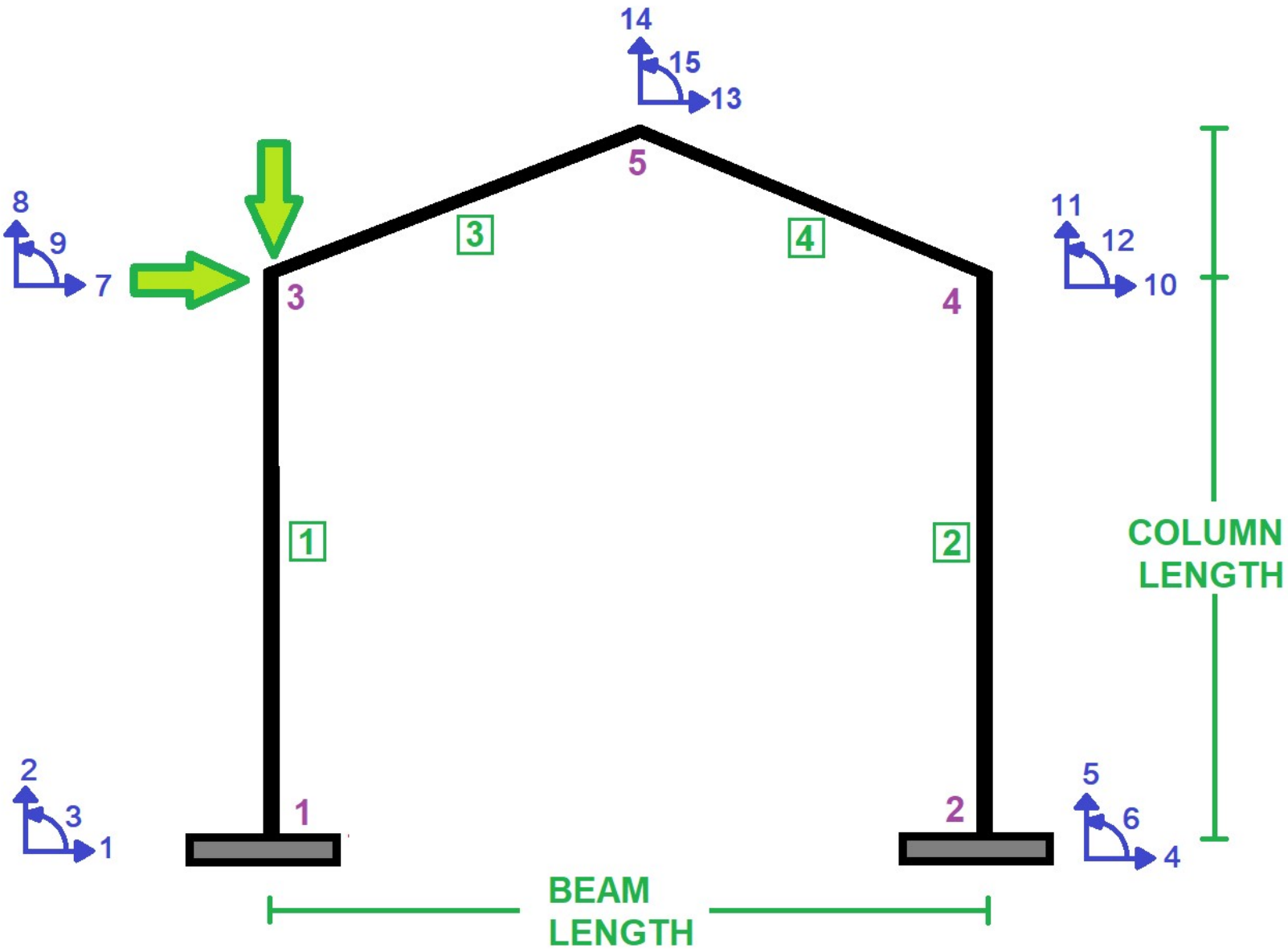
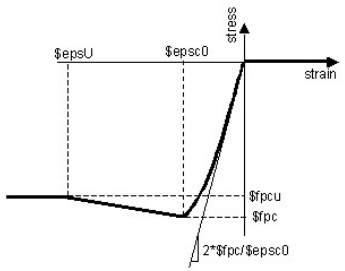
IN THE NAME OF ALLAH

REVERSED CYCLIC PUSHOVER ANALYSIS OF INDUSTRIAL CONCRETE GABLE FRAME WITH PRISMATIC ELEMENTS EVALUATING STRAIN HARDENING AND ULTIMATE STRAIN CRITERIA USING OPENSEES

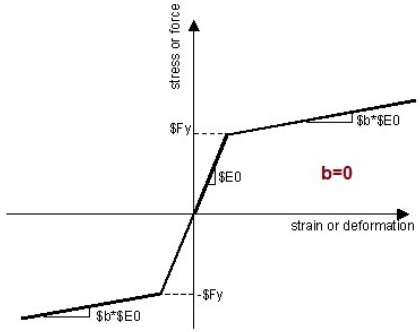
WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

ZZ
098
32
33
ZZ

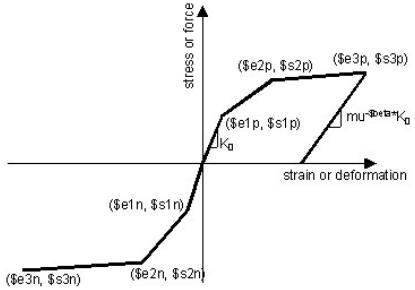

14
15
13
5
8
9
7
3
3
4
11
12
10
4
1
2
COLUMN
LENGTH
2
3
1
1
2
5
6
4
BEAM
LENGTH



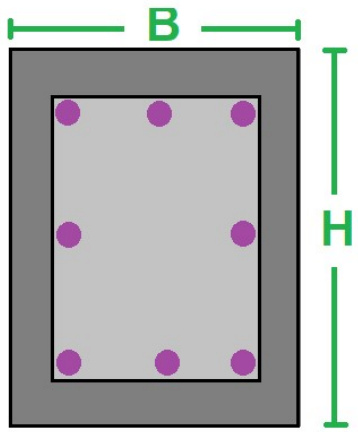
CORE AND COVER CONCRETE REALTION



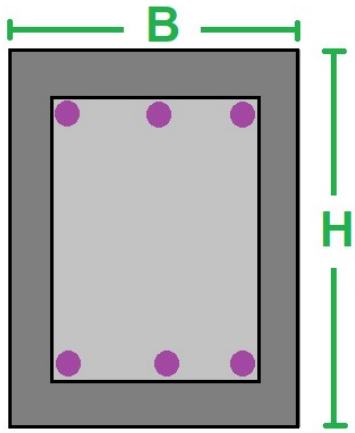
WITHOUT HARDENING AND ULTIMATE STRAIN



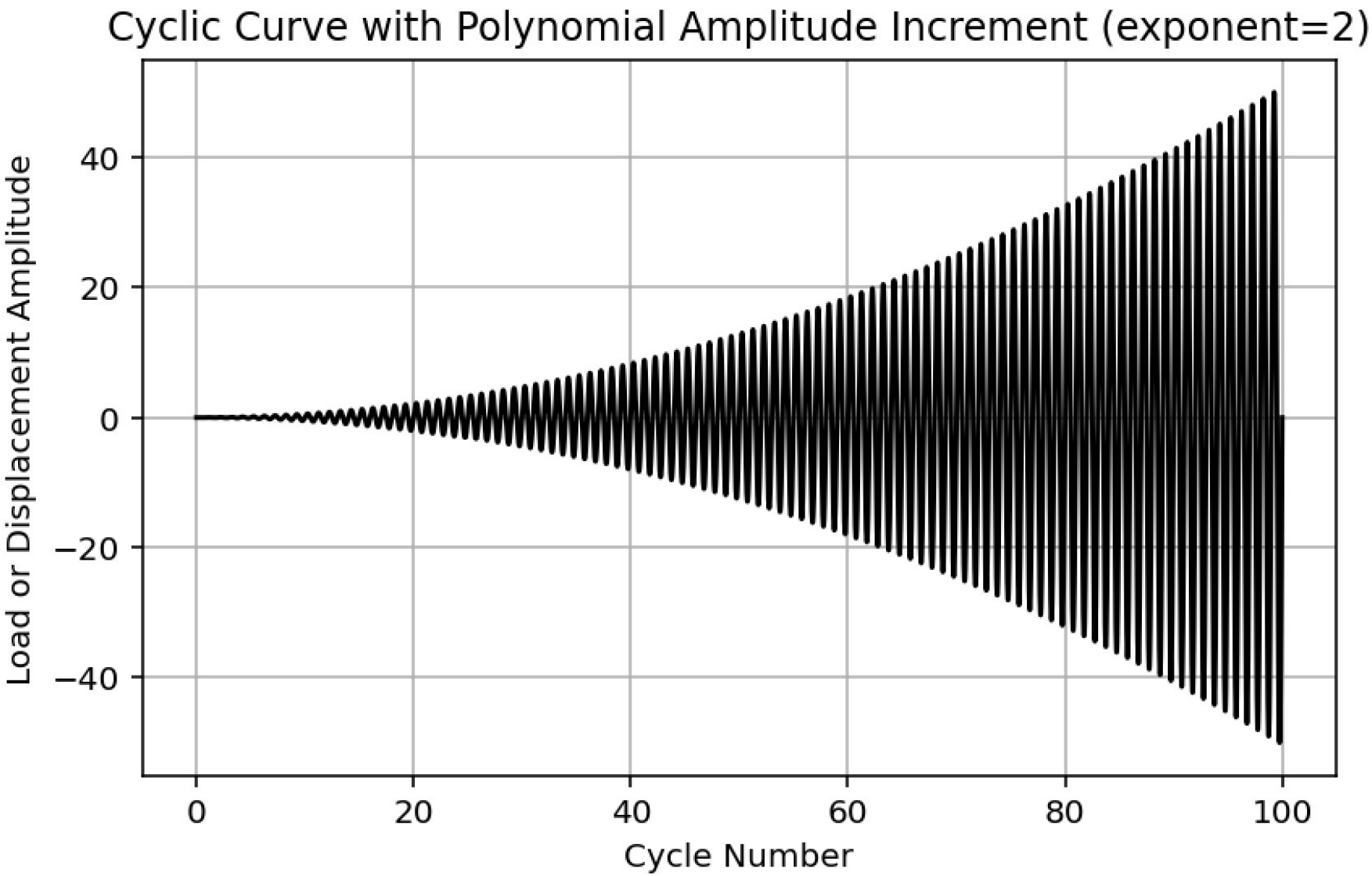
WITH HARDENING AND ULTIMATE STRAIN

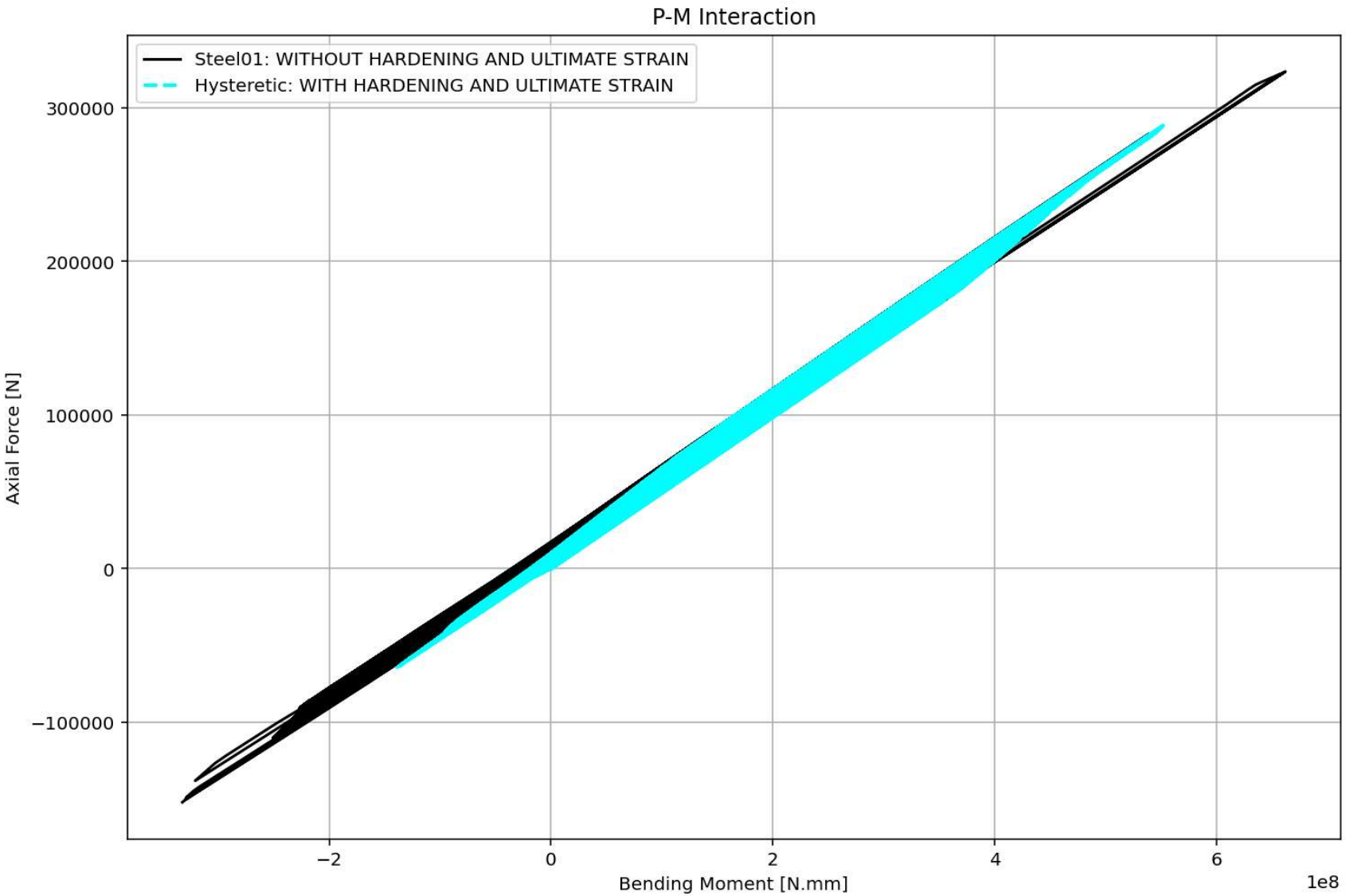


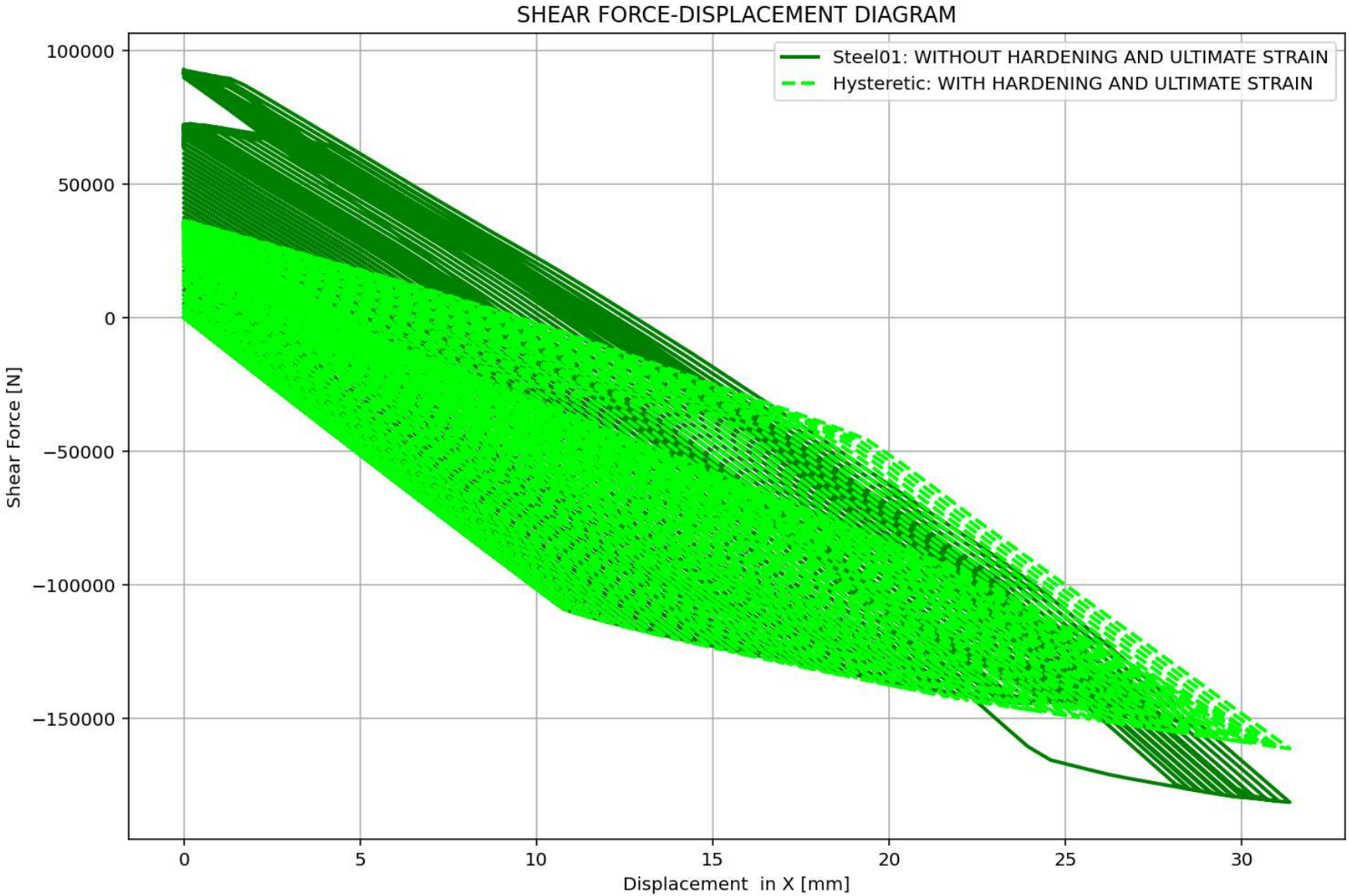
COLUMN SECTION

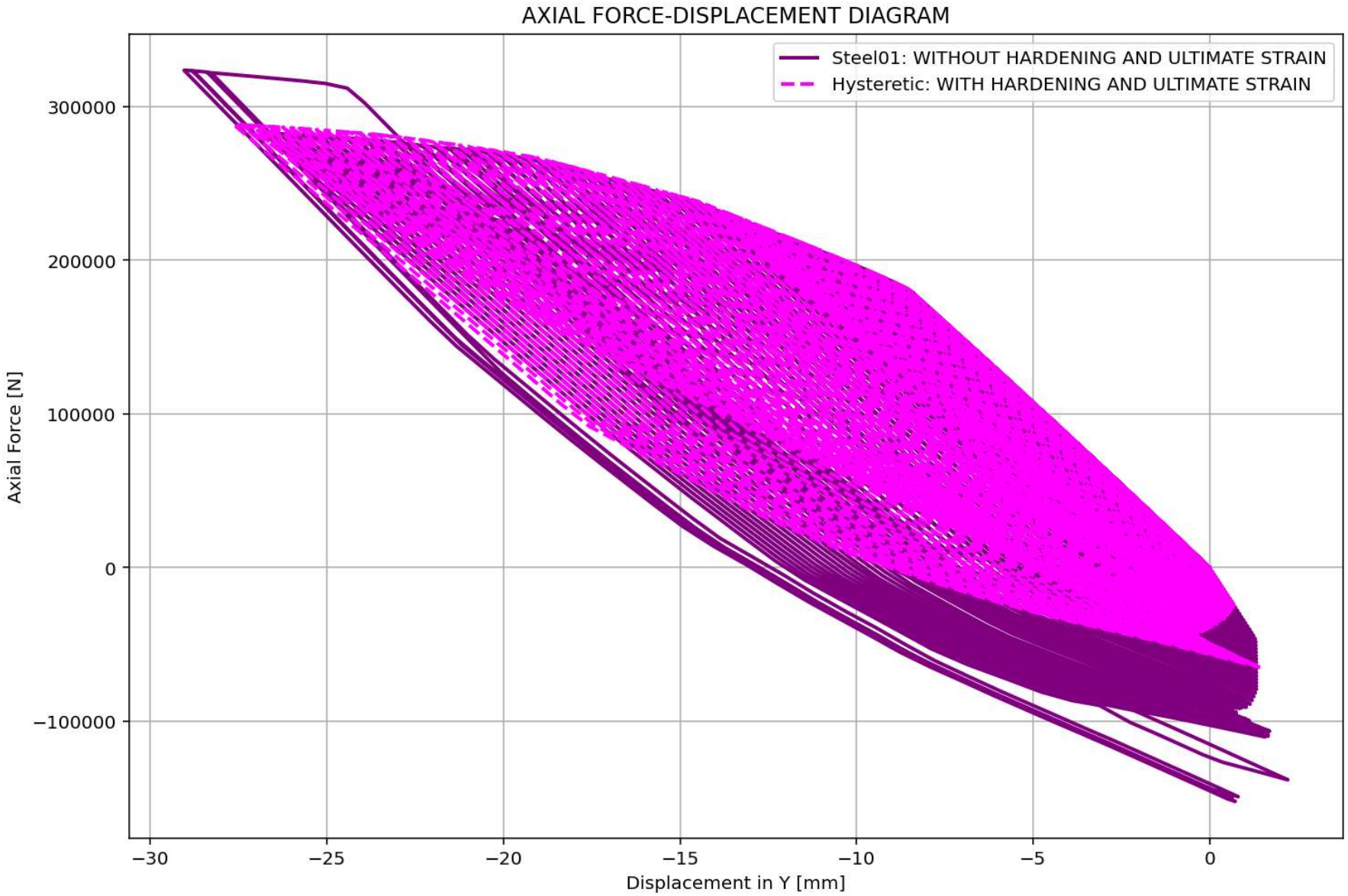


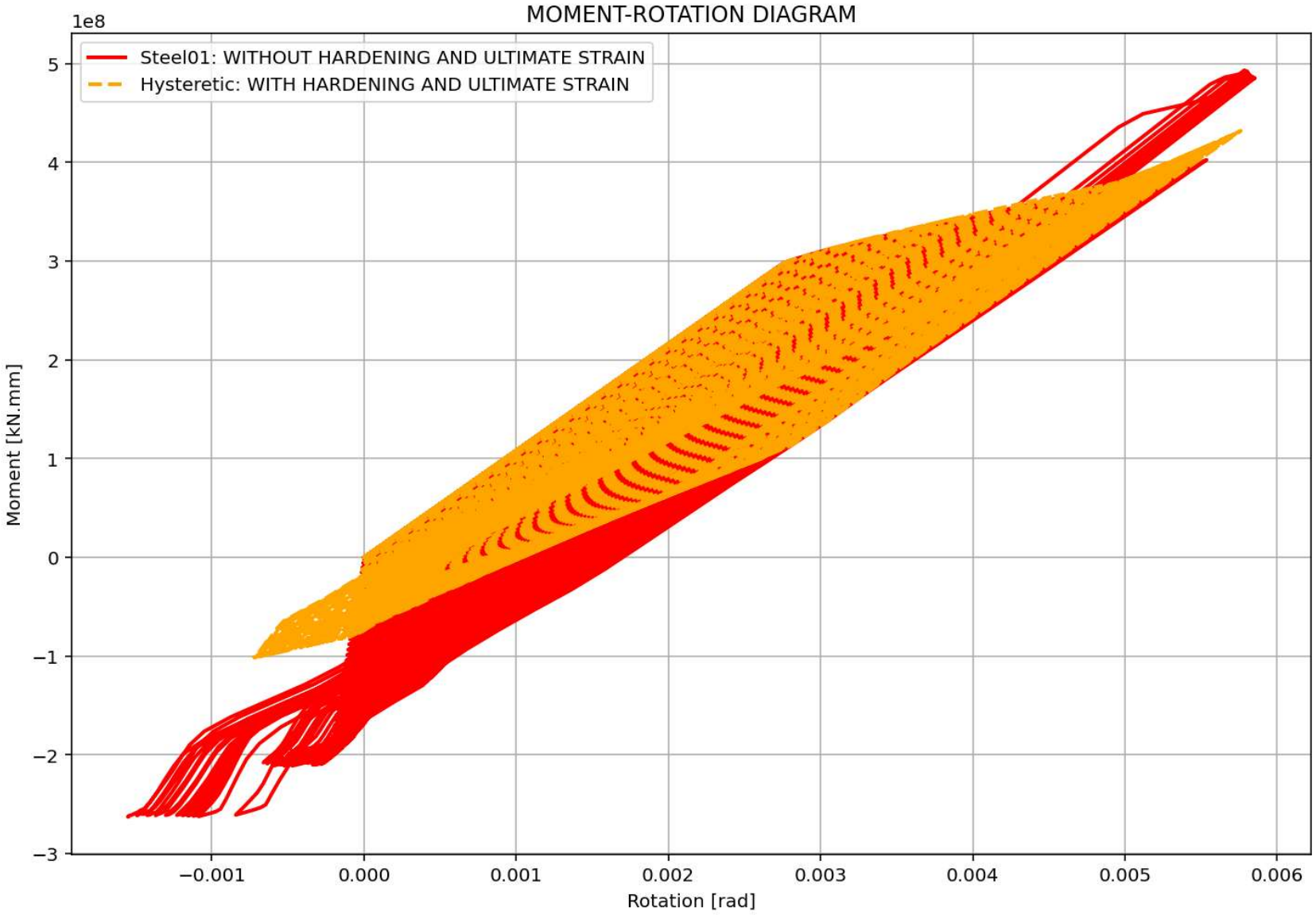
BEAM SECTION

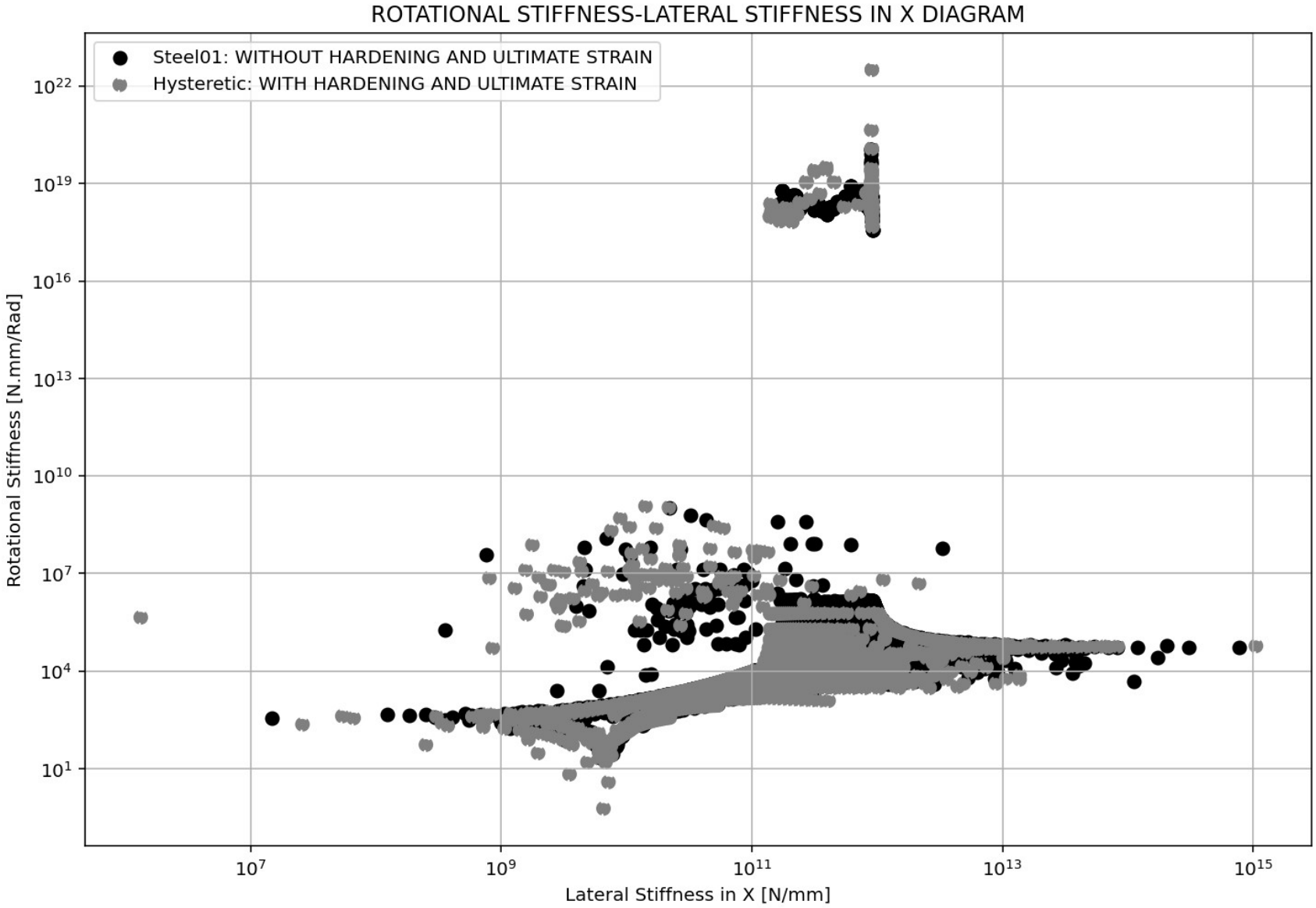

Cyclic Curve with Polynomial Amplitude Increment (exponent=2)
Load or Displacement Amplitude
40
20
0
−20
−40
0
20
40
60
80
100
Cycle Number

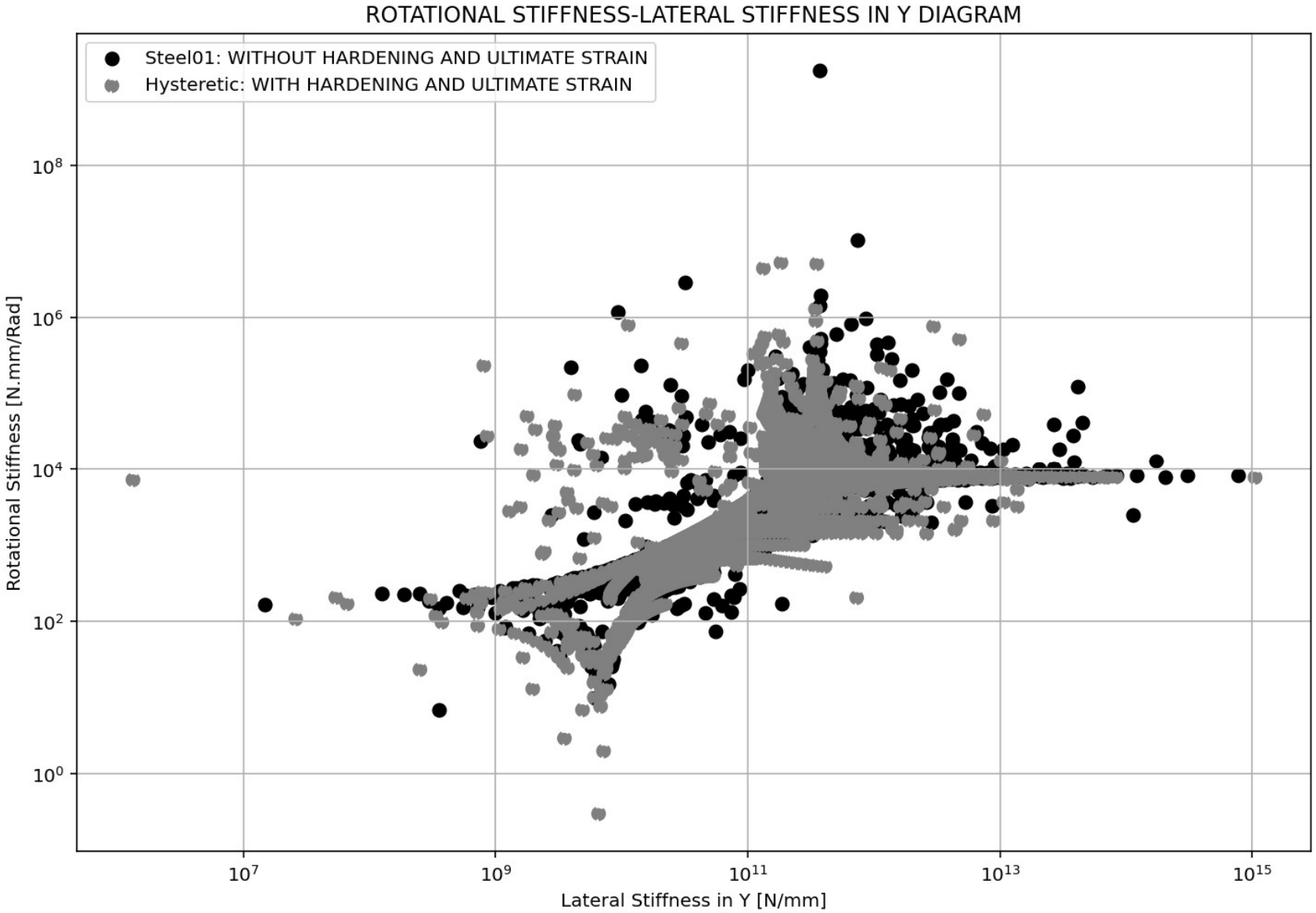

P-M Interaction
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
300000
200000
100000
0
−100000
Axial Force [N]
−2
0
2
4
6
Bending Moment [N.mm]
1e8

