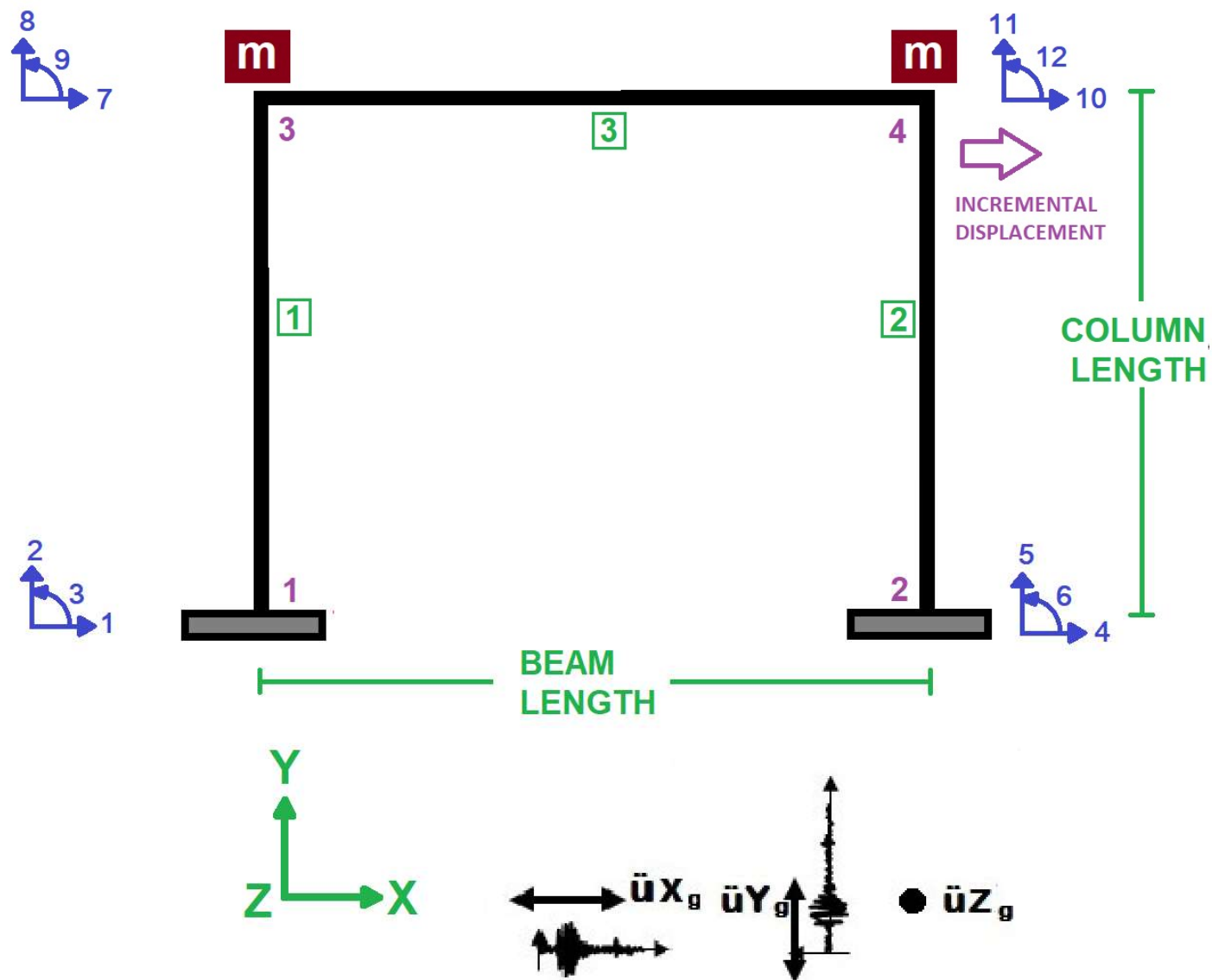
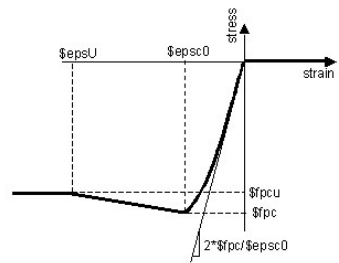


IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

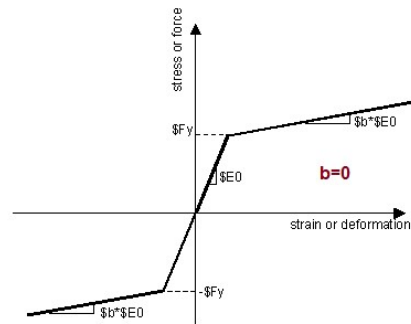
# **UTILIZING PARALLEL PROCESSING PROCEDURES FOR THE SIMULTANEOUS EXECUTION OF NONLINEAR STATIC AND DYNAMIC CONCRETE STRUCTURAL ANALYSIS, USING OPENSEES**

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

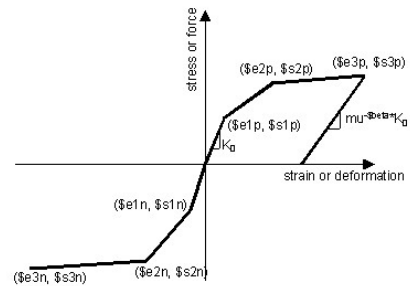




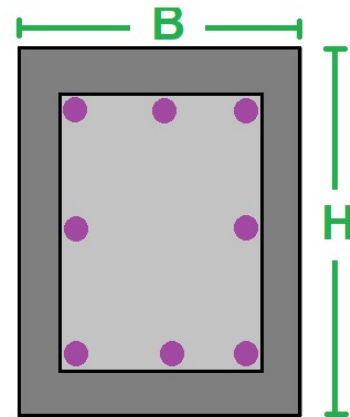
**CORE AND COVER CONCRETE REALTION**



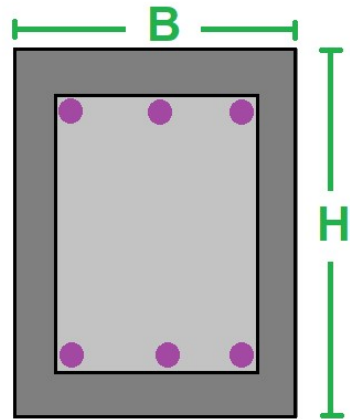
**WITHOUT HARDENING AND ULTIMATE STRAIN**



**WITH HARDENING AND ULTIMATE STRAIN**



**COLUMN SECTION**



**BEAM SECTION**

File Edit Search Source Run Debug Consoles Projects Tools View Help

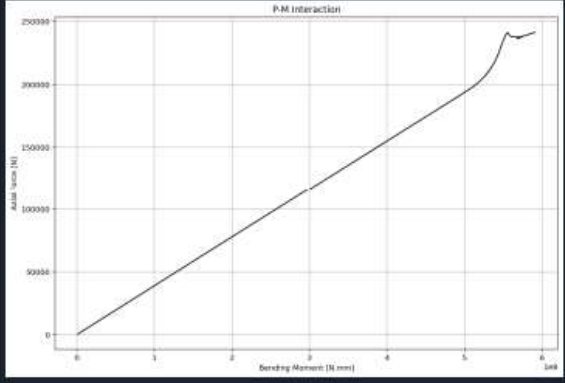
C:\Users\Dell\Desktop\OPENSEES\_FILES\CONCRETE\_FRAME\_EXAMPLES\PARALLEL\_COMPUTING\CONCRETE\_FRAME\_PARALLEL\_COMPUTING.py

SALAR\_PLOT\_FUN.py EXCEL\_EXPORT\_FUN.py BILINEAR\_CURVE.py CONCRETE\_FRAME\_PARALLEL\_COMPUTING.py

```
392 import concurrent.futures
393 from multiprocessing import freeze_support
394 import time as TI # Import time module with alias
395
396 def RUN_ANALYSIS():
397     with concurrent.futures.ProcessPoolExecutor() as executor:
398         _ = executor.submit(PD_ANALYSIS(STEEL_KIND=2, ANA_KIND='PUSHOVER'))
399         _ = executor.submit(PD_ANALYSIS(STEEL_KIND=2, ANA_KIND='DYNAMIC'))
400
401
402 if __name__ == '__main__':
403     current_time = TI.strftime("%H:%M:%S", TI.localtime())
404     print(f"Current time (HH:MM:SS): {current_time}\n\n")
405     freeze_support() # Required for Windows support
406     _ = RUN_ANALYSIS()
407     current_time = TI.strftime("%H:%M:%S", TI.localtime())
408     print(f"Current time (HH:MM:SS): {current_time}\n\n")
409
410 """
411 import concurrent.futures
412 from multiprocessing import freeze_support
413 import time as TI # Import time module with alias
414
415 def RUN_ANALYSIS():
416     """ Executes static and dynamic analyses in parallel
417     with concurrent.futures.ProcessPoolExecutor() as executor:
418         # Correct submission: pass function reference + arguments separately
419         future_static = executor.submit(PD_ANALYSIS, STEEL_KIND=2, ANA_KIND='PUSHOVER')
420         future_dynamic = executor.submit(PD_ANALYSIS, STEEL_KIND=2, ANA_KIND='DYNAMIC')
421
422         # Retrieve results (blocks until completion)
423         static_result = future_static.result()
424         dynamic_result = future_dynamic.result()
425
426     return static_result, dynamic_result
```

24 %

P-M Interaction



Help Variable Explorer Debugger Plots Files

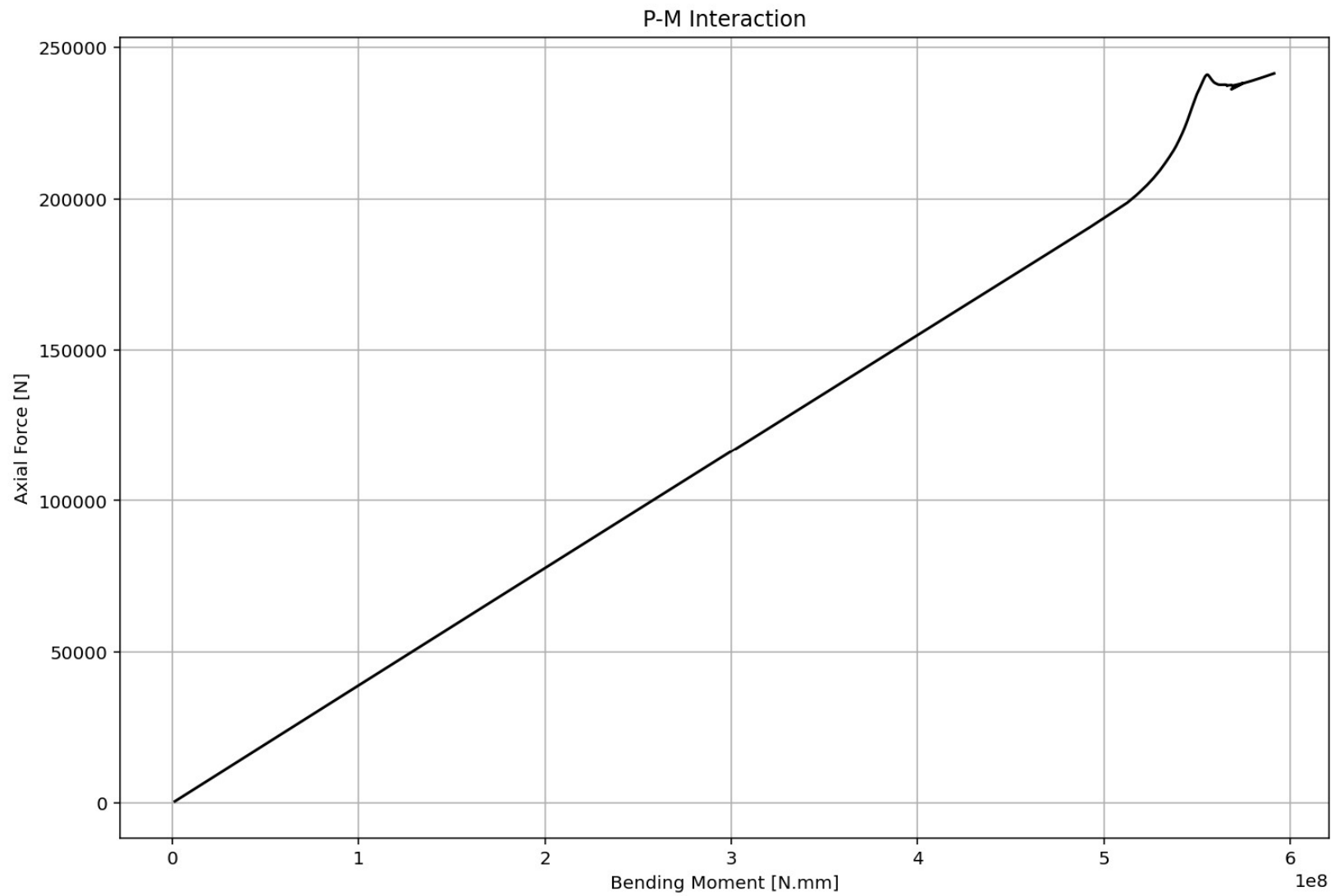
Console 1/A

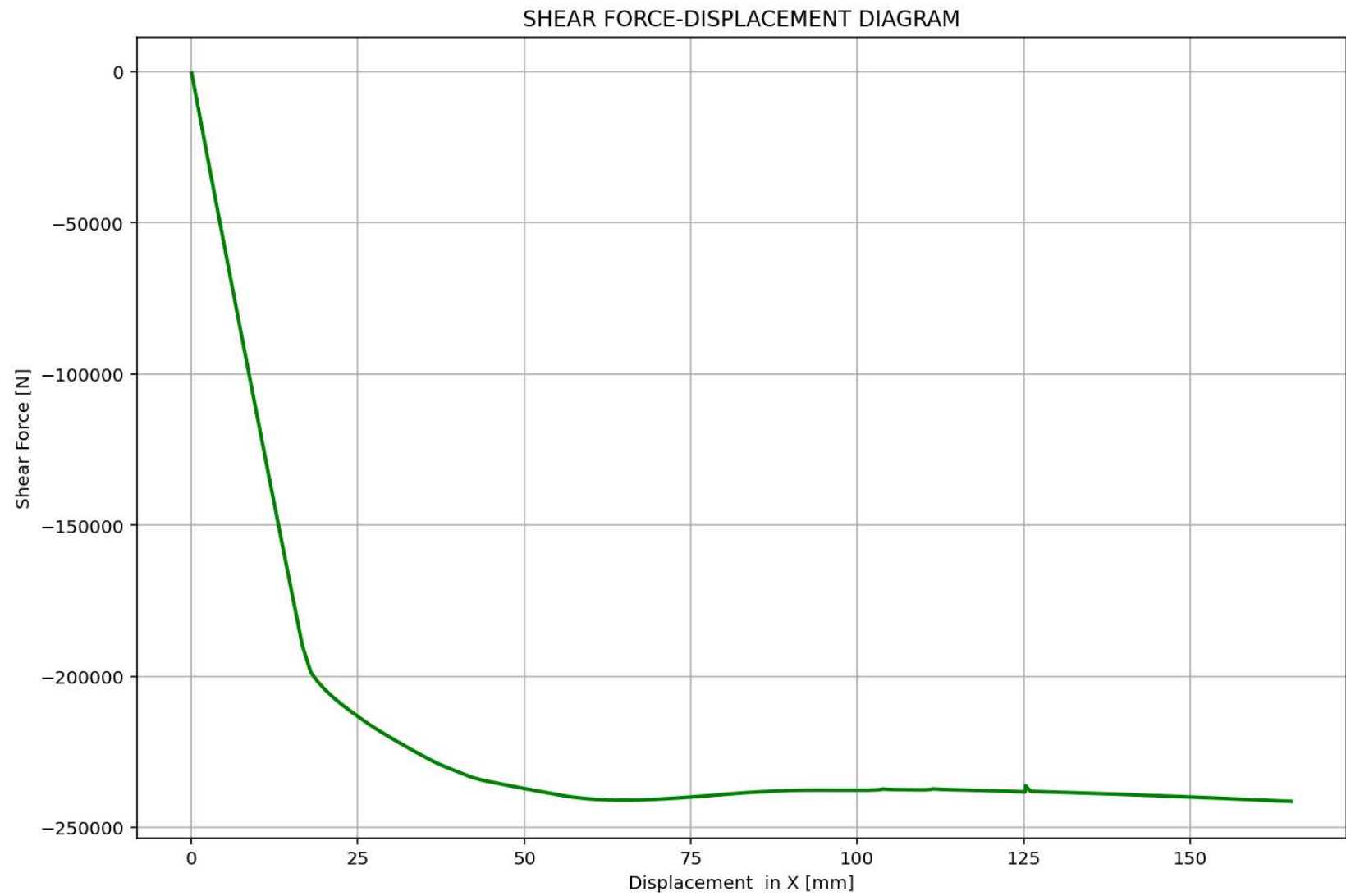
Element: 12 Type: ForceBeamColumn2d Connected Nodes: 13 4  
Number of Sections: 5 Mass density: 3.75  
Lobatto  
End 1 Forces (P V M): 8.06007 -6.1974 6883.91  
End 2 Forces (P V M): -8.06007 6.1974 -17729.4  
  
SP\_Constraints: numConstraints: 6  
  
numComponents: 6  
SP\_Constraint: 0 Node: 1 DOF: 1 ref value: 0 current value: 0  
initial value: 0

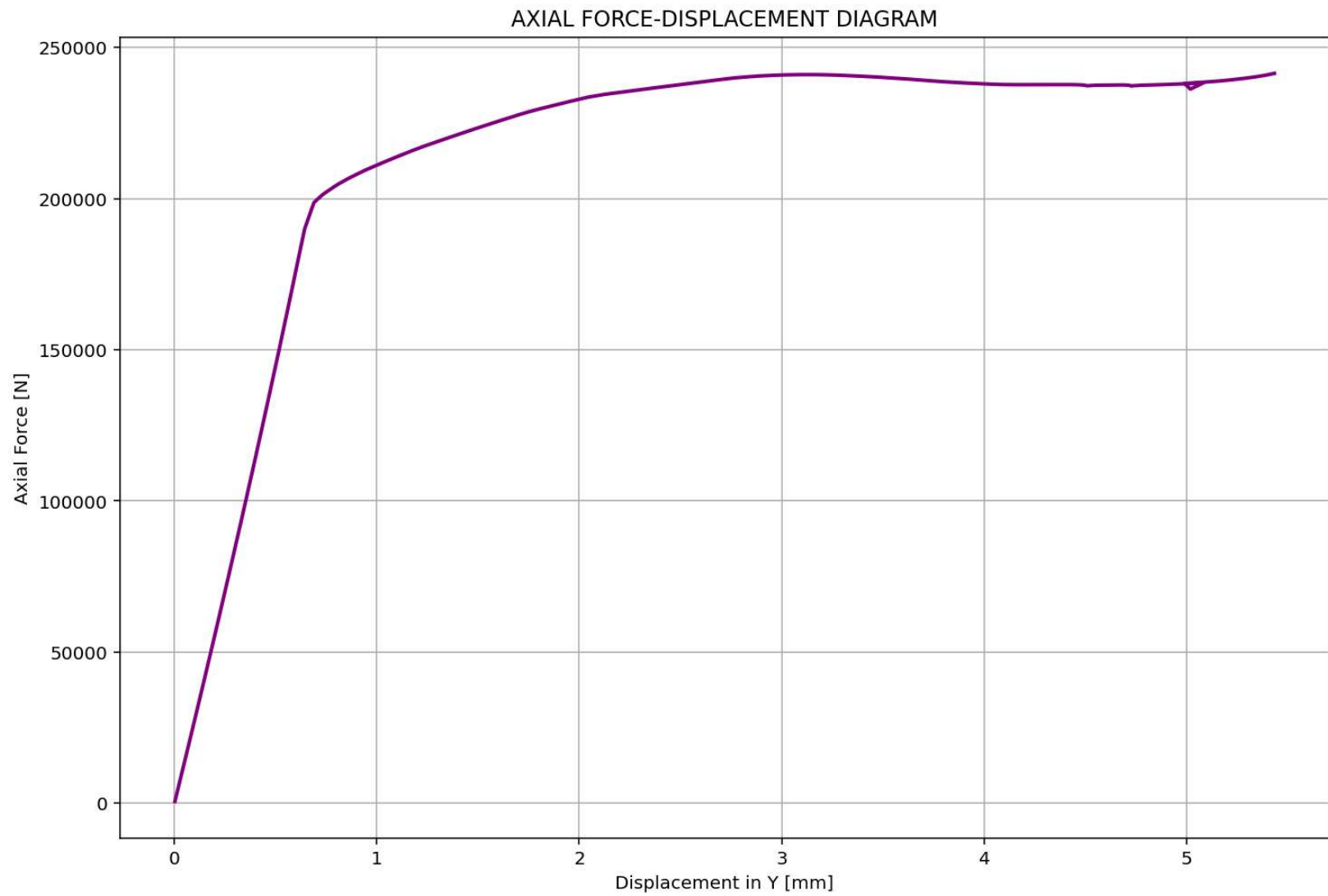
IPython Console History

Inline Conda: anaconda3 (Python 3.12.7) LSP: Python Line 406, Col 6 UTF-8 CRLF RW Mem 40%

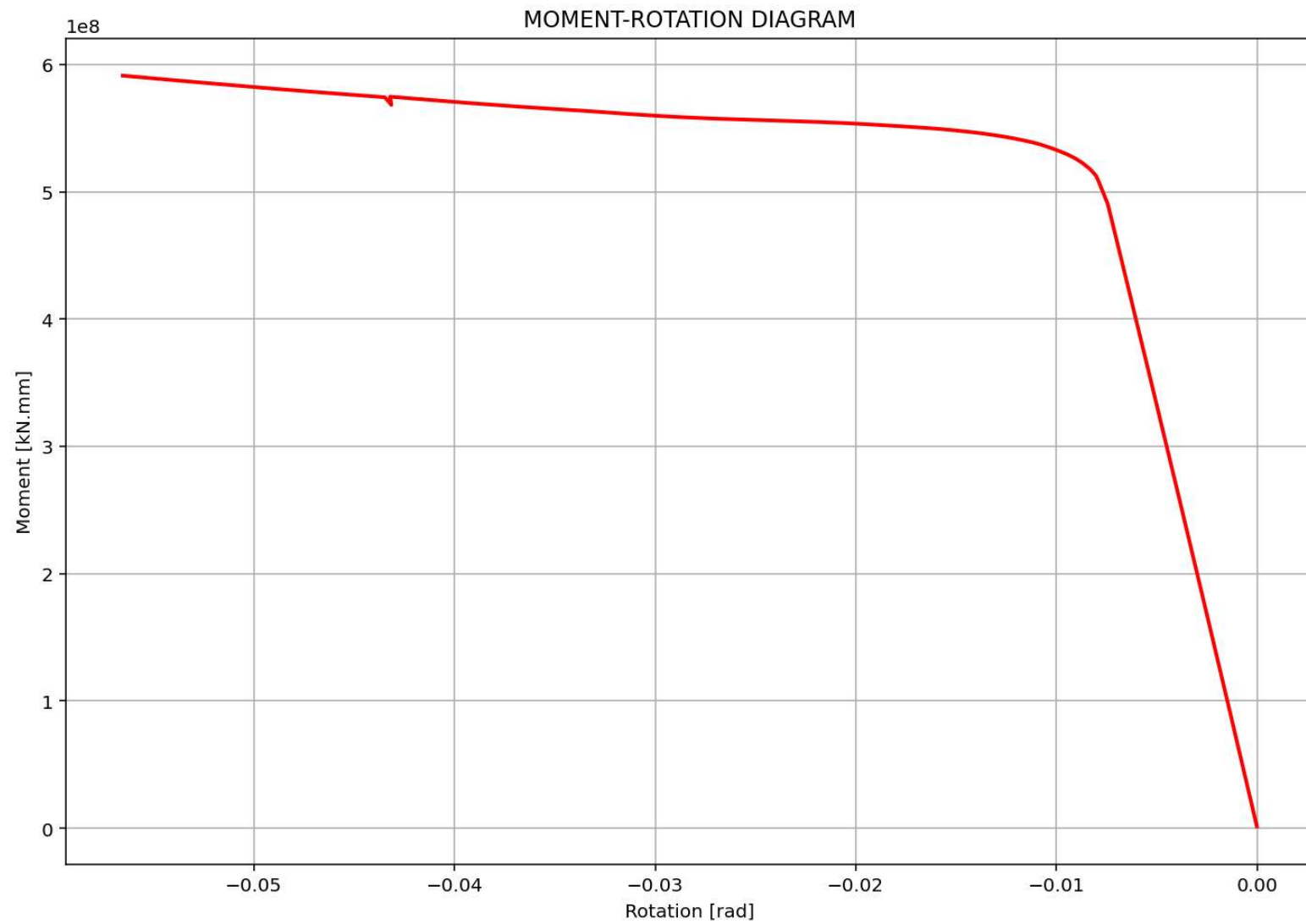
# **NONLINEAR STATIC ANALYSIS (PUSHOVER)**



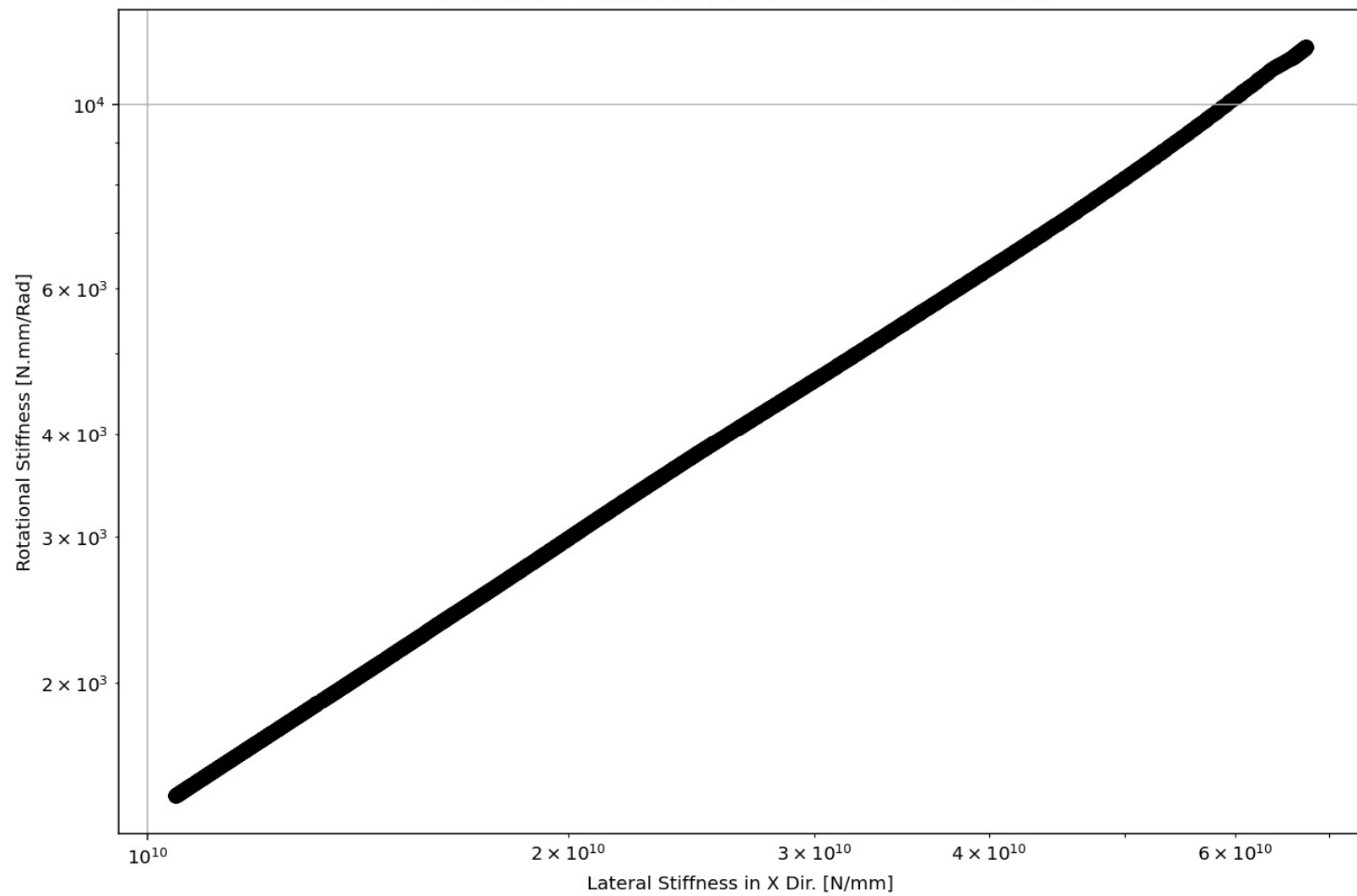




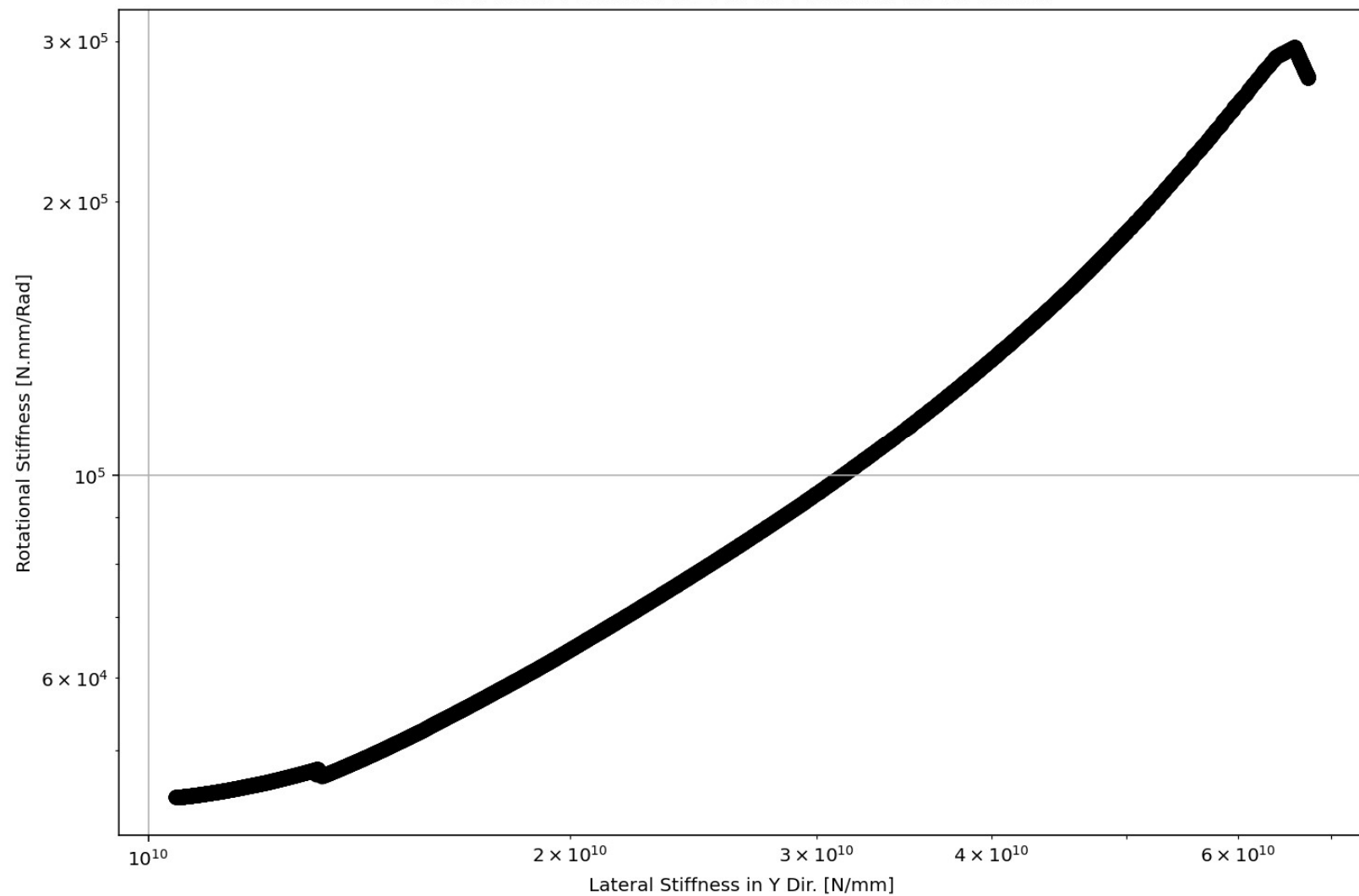


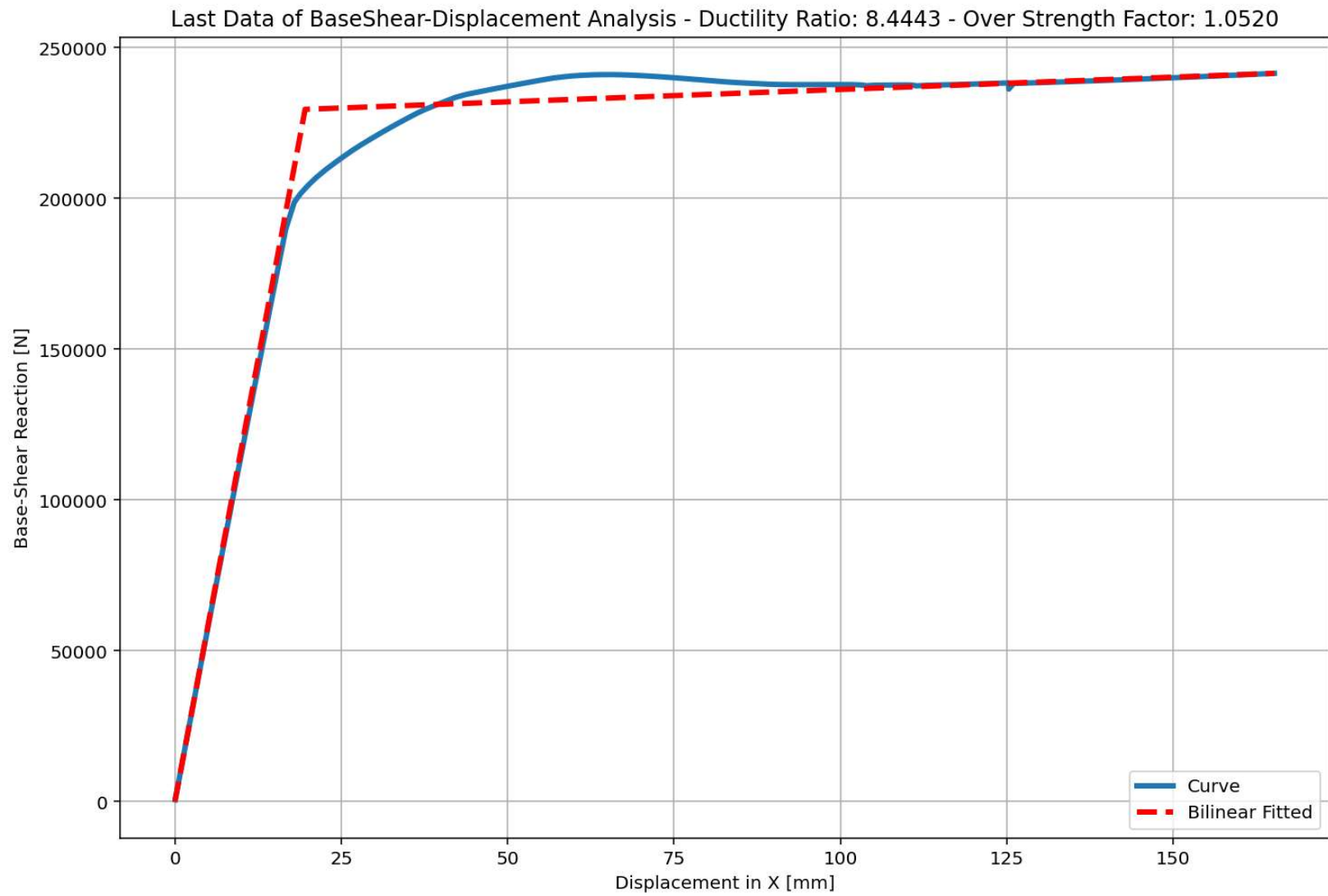


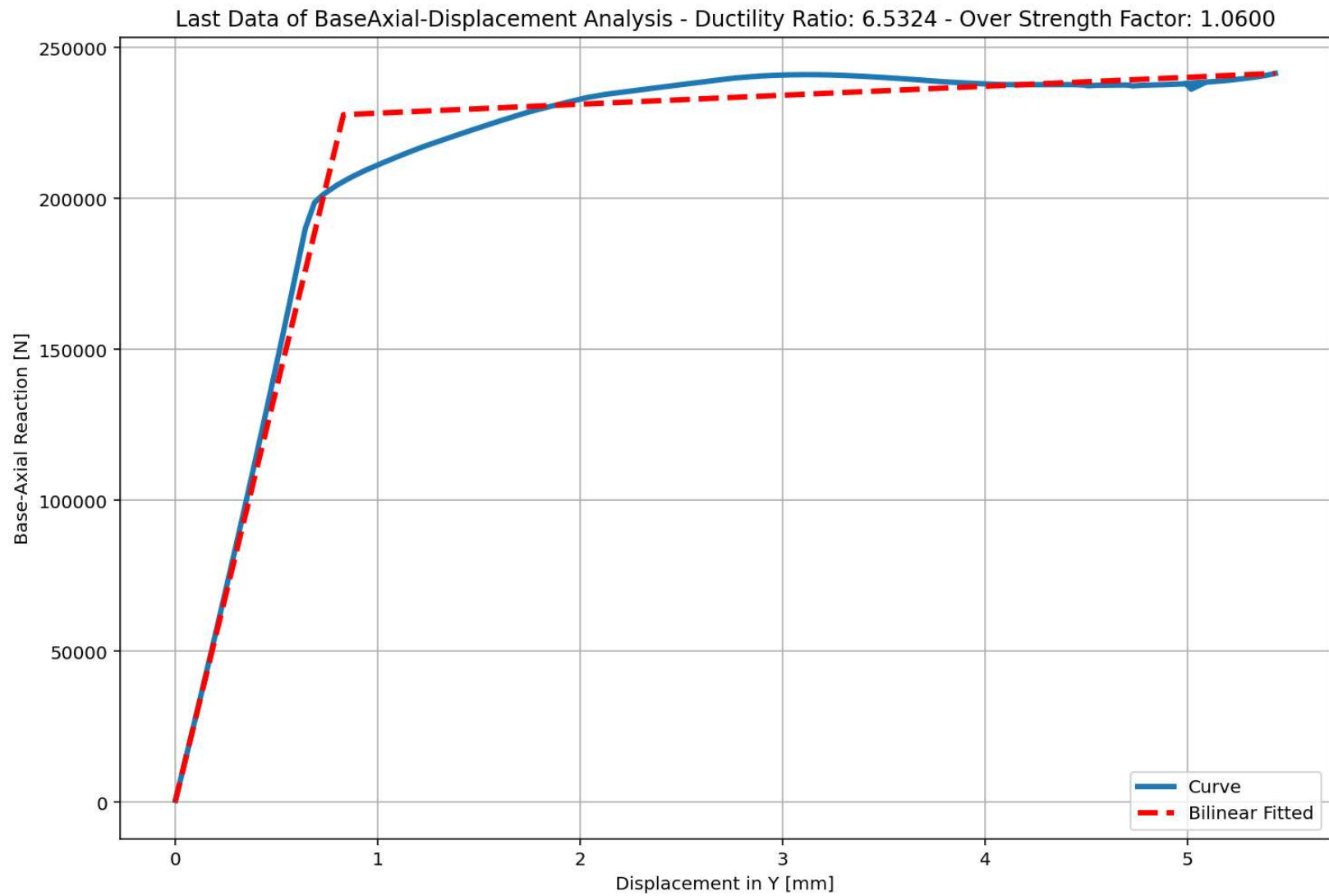
ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM

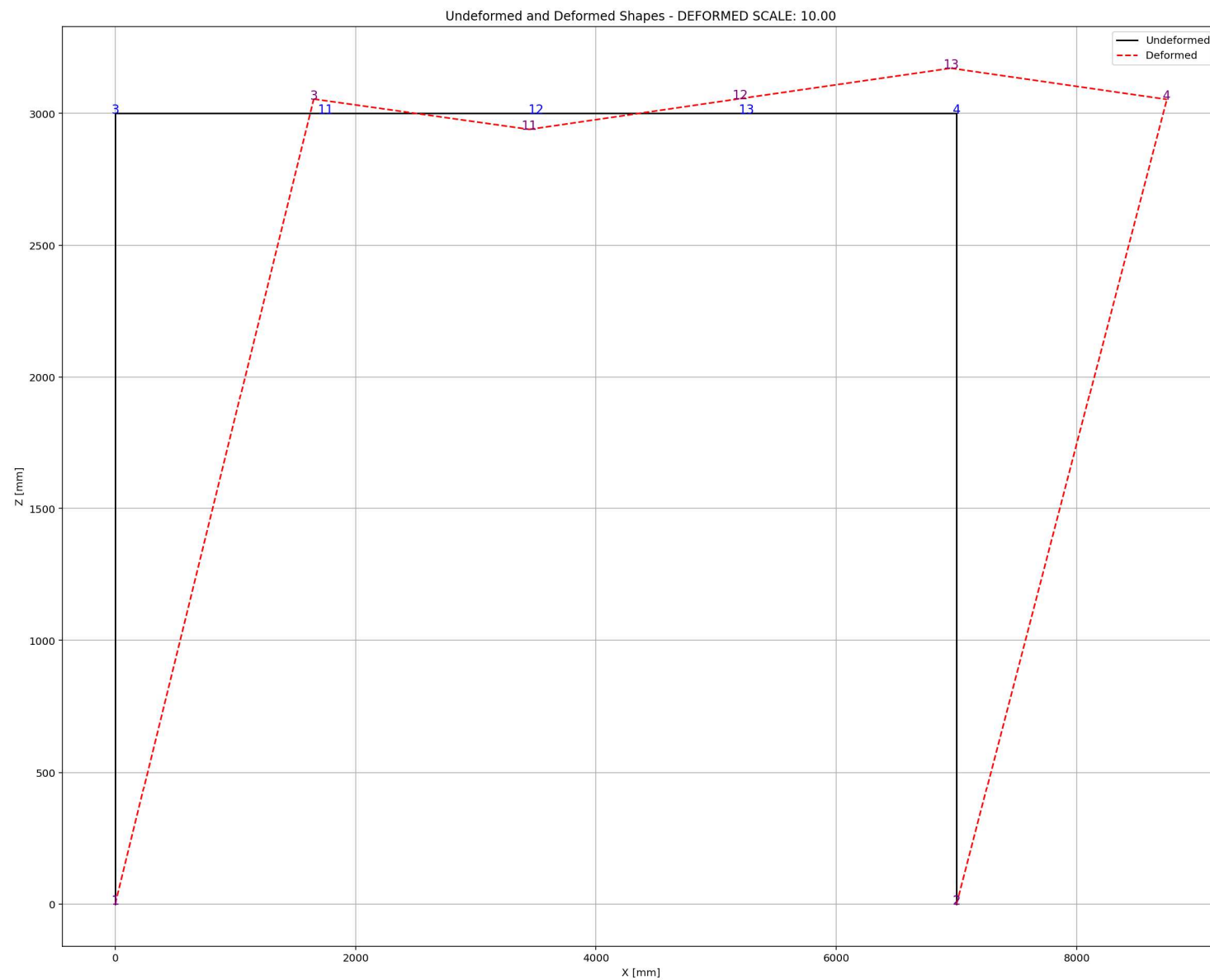


ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM



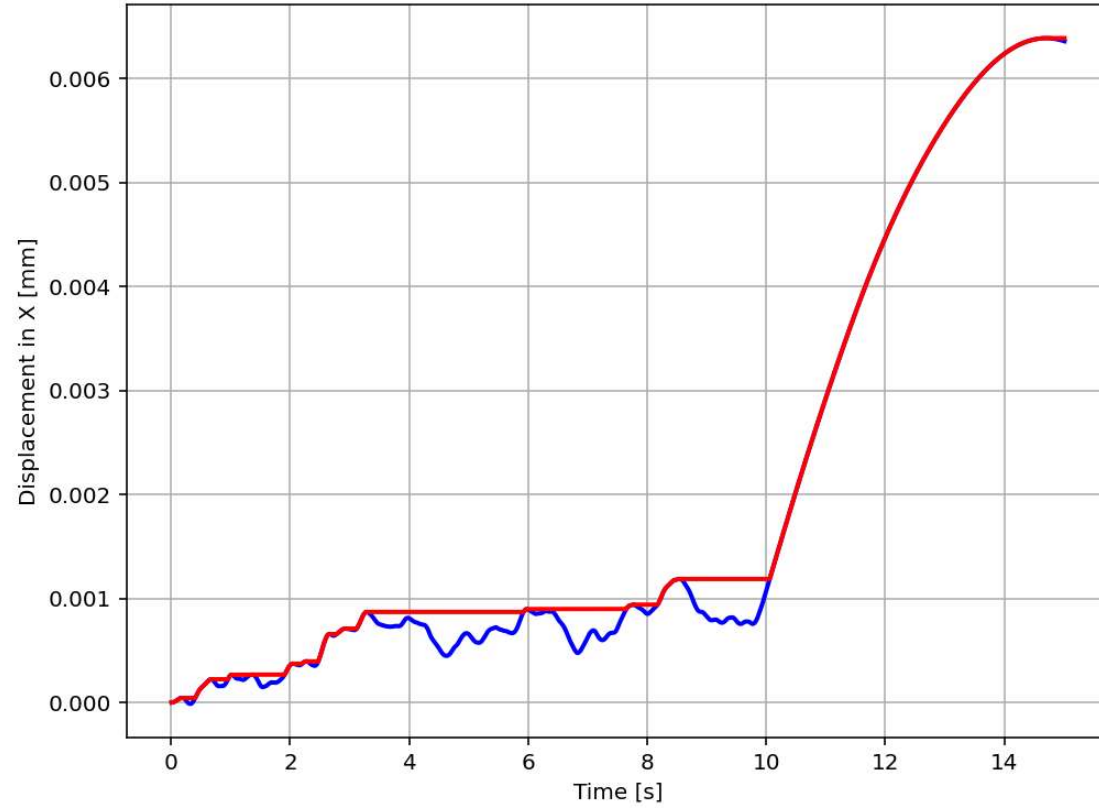




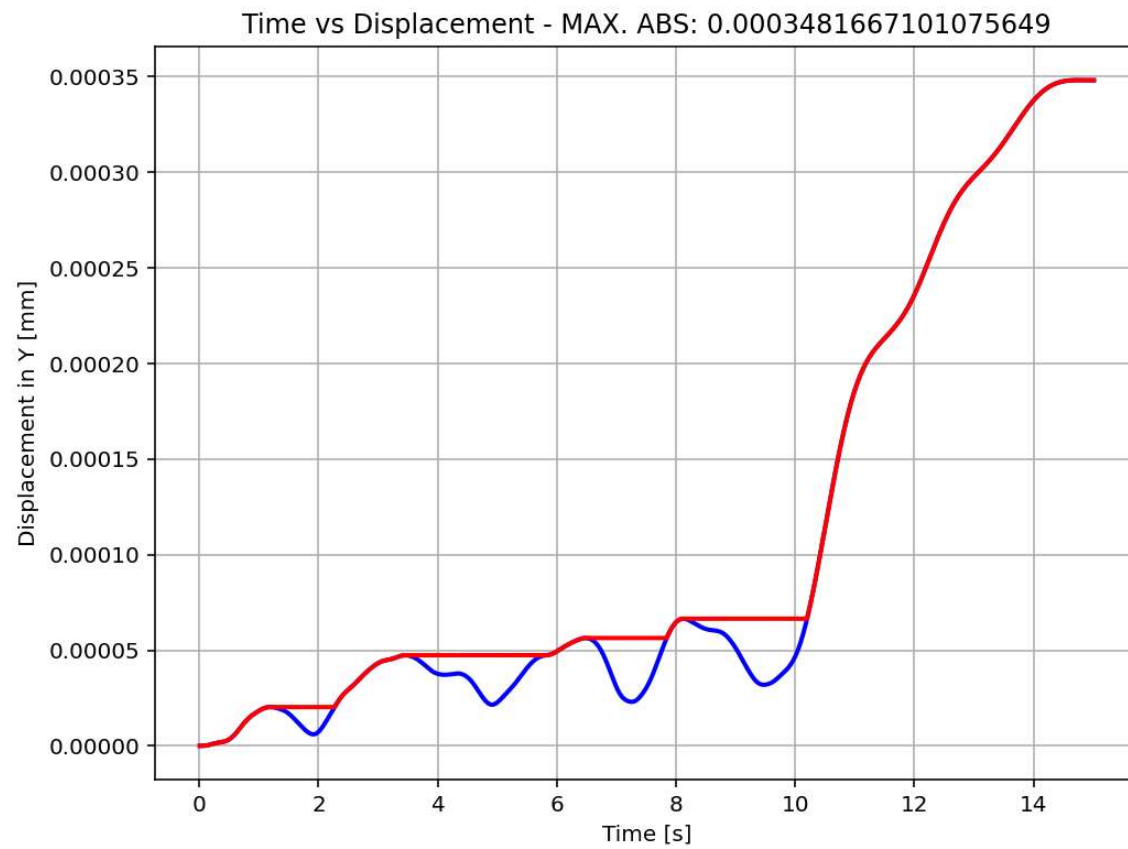


