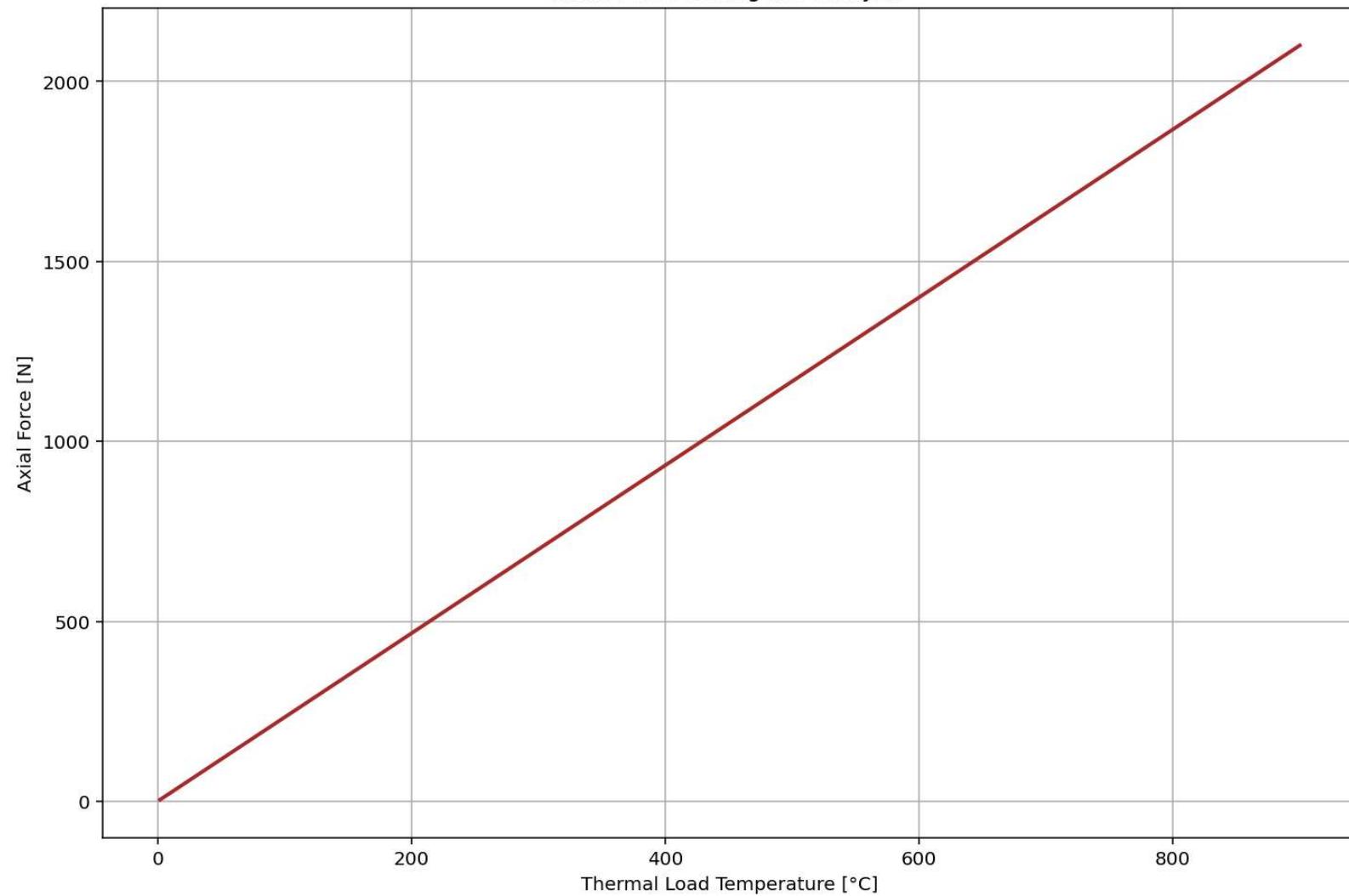


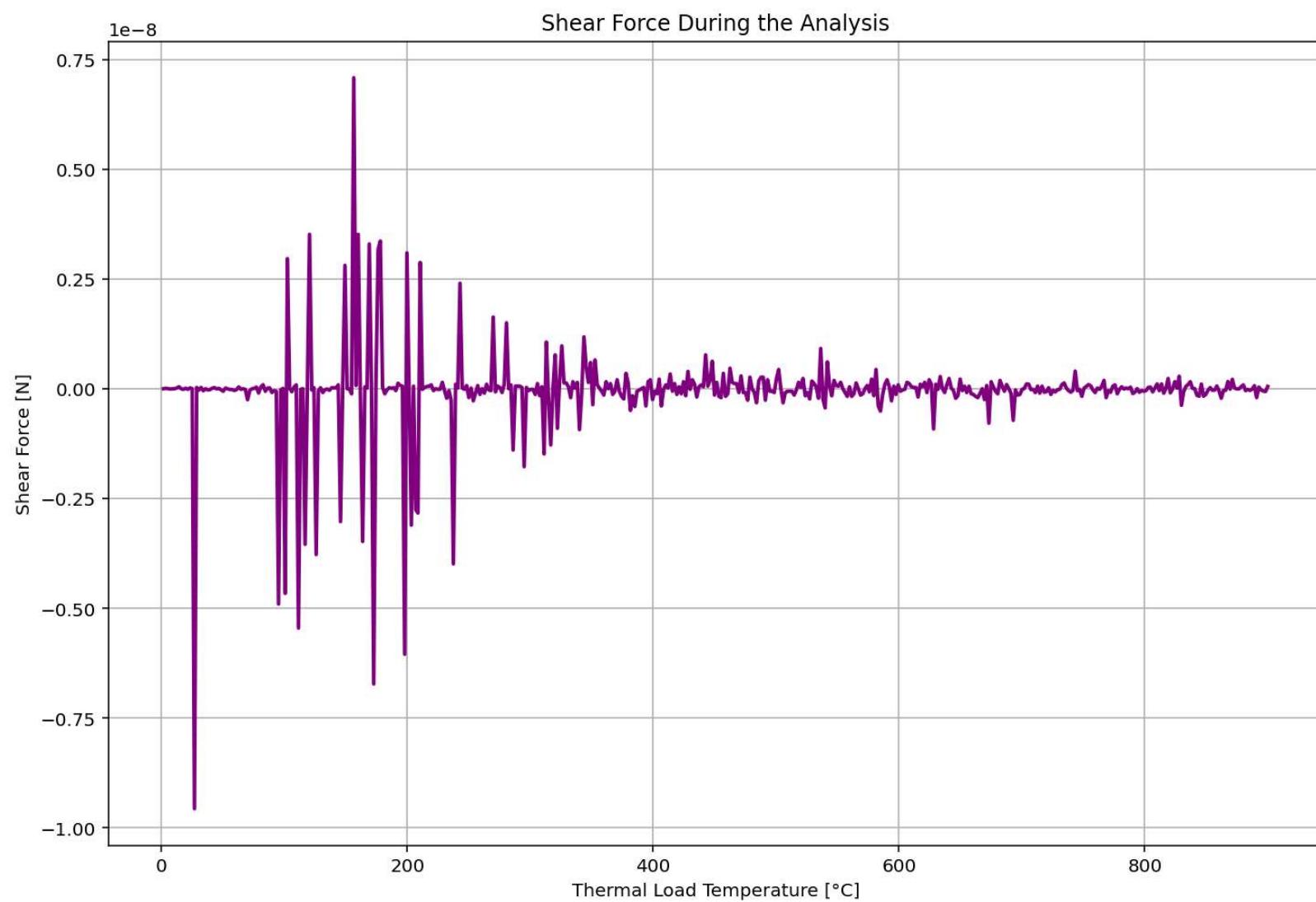
ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM

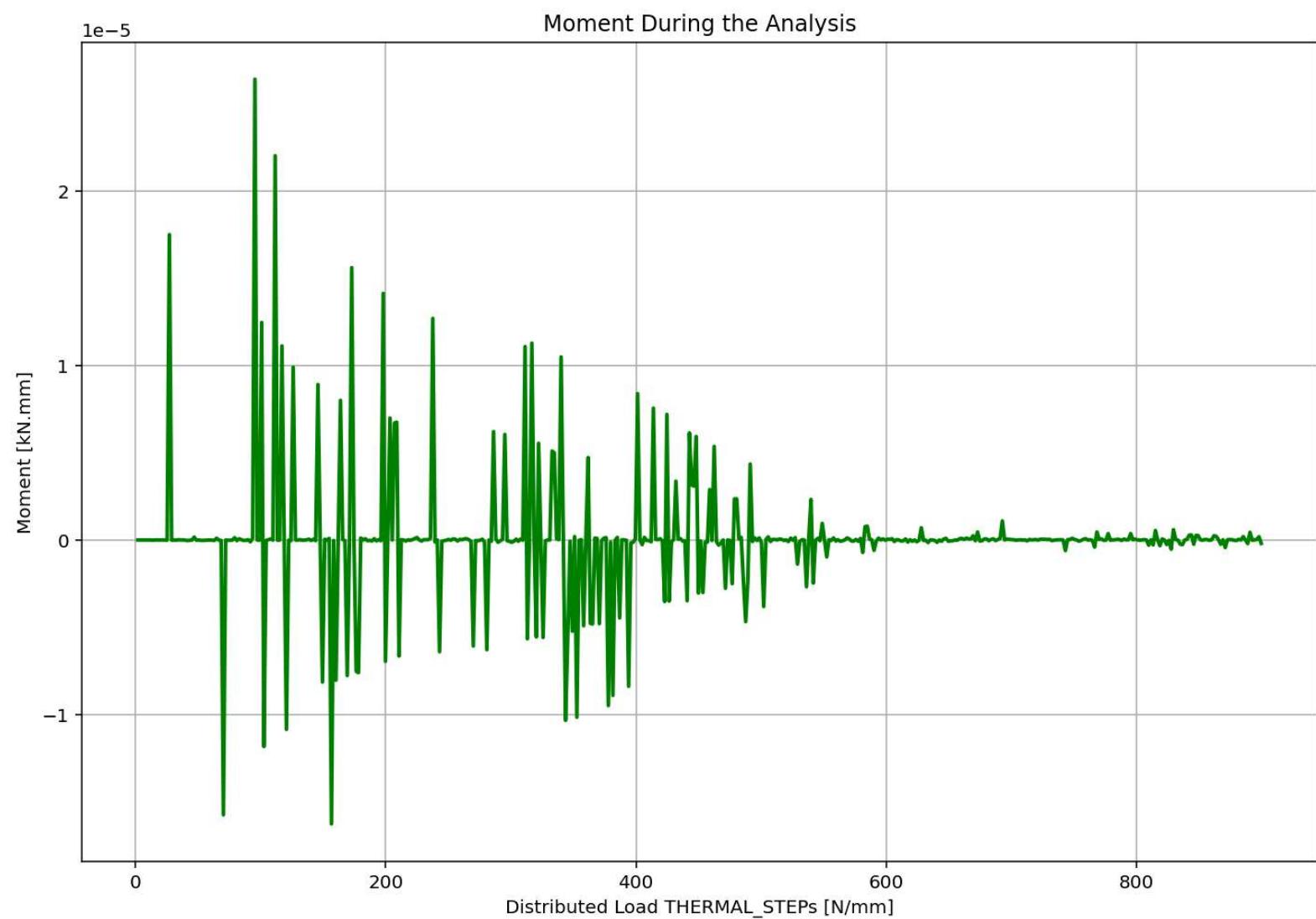




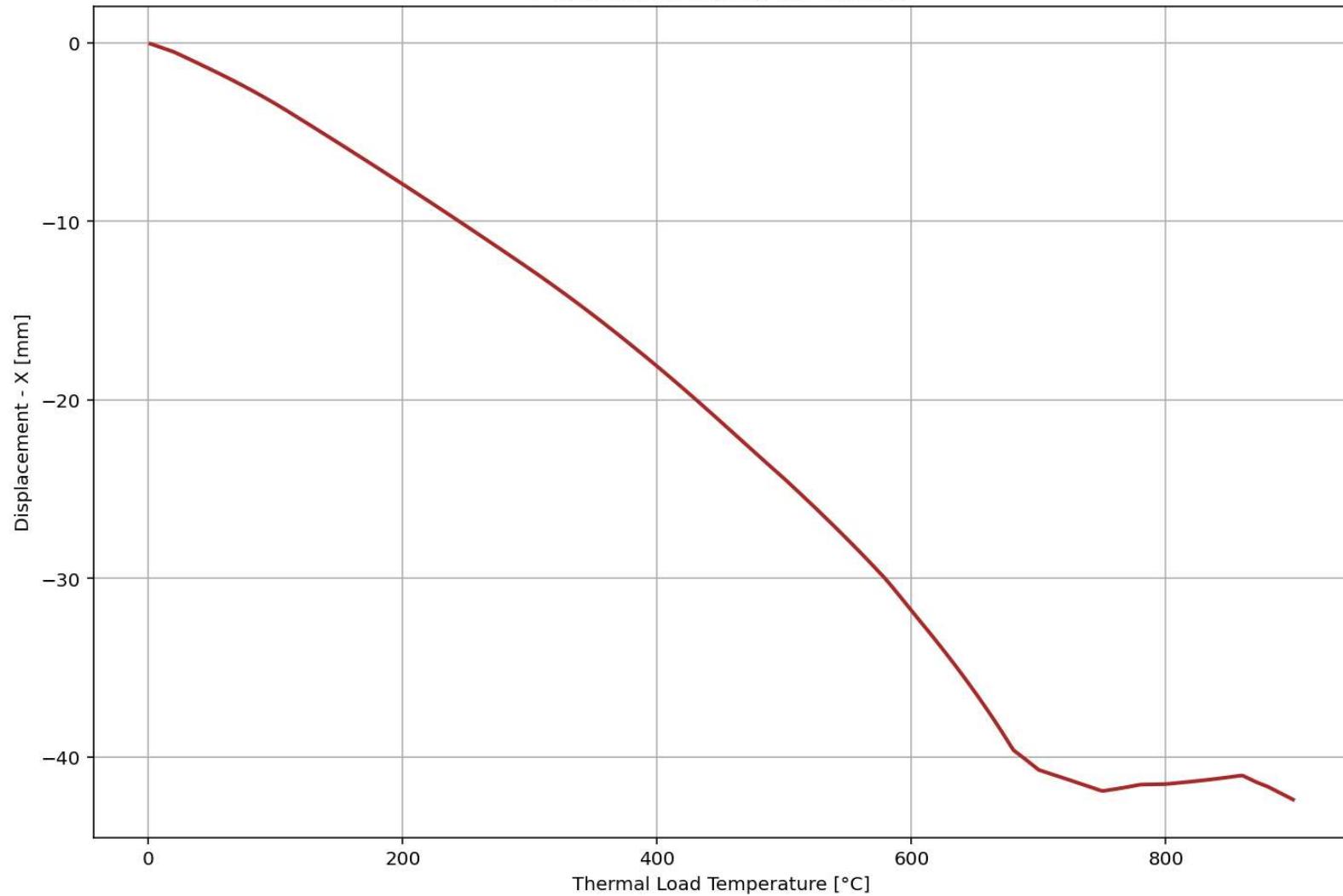
Axial Force During