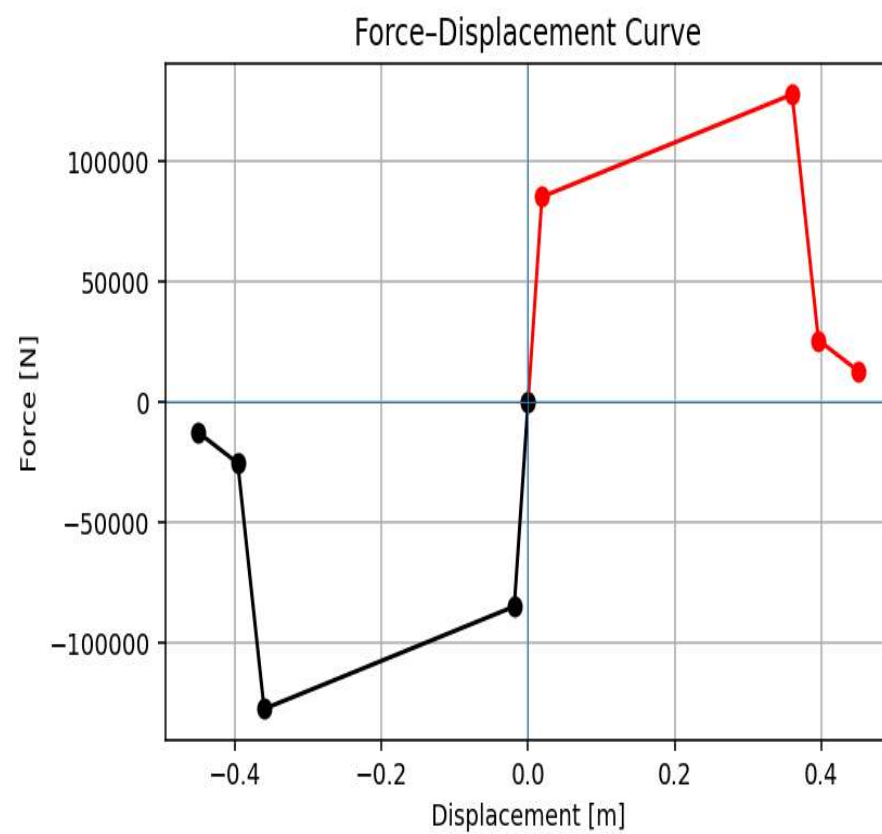
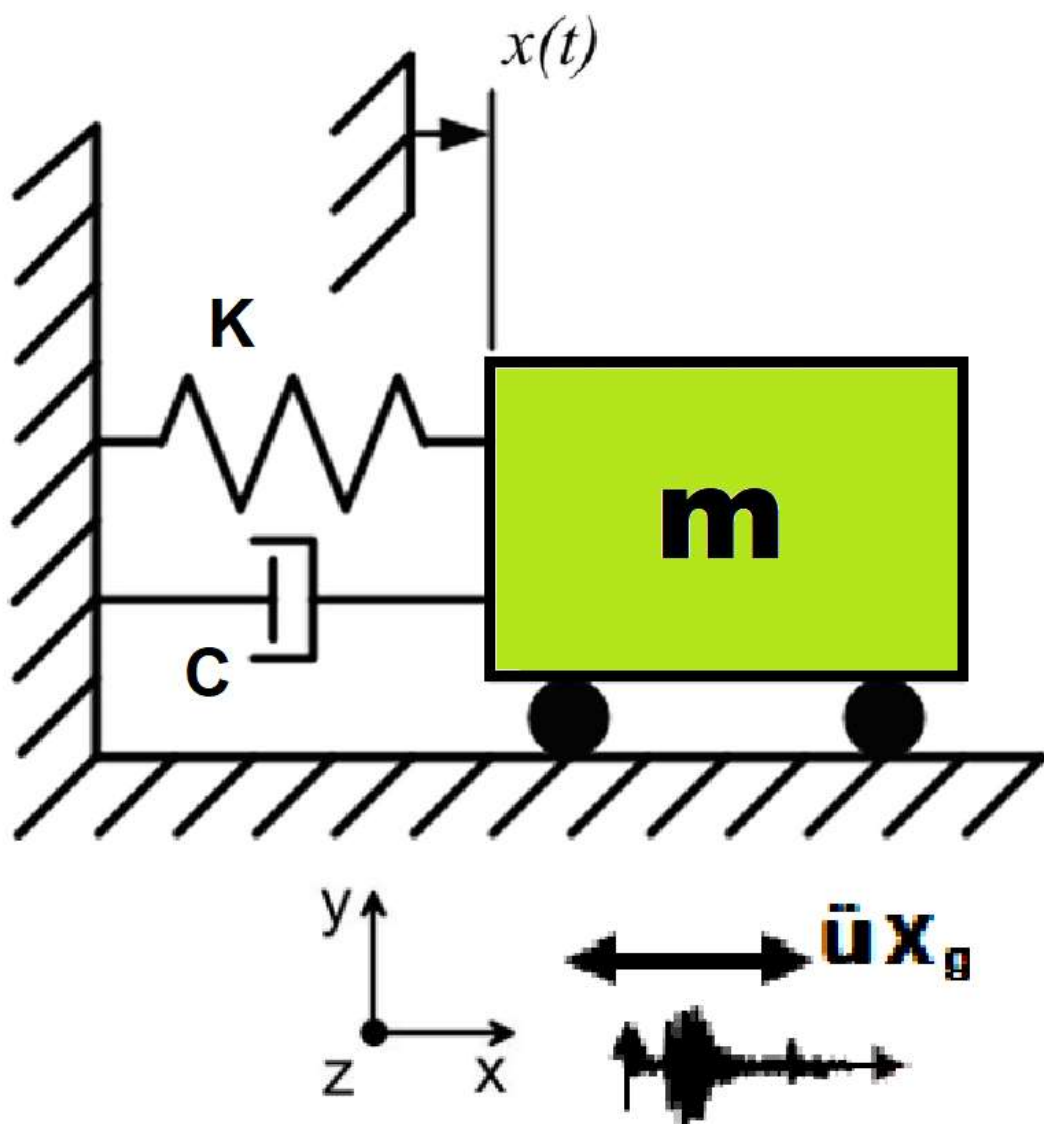


>> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<

NONLINEAR DYNAMIC ANALYSIS UNDER A SINGLE GROUND MOTION RECORD COMPUTATION AND VISUALIZATION RESPONSE SPECTRA OF ACCELERATION, VELOCITY, DISPLACEMENT DUCTILITY DAMAGE INDEX USING OPENSEES

(CONSTANT STRUCTURAL DUCTILITY RATIO RESPONