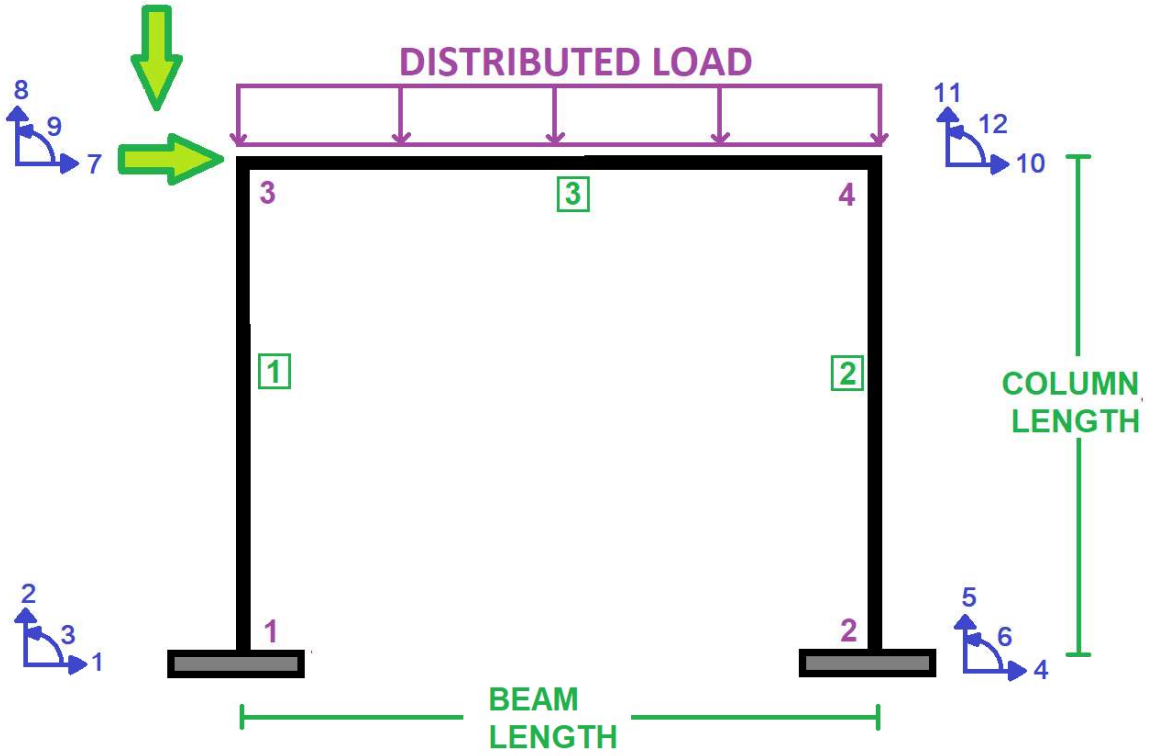
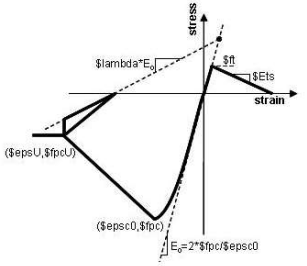
IN THE NAME OF ALLAH

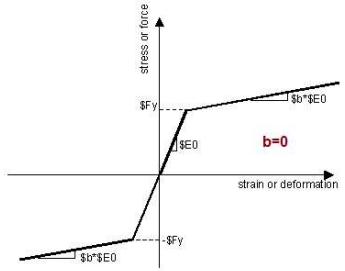
SENSITIVITY ANALYSIS OF CONCRETE FRAME BY CHANGING COLUMN REBAR DIAMETER AND COLUMN SECTION DEPTH. ANALYZING CREEP AND SHRINKAGE OF A CONCRETE FRAME. EVALUATING STRAIN HARDENING USING OPENSEES AND CALCULATE STRUCTURAL BEHAVIOR COEFFICIENT