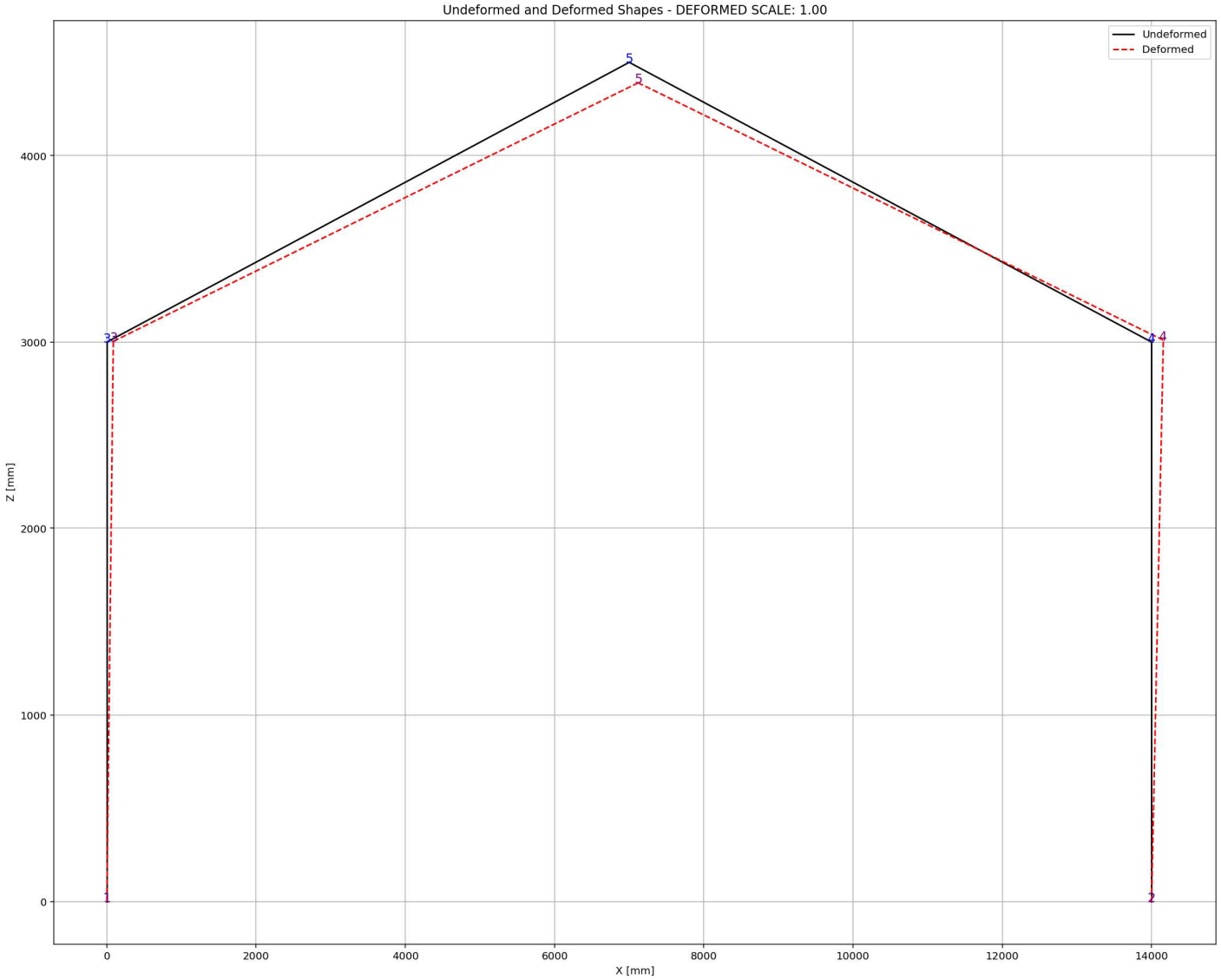

SHEAR FORCE-DISPLACEMENT DIAGRAM
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
Shear Force [N]
100000
50000
0
−50000
−100000
−150000
0
5
10
15
20
25
30
Displacement in X [mm]


AXIAL FORCE-DISPLACEMENT DIAGRAM
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
Axial Force [N]
300000
200000
100000
0
−100000
−30
−25
−20
−15
−10
−5
0
Displacement in Y [mm]


MOMENT-ROTATION DIAGRAM
1e8
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
Moment [kN.mm]
5
4
3
2
1
0
−1
−2
−3
−0.001
0.000
0.001
0.002
0.003
0.004
0.005
0.006
Rotation [rad]


ROTATIONAL STIFFNESS-LATERAL STIFFNESS IN X DIAGRAM
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
Rotational Stiffness [N.mm/Rad]
Lateral Stiffness in X [N/mm]
10^{22}
10^{19}
10^{16}
10^{13}
10^{10}
10^{7}
10^{4}
10^{1}
10^{7}
10^{9}
10^{11}
10^{13}
10^{15}


ROTATIONAL STIFFNESS-LATERAL STIFFNESS IN Y DIAGRAM
Steel01: WITHOUT HARDENING AND ULTIMATE STRAIN
Hysteretic: WITH HARDENING AND ULTIMATE STRAIN
Rotational Stiffness [N.mm/Rad]
10^{8}
10^{6}
10^{4}
10^{2}
10^{0}
10^{7}
10^{9}
10^{11}
10^{13}
10^{15}
Lateral Stiffness in Y [N/mm]


Undeformed and Deformed Shapes - DEFORMED SCALE: 1.00
Undeformed
Deformed
Z [mm]
X [mm]
0
1000
2000
3000
4000
0
2000
4000
6000
8000
10000
12000
14000
1
2
3
3
4
4
5
5