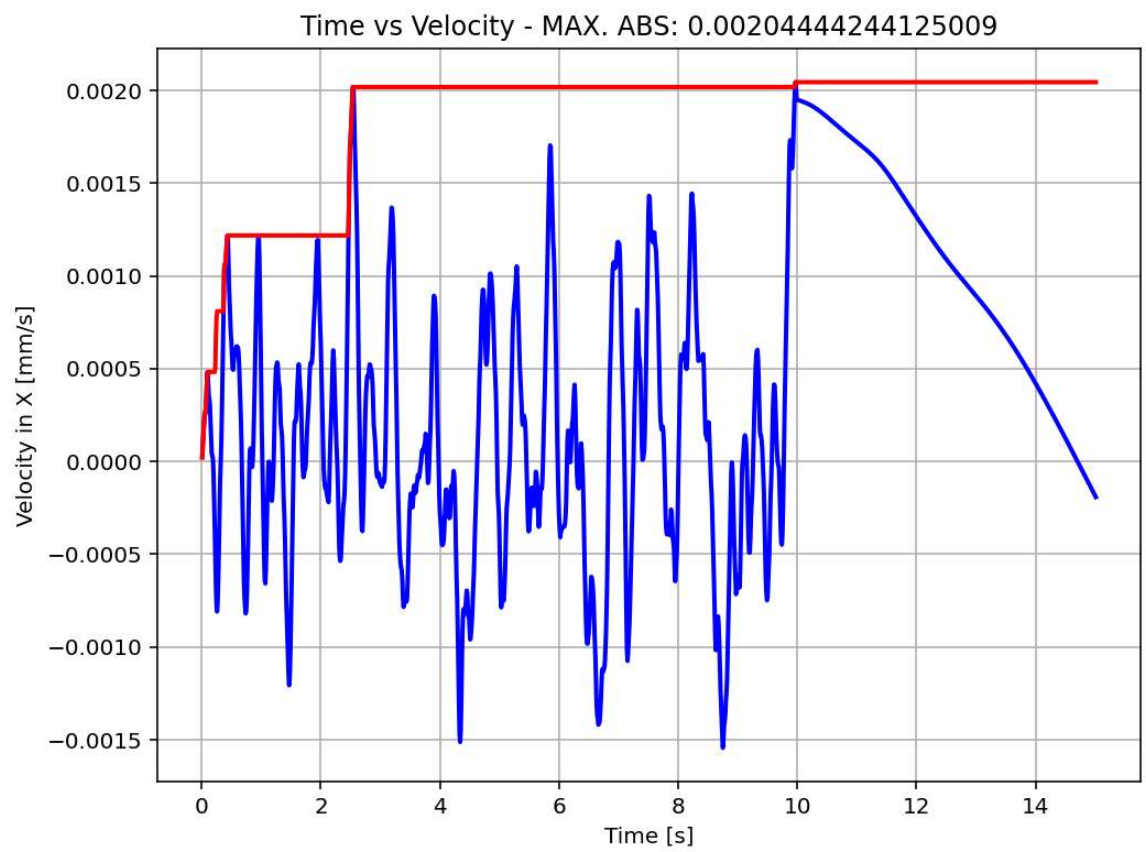
# NONLINEAR DYNAMIC ANALYSIS

Time vs Displacement - MAX. ABS: 0.006387640375485913 |  $\xi$  (Calculated): 3.17547e+00 %









Time vs Velocity - MAX. ABS: 0.00017276926301717222