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

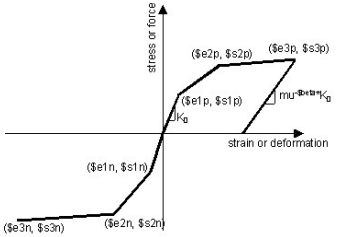




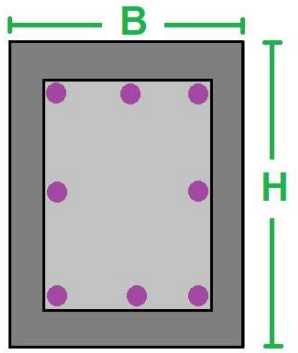
CORE AND COVER CONCRETE REALTION



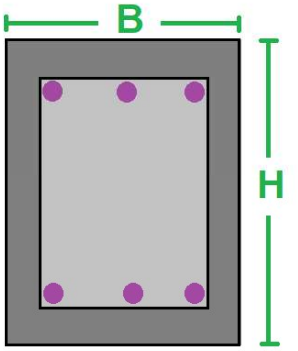
WITHOUT HARDENING AND ULTIMATE STRAIN



WITH HARDENING AND ULTIMATE STRAIN

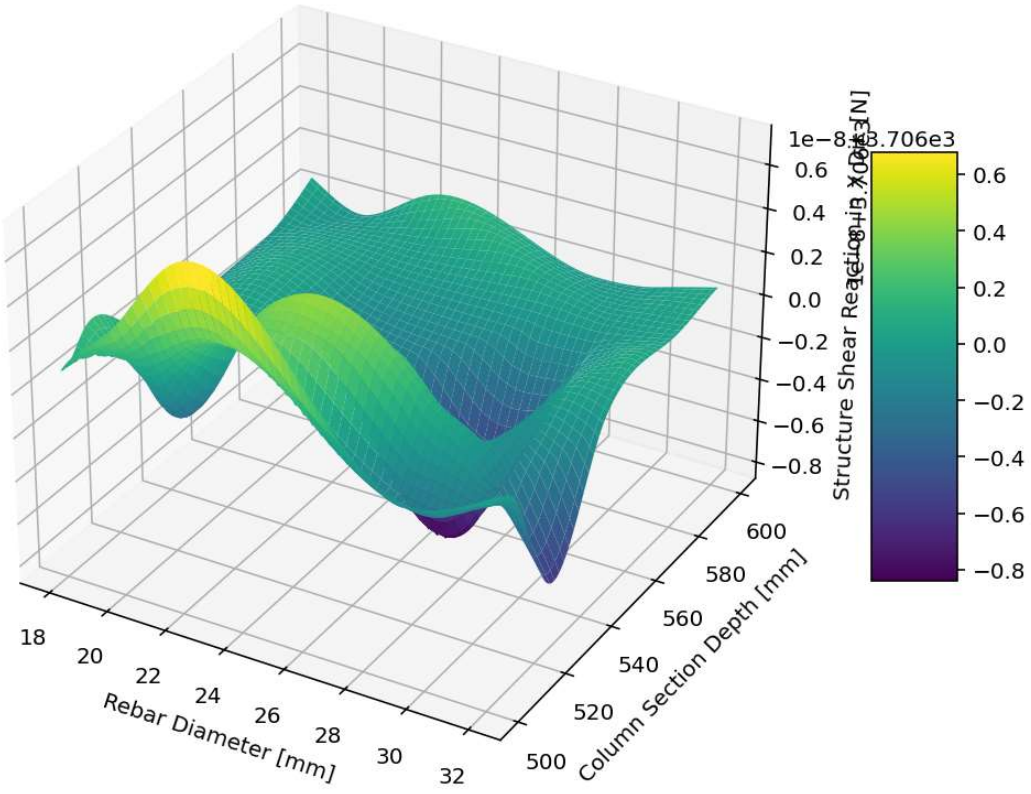


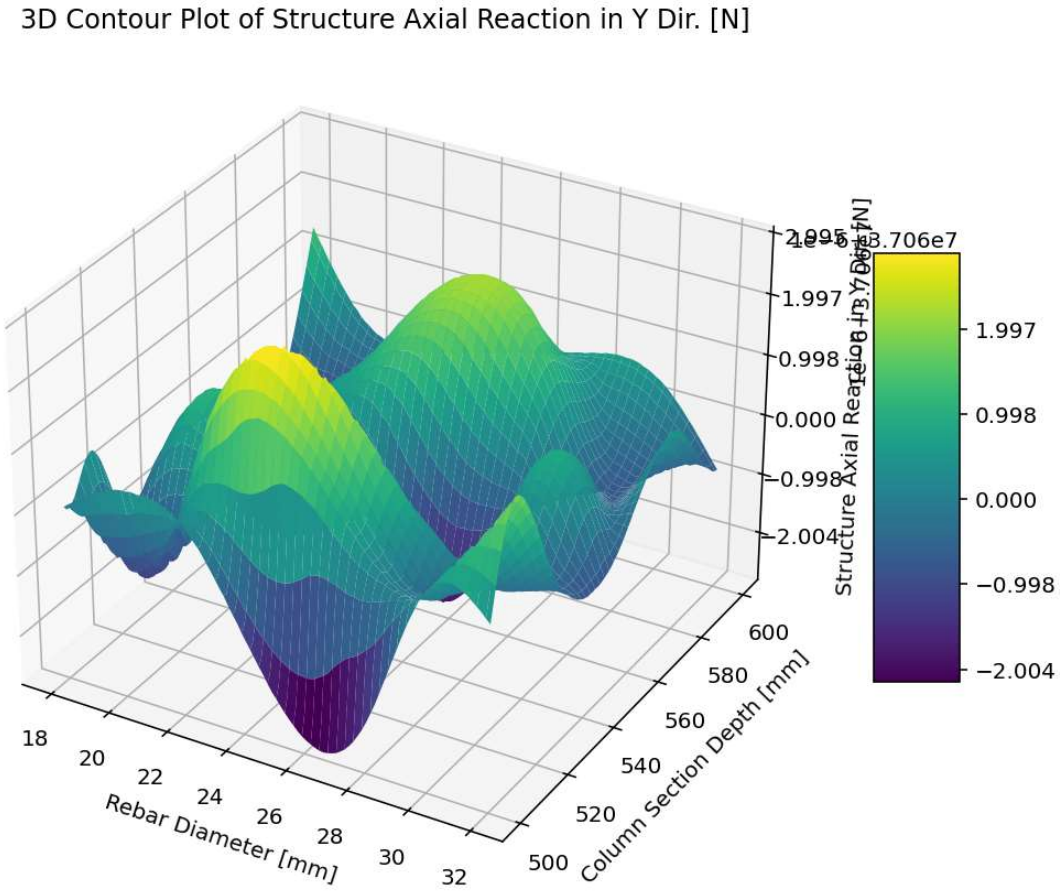
COLUMN SECTION



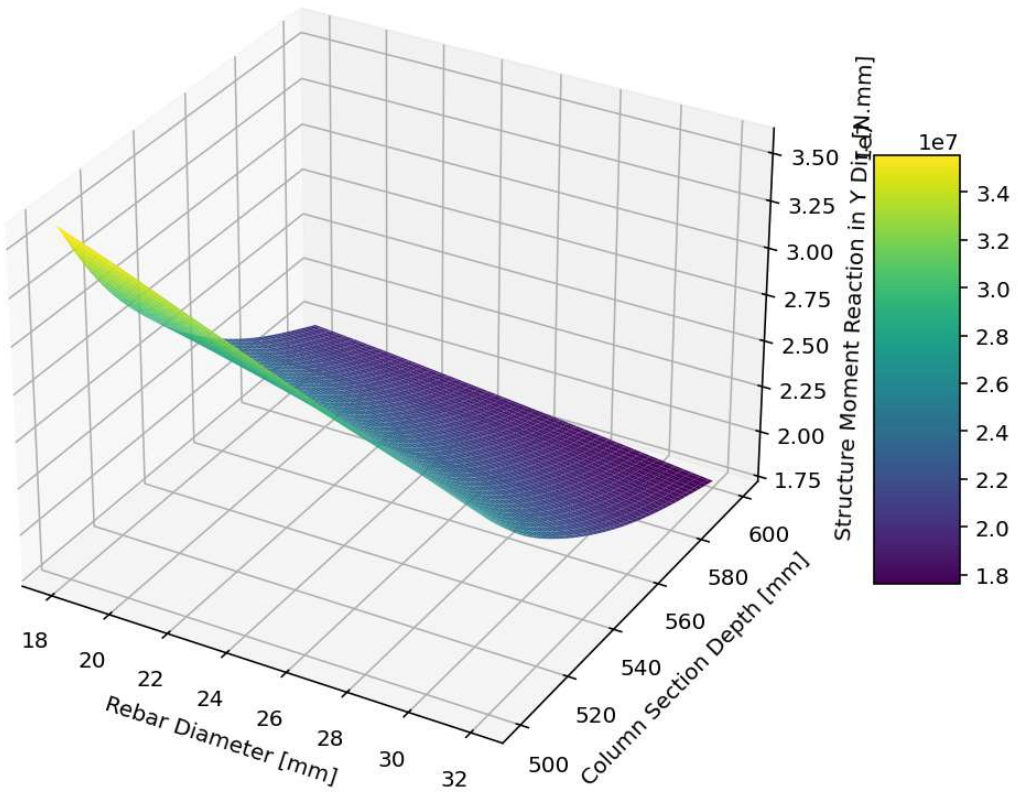
BEAM SECTION

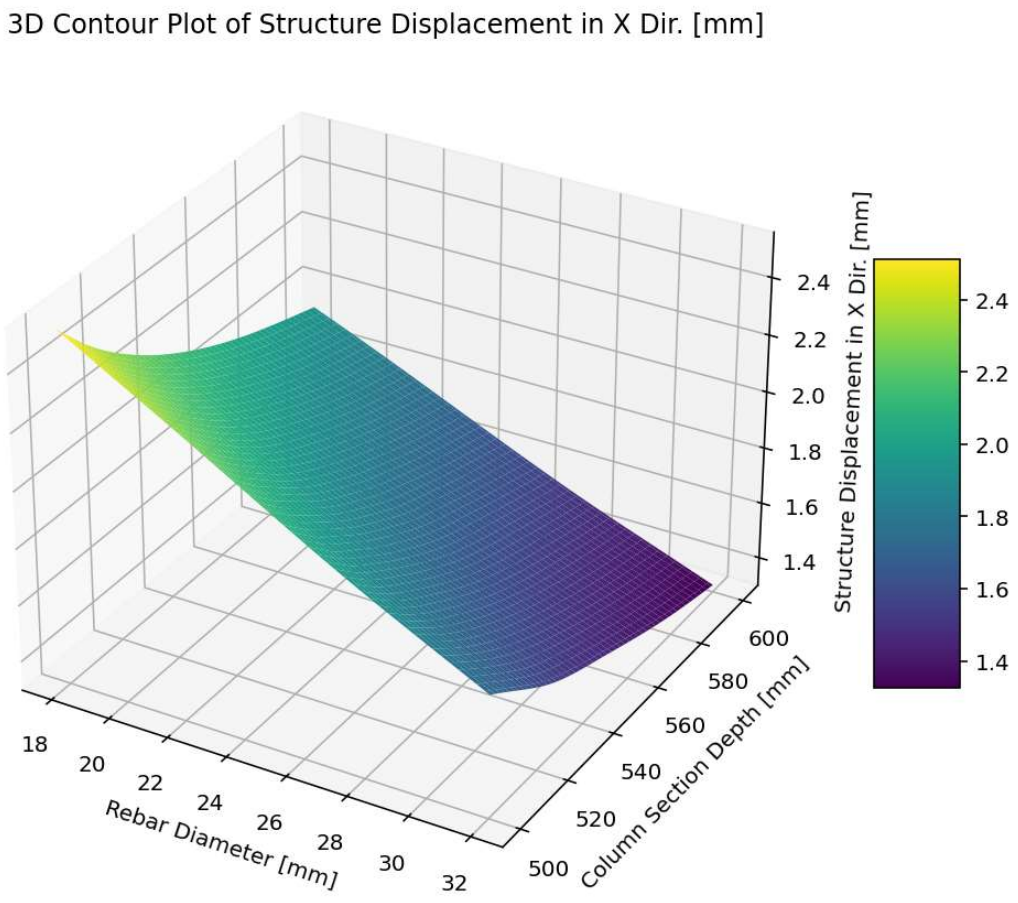
3D Contour Plot of Structure Shear Reaction in X Dir. [N]

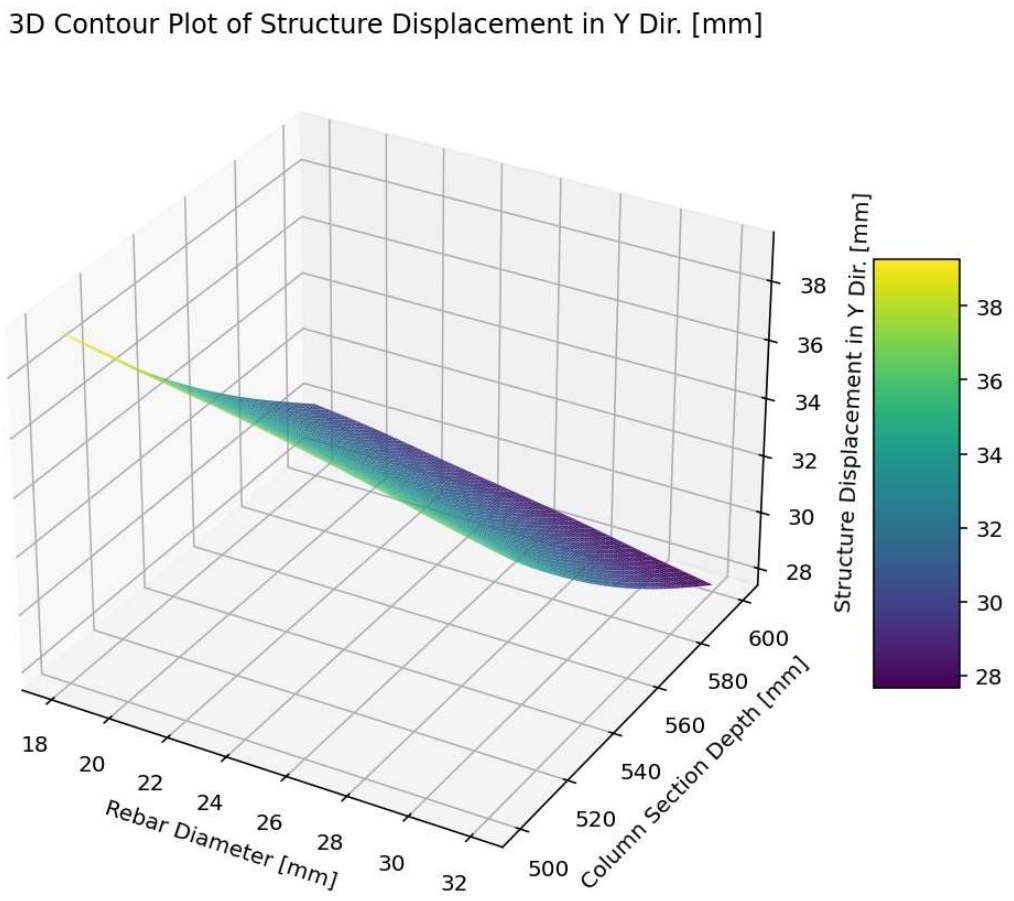


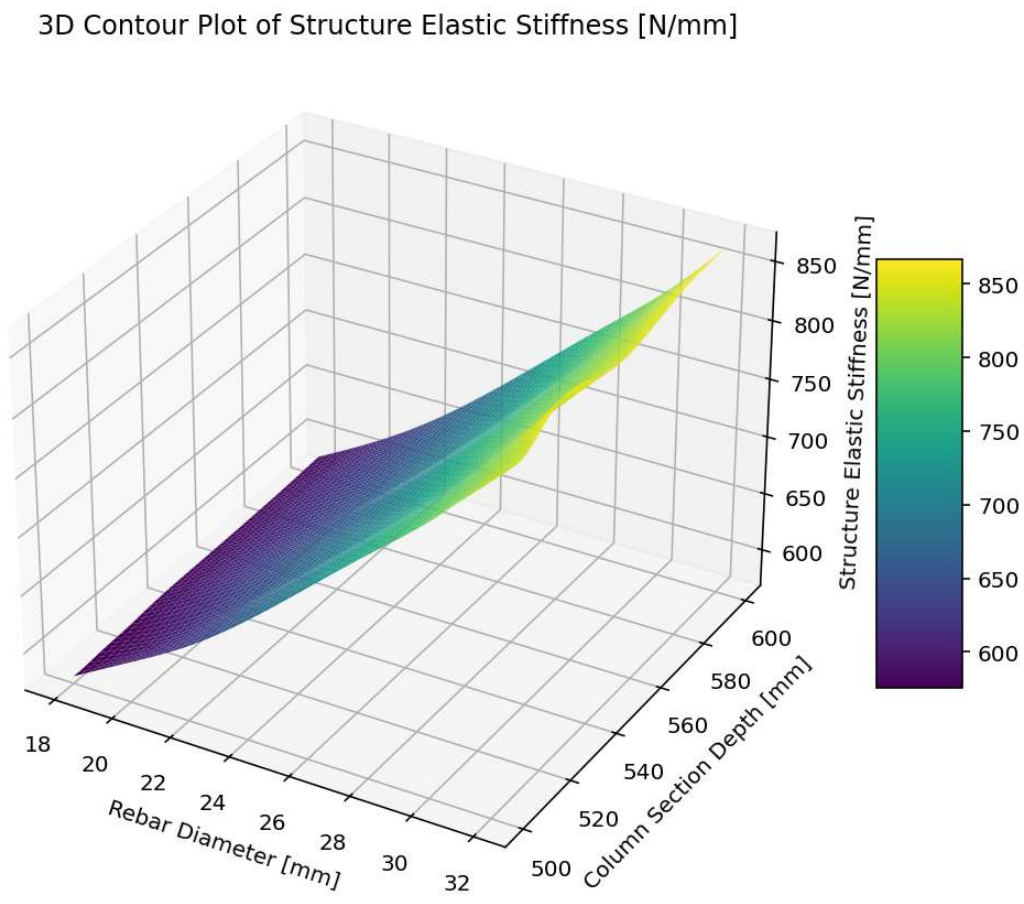

3D Contour Plot of Structure Axial Reaction in Y Dir. [N]
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600
Structure Axial Reaction in Y Dir. [N]
1.997
0.998
0.000
−0.998
−2.004
3.706e7
1.997
0.998
0.000
−0.998
−2.004

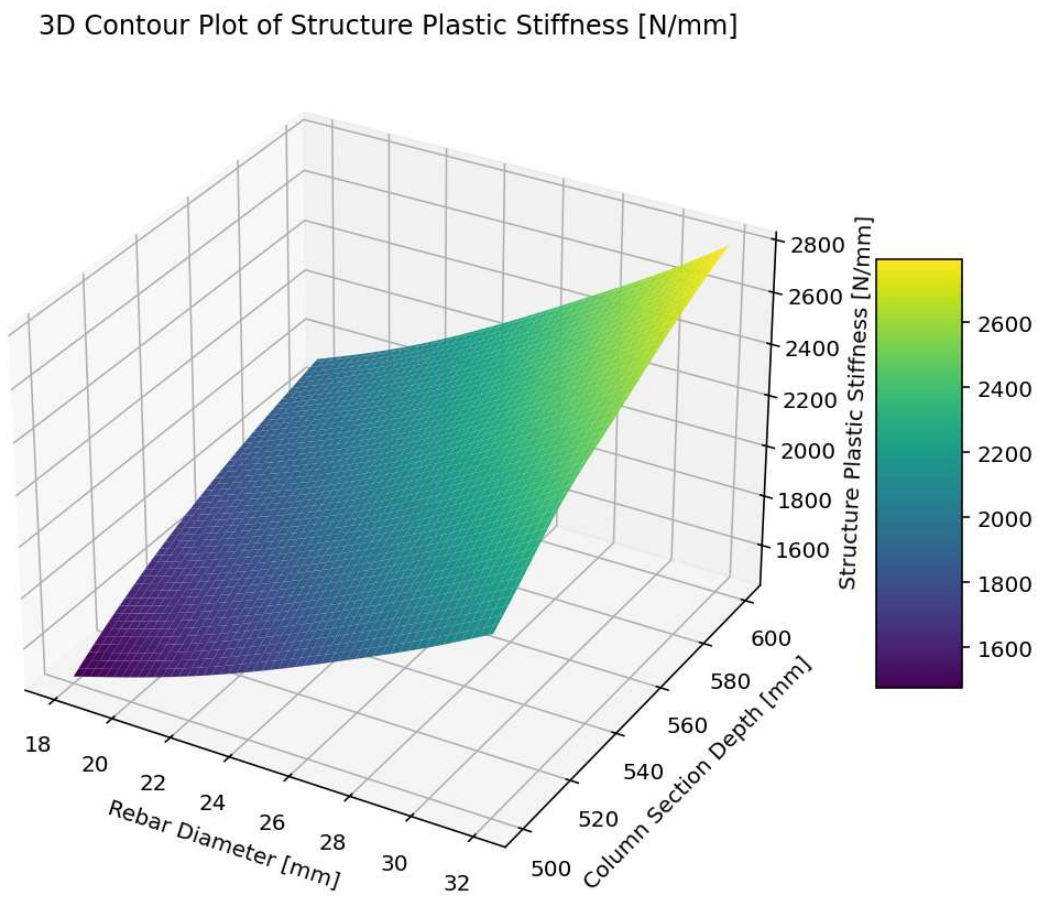
3D Contour Plot of Structure Moment Reaction in Y Dir. [N.mm]

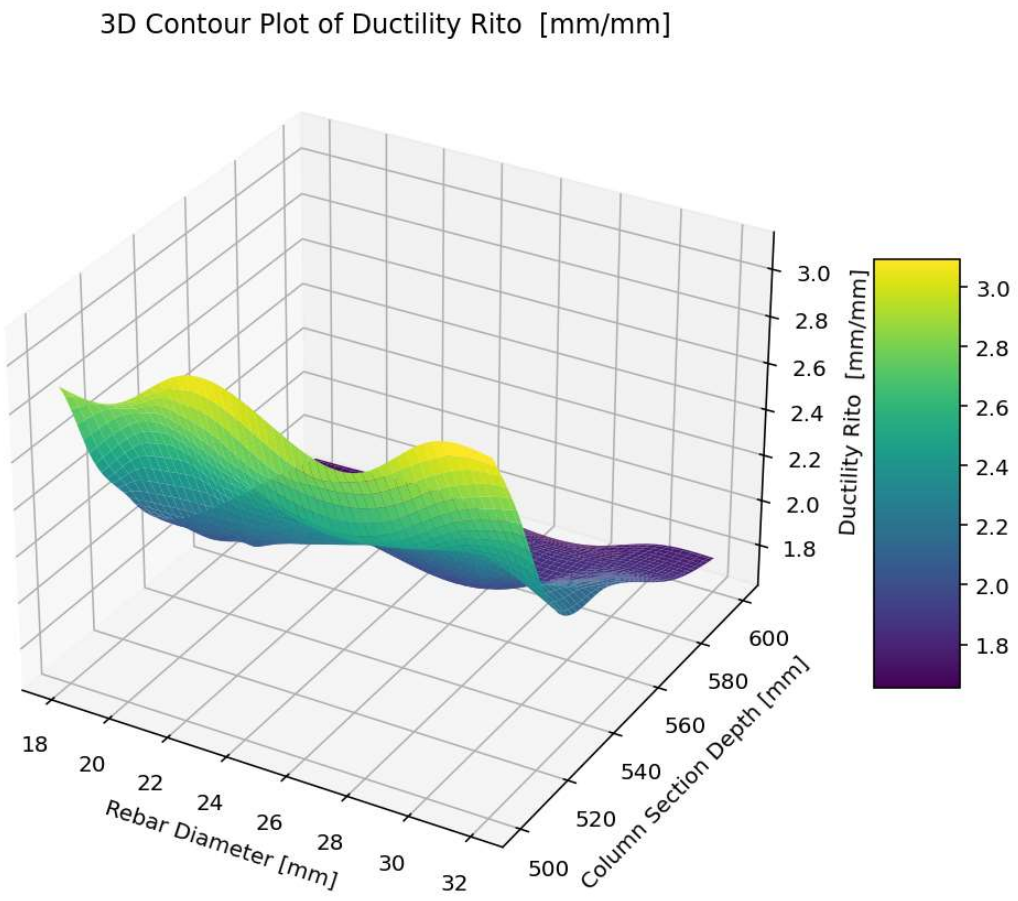


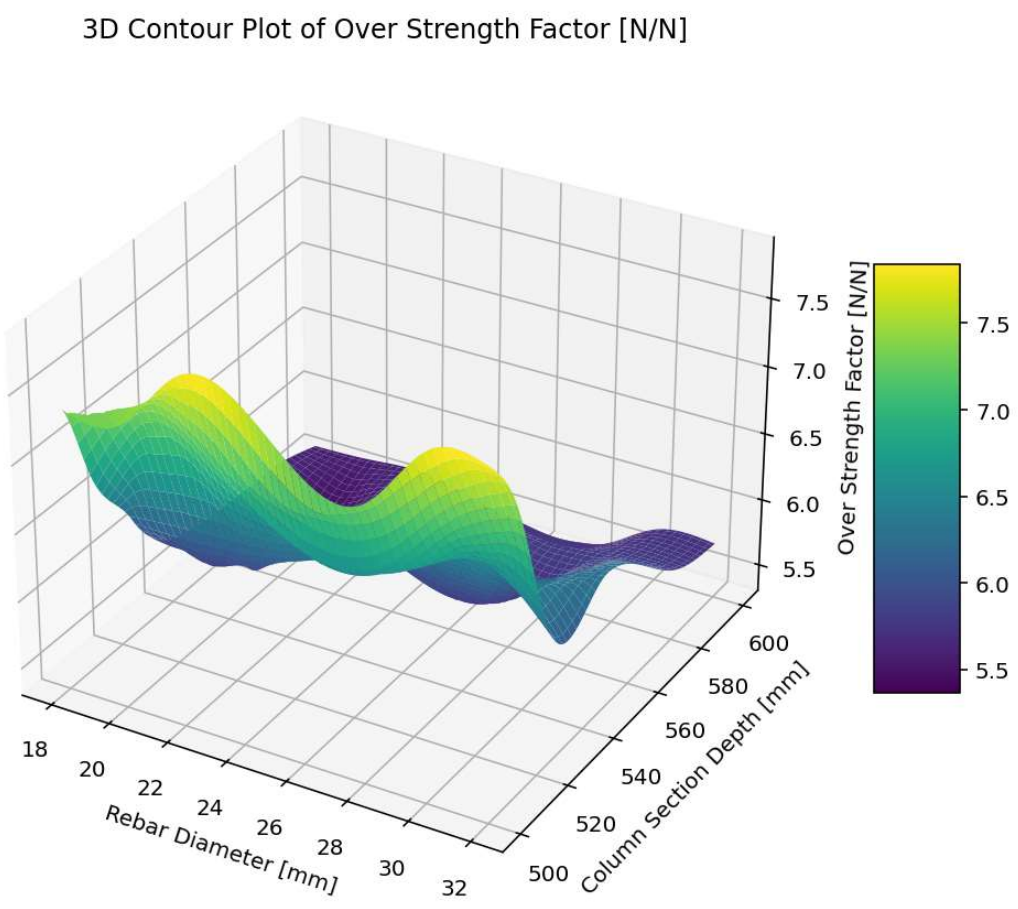

3D Contour Plot of Structure Displacement in X Dir. [mm]
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600
Structure Displacement in X Dir. [mm]
1.4
1.6
1.8
2.0
2.2
2.4

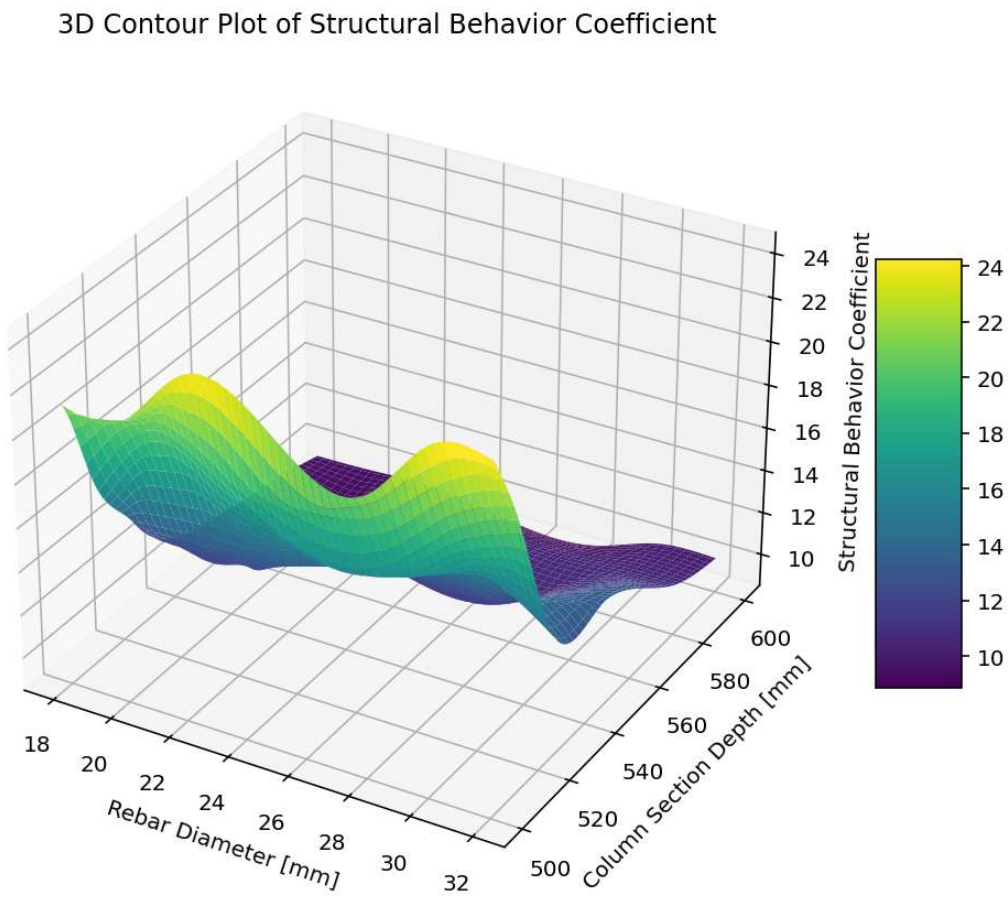

3D Contour Plot of Structure Displacement in Y Dir. [mm]
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600
Structure Displacement in Y Dir. [mm]
28
30
32
34
36
38

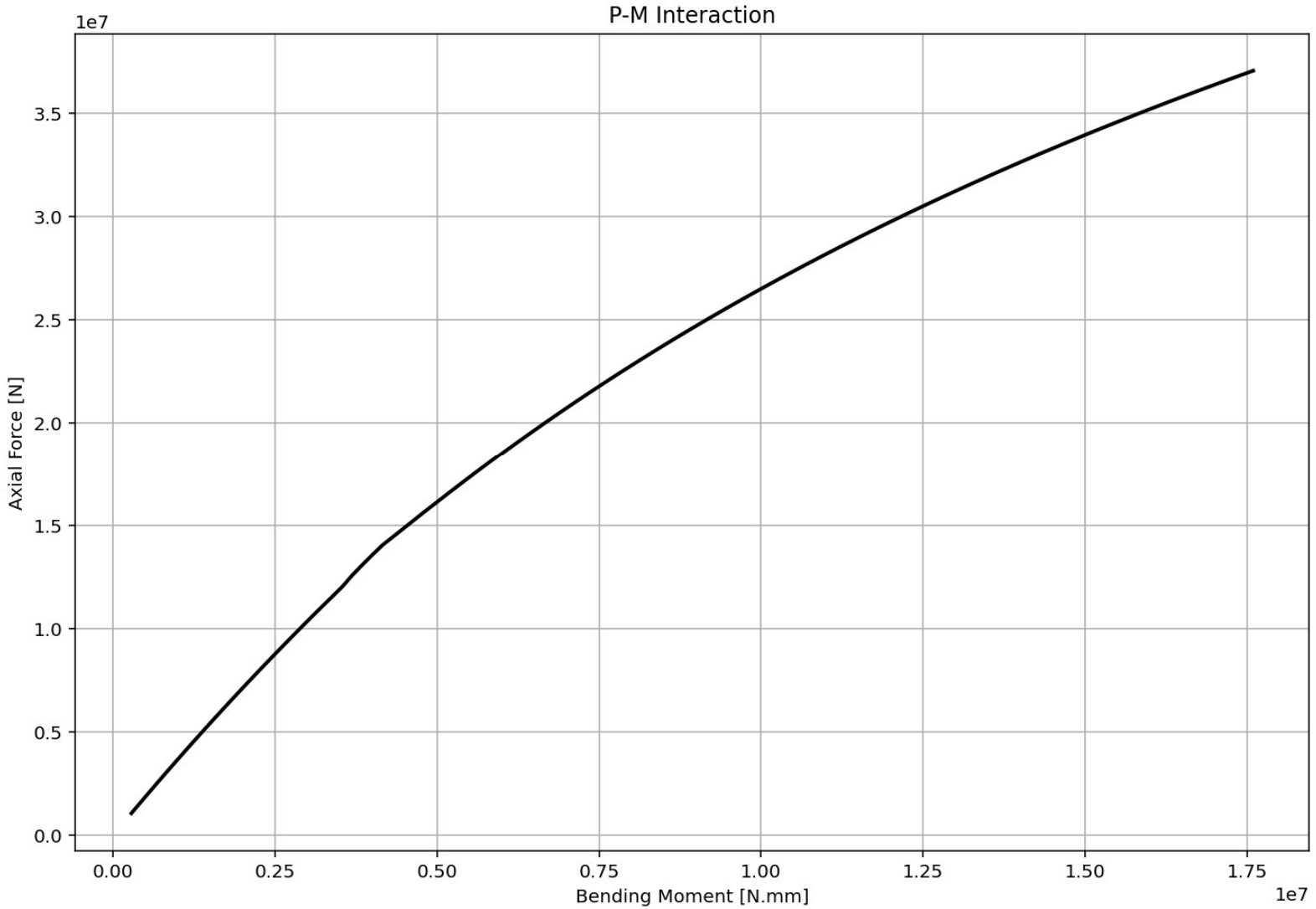

3D Contour Plot of Structure Elastic Stiffness [N/mm]
Structure Elastic Stiffness [N/mm]
850
800
750
700
650
600
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600

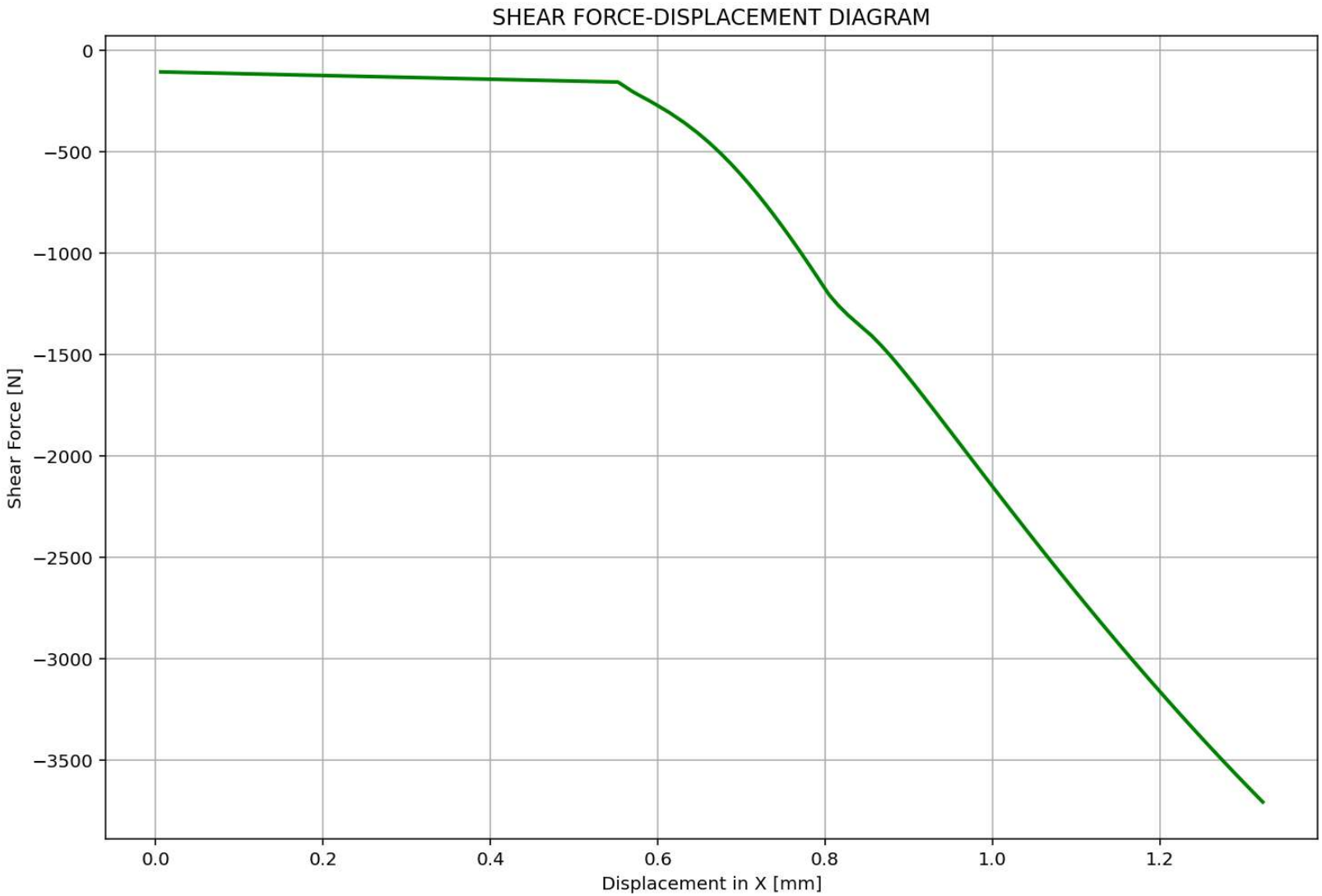

3D Contour Plot of Structure Plastic Stiffness [N/mm]
Structure Plastic Stiffness [N/mm]
2800
2600
2400
2200
2000
1800
1600
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600

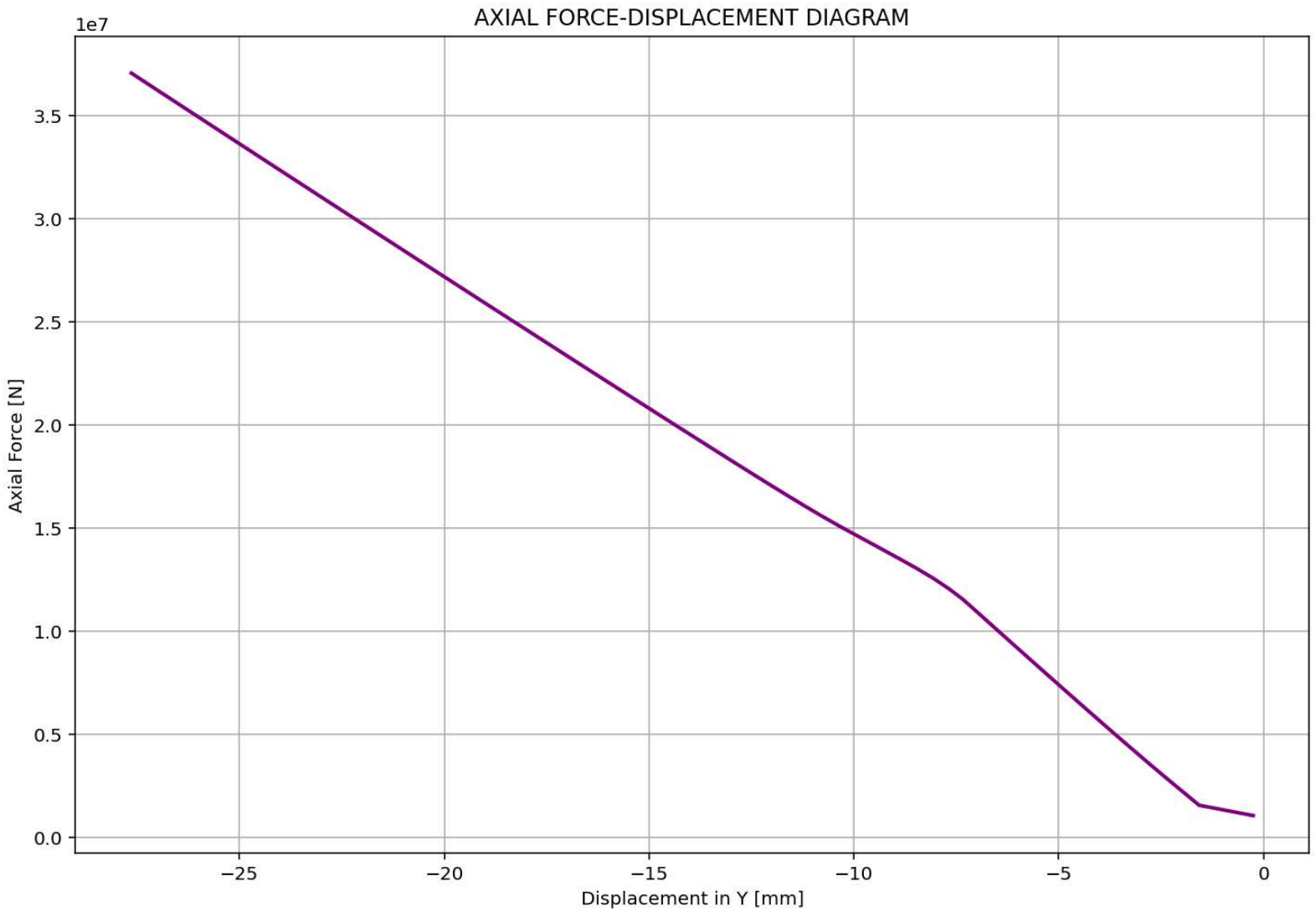

3D Contour Plot of Ductility Rito [mm/mm]
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600
Ductility Rito [mm/mm]
1.8
2.0
2.2
2.4
2.6
2.8
3.0

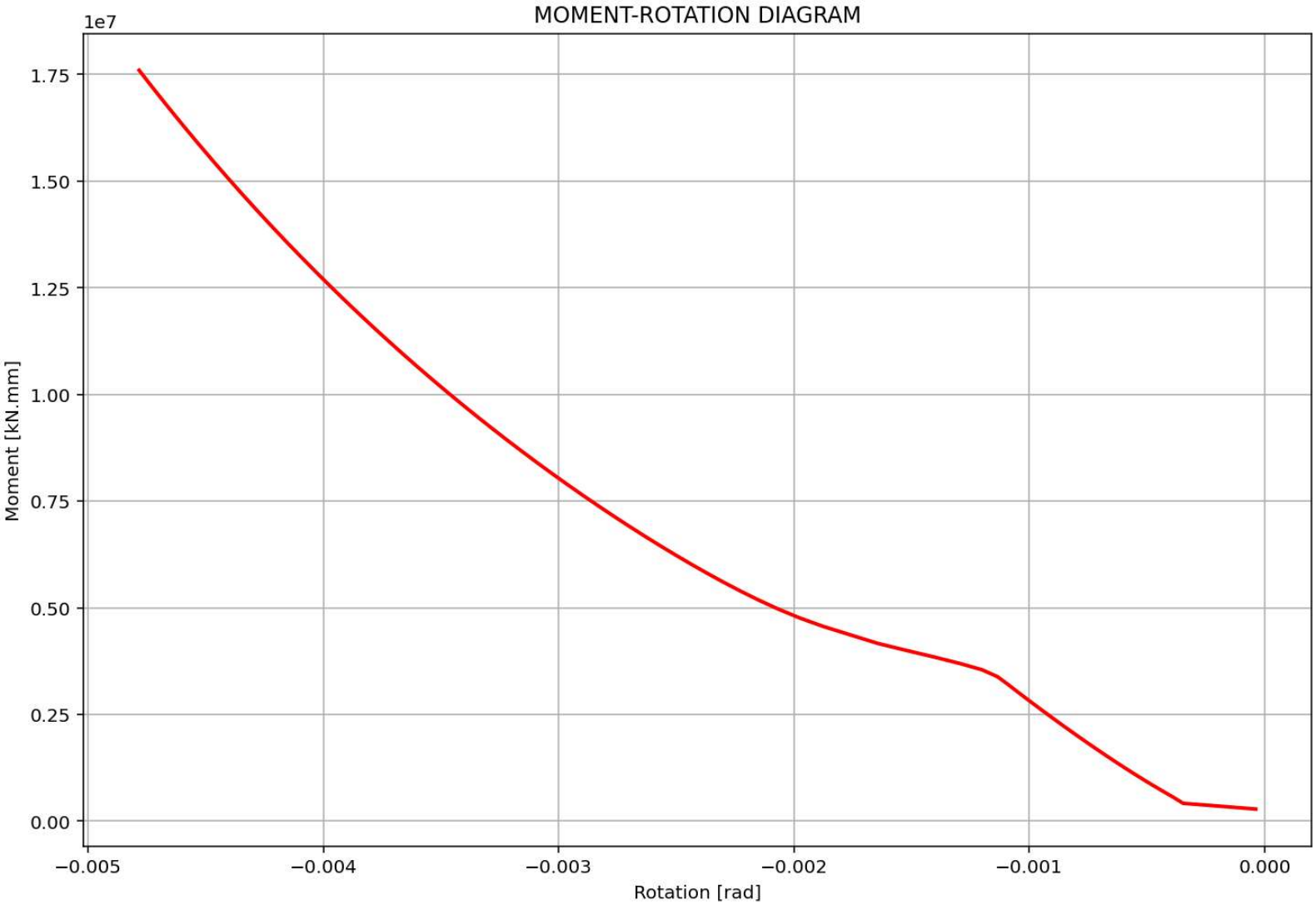

3D Contour Plot of Over Strength Factor [N/N]
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600
7.5
7.0
6.5
6.0
5.5
Over Strength Factor [N/N]
7.5
7.0
6.5
6.0
5.5

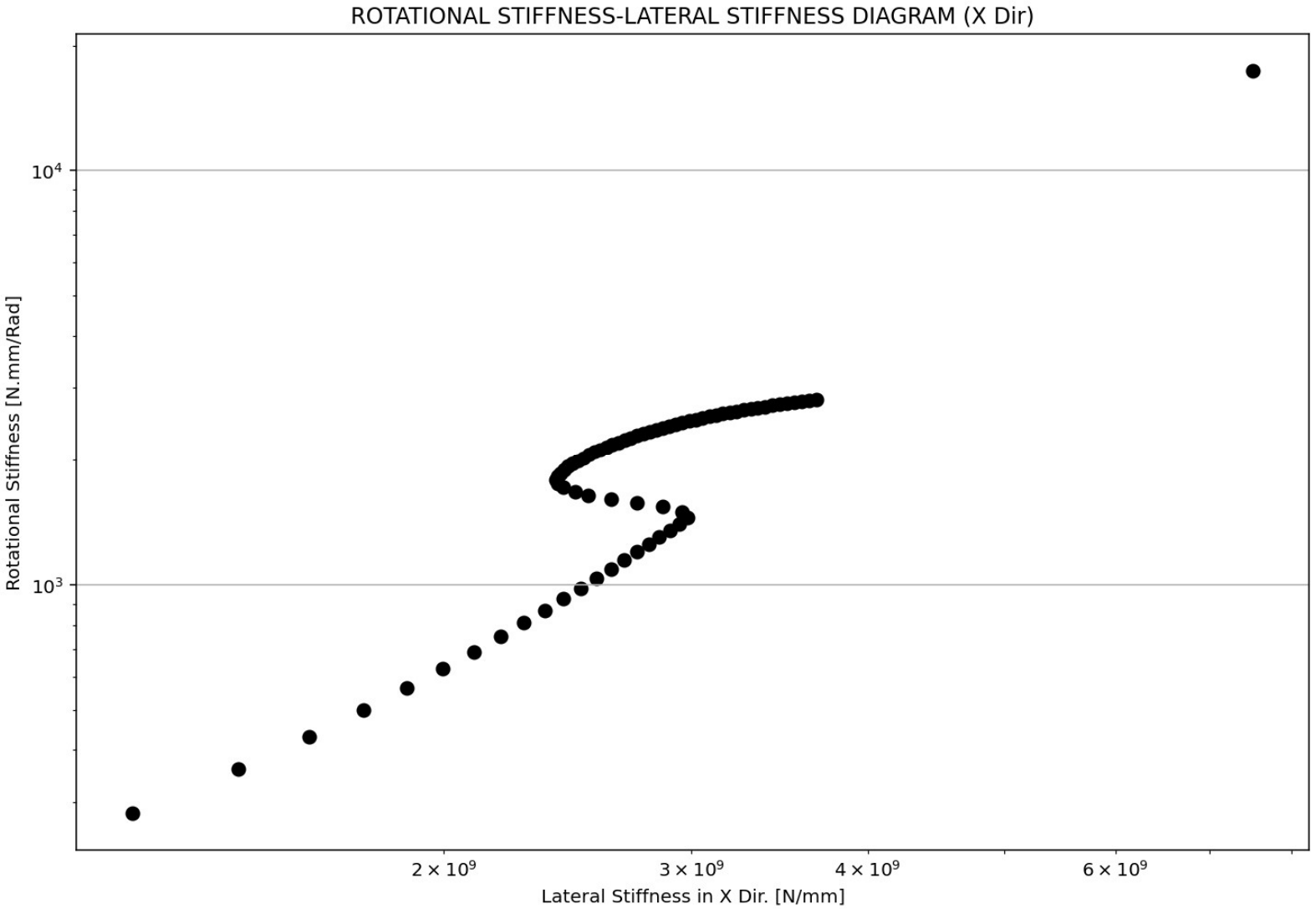

3D Contour Plot of Structural Behavior Coefficient
Structural Behavior Coefficient
24
22
20
18
16
14
12
10
Rebar Diameter [mm]
18
20
22
24
26
28
30
32
Column Section Depth [mm]
500
520
540
560
580
600

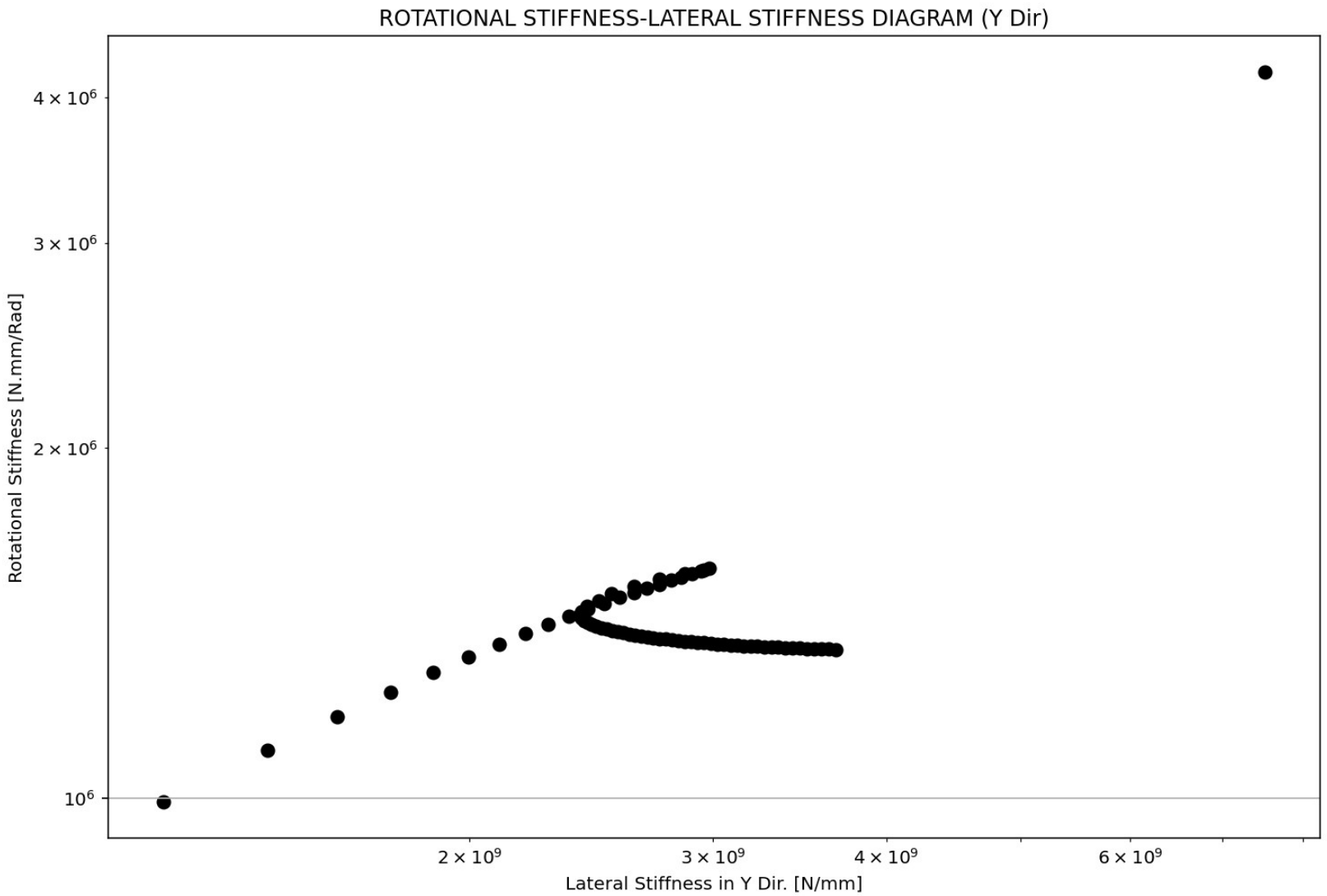

P-M Interaction
1e7
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Axial Force [N]
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
Bending Moment [N.mm]
1e7

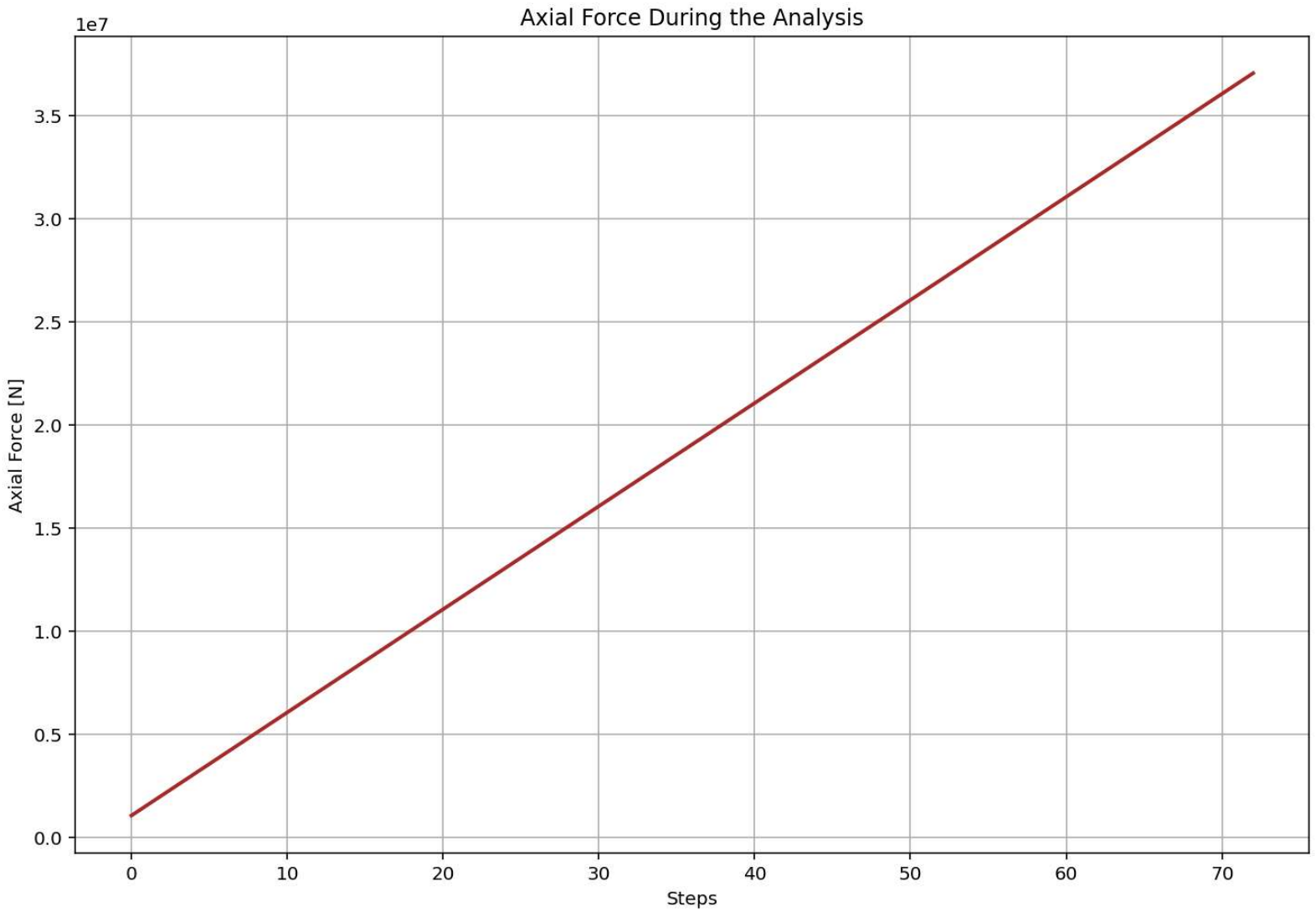

SHEAR FORCE-DISPLACEMENT DIAGRAM
Shear Force [N]
0
−500
−1000
−1500
−2000
−2500
−3000
−3500
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Displacement in X [mm]

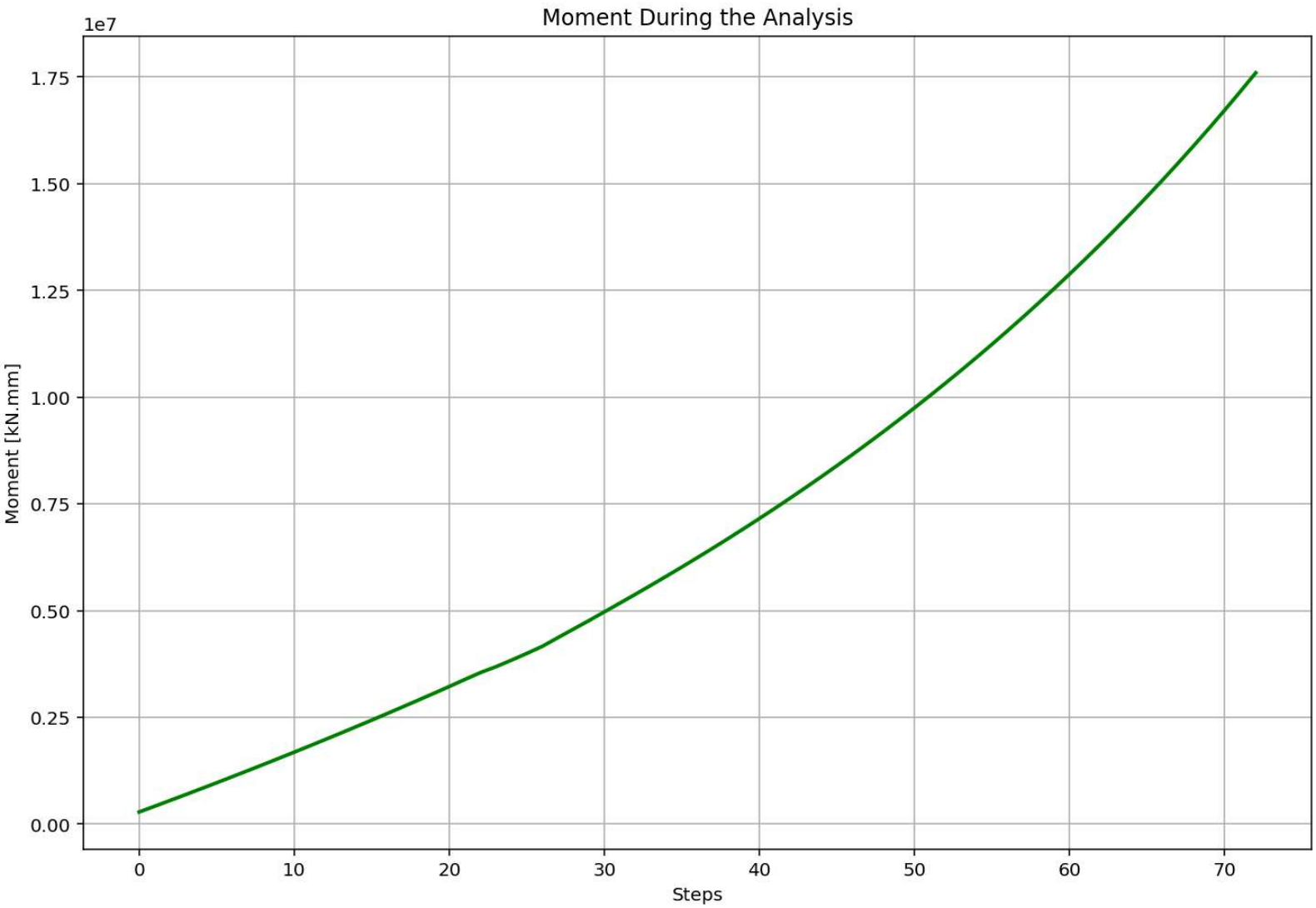

AXIAL FORCE-DISPLACEMENT DIAGRAM
1e7
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Axial Force [N]
−25
−20
−15
−10
−5
0
Displacement in Y [mm]