the Analysis



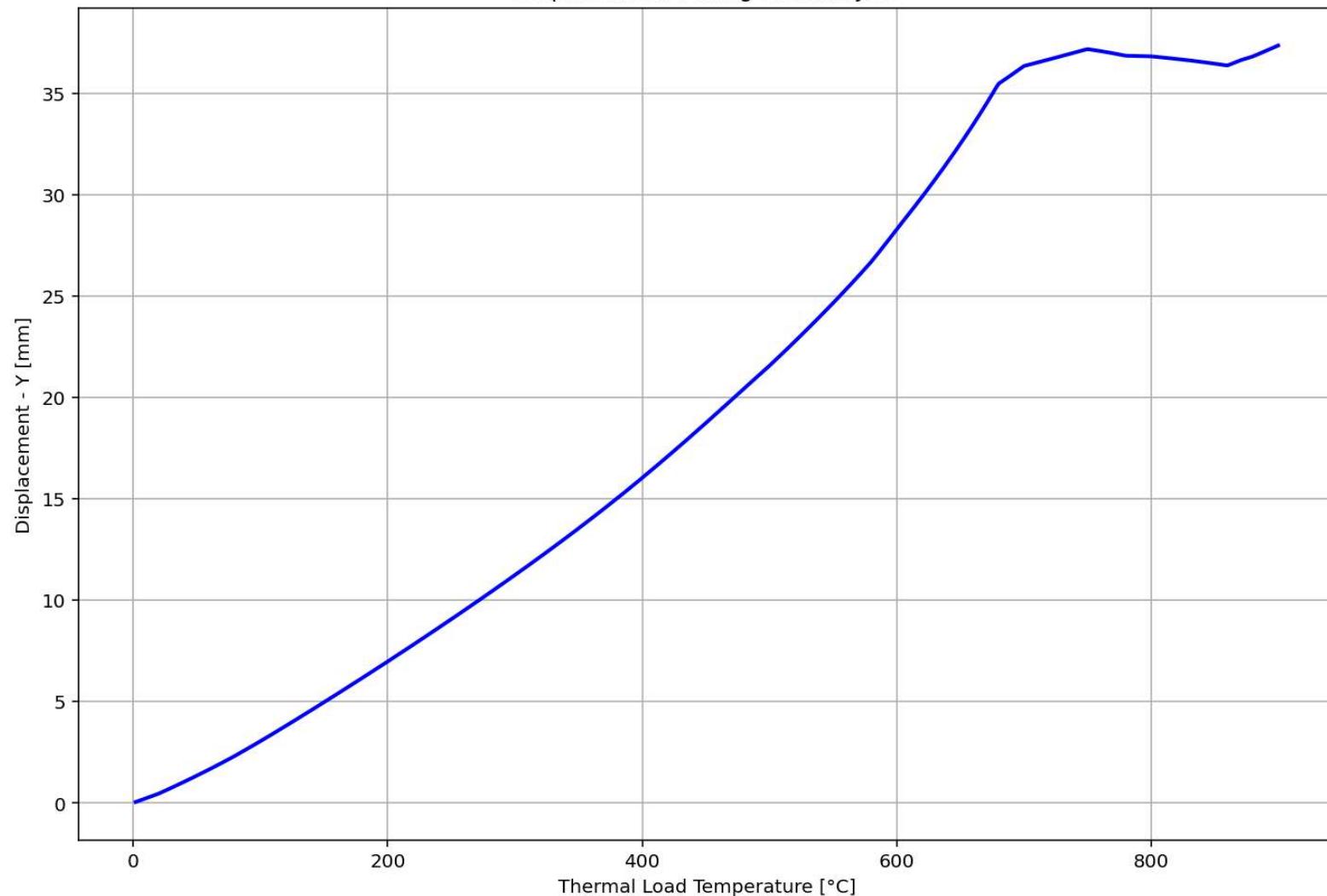




Displacement During the Analysis



Displacement During the Analysis



Rotation During the Analysis