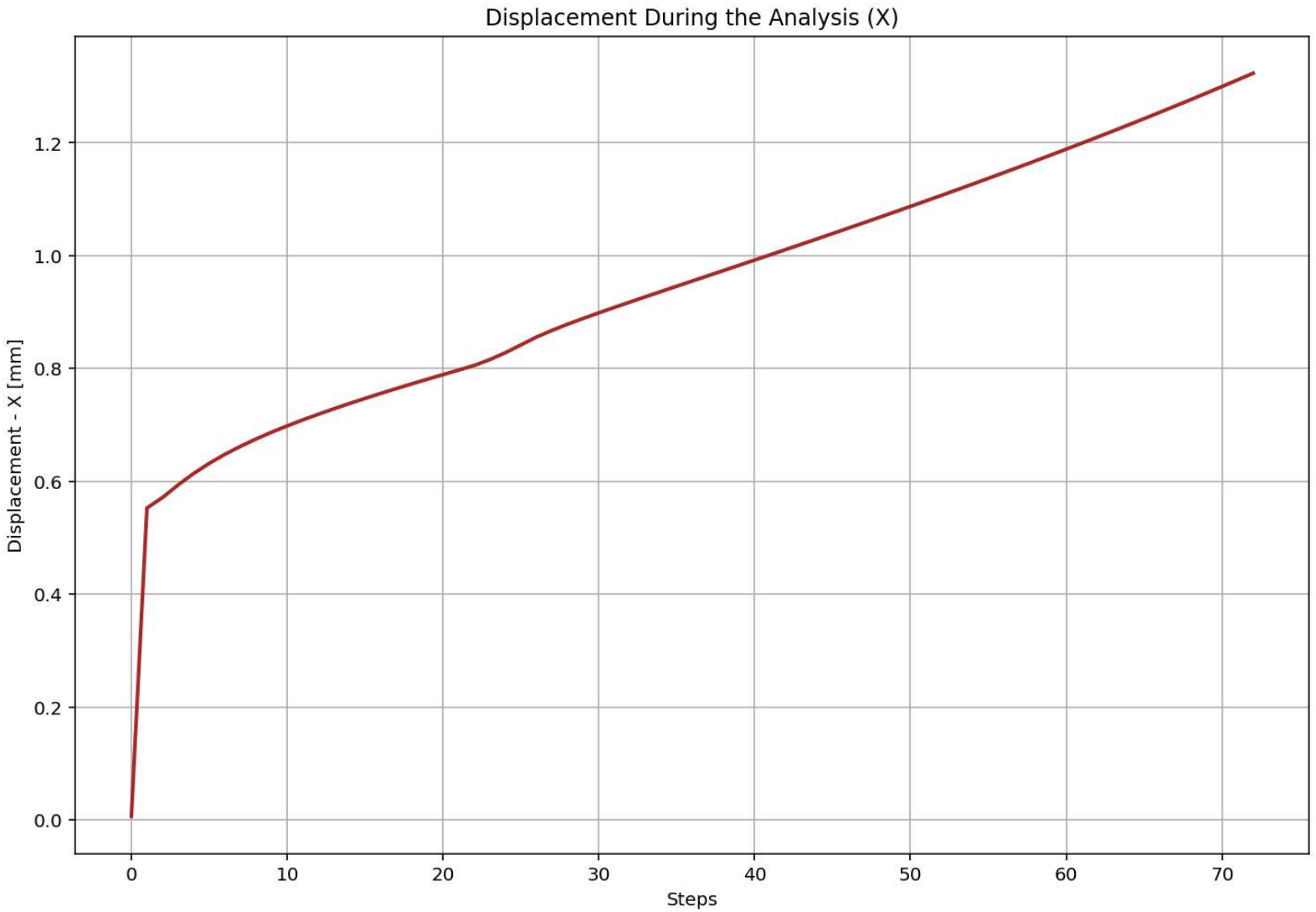

MOMENT-ROTATION DIAGRAM
1e7
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Moment [kN.mm]
−0.005
−0.004
−0.003
−0.002
−0.001
0.000
Rotation [rad]

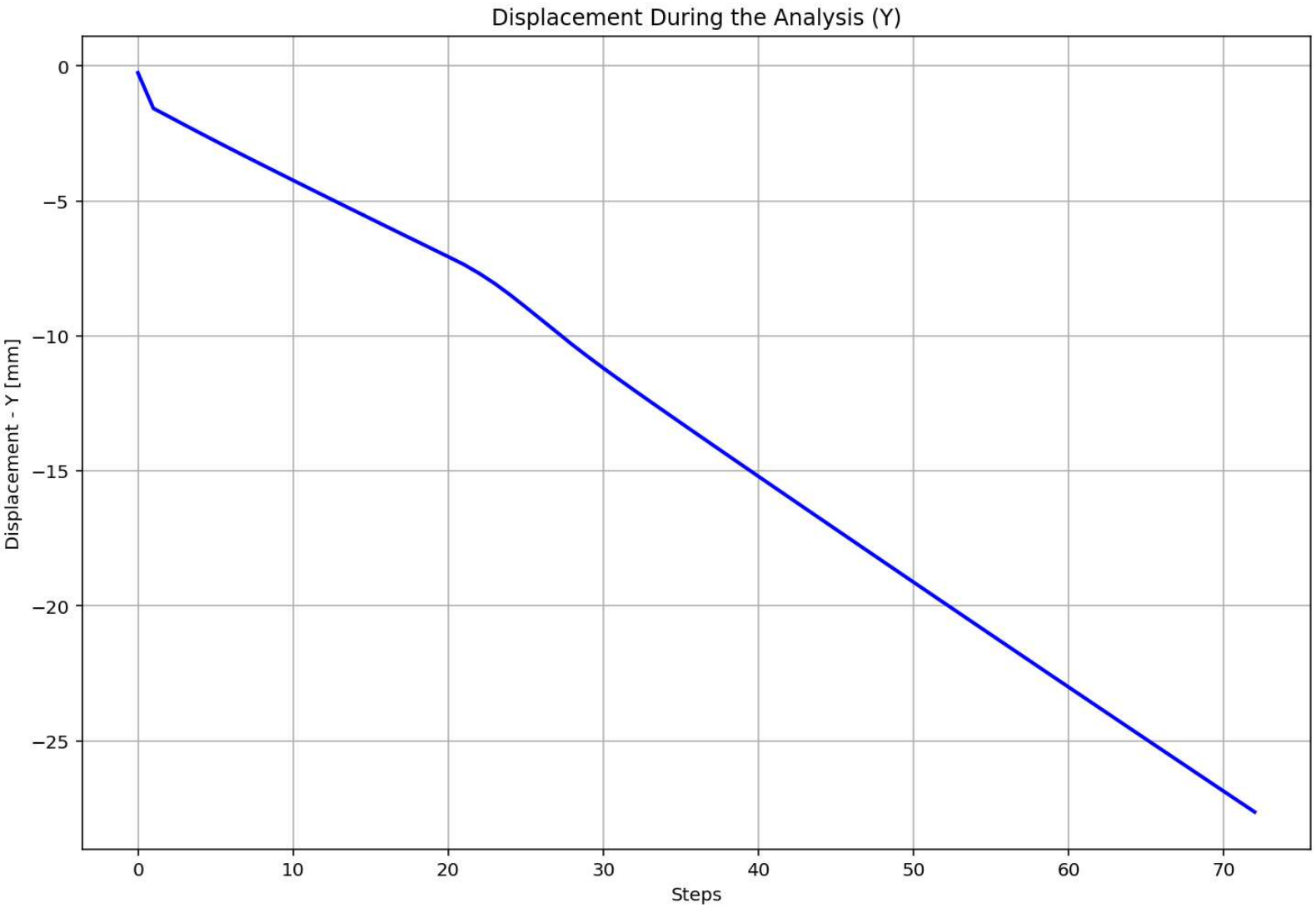

ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM (X Dir)
Rotational Stiffness [N.mm/Rad]
10^4
10^3
2×10^9
3×10^9
4×10^9
6×10^9
Lateral Stiffness in X Dir. [N/mm]

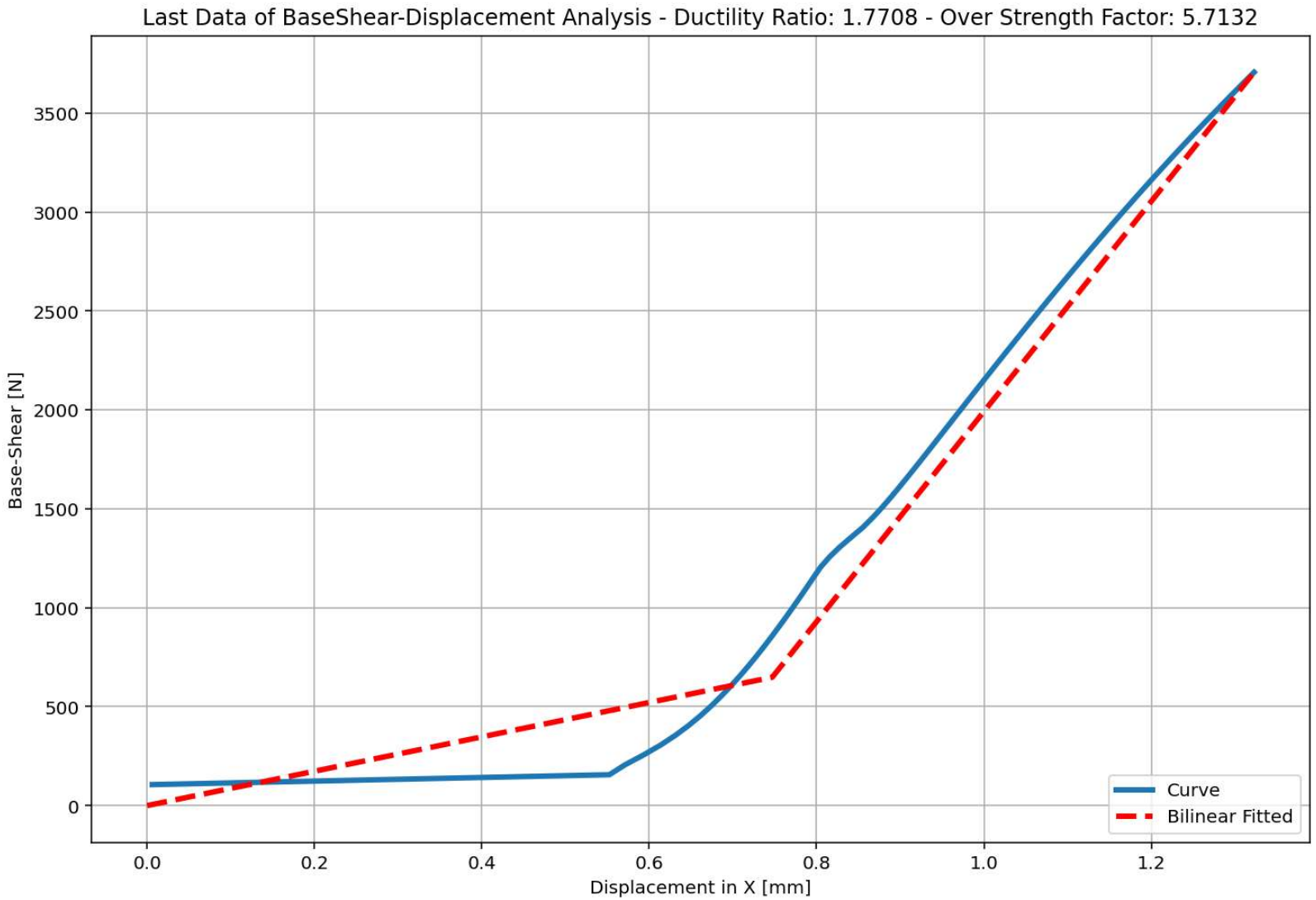

ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM (Y Dir)
Rotational Stiffness [N.mm/Rad]
4×10^6
3×10^6
2×10^6
10^6
2×10^9
3×10^9
4×10^9
6×10^9
Lateral Stiffness in Y Dir. [N/mm]

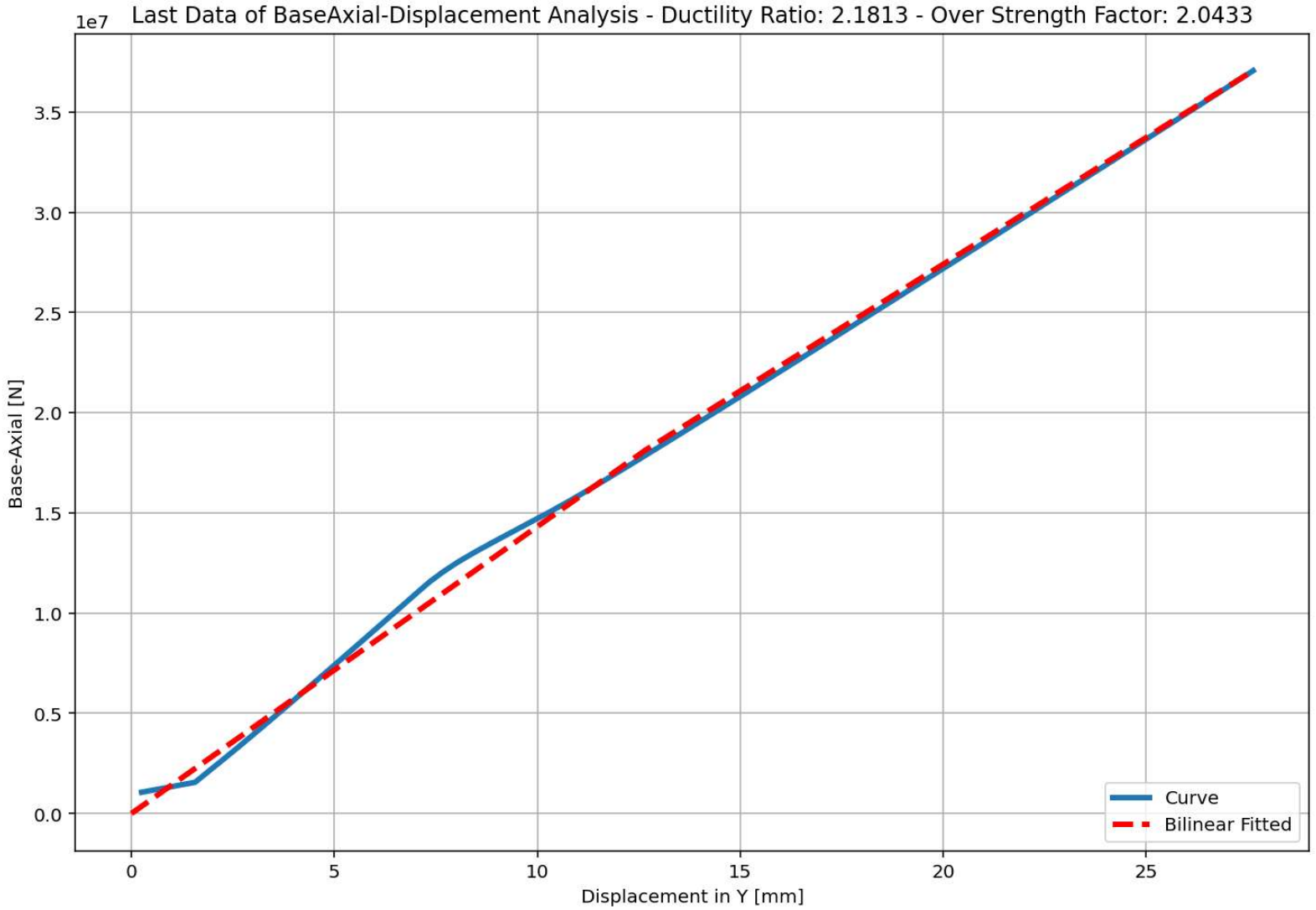

Axial Force During the Analysis
1e7
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Axial Force [N]
0
10
20
30
40
50
60
70
Steps

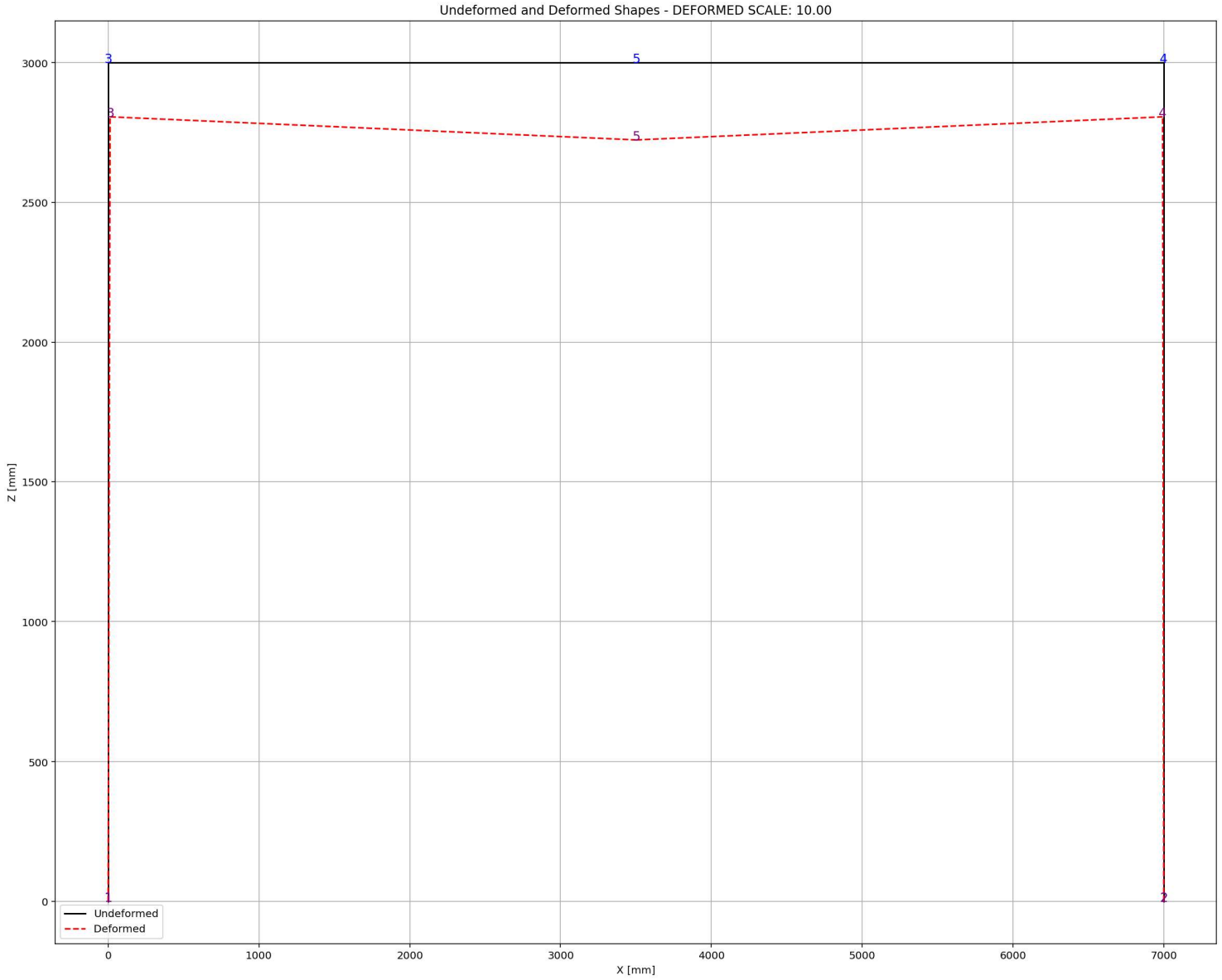

Moment During the Analysis
1e7
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Moment [kN.mm]
0
10
20
30
40
50
60
70
Steps


Displacement During the Analysis (X)
Displacement - X [mm]
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
10
20
30
40
50
60
70
Steps


Displacement During the Analysis (Y)
Displacement - Y [mm]
0
−5
−10
−15
−20
−25
0
10
20
30
40
50
60
70
Steps


Last Data of BaseShear-Displacement Analysis - Ductility Ratio: 1.7708 - Over Strength Factor: 5.7132
Base-Shear [N]
3500
3000
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Displacement in X [mm]
Curve
Bilinear Fitted


Last Data of BaseAxial-Displacement Analysis - Ductility Ratio: 2.1813 - Over Strength Factor: 2.0433
1e7
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Base-Axial [N]
0
5
10
15
20
25
Displacement in Y [mm]
Curve
Bilinear Fitted


Undeformed and Deformed Shapes - DEFORMED SCALE: 10.00
Z [mm]
X [mm]
Undeformed
Deformed
3
5
4
1
2
0
500
1000
1500
2000
2500
3000
0
1000
2000
3000
4000
5000
6000
7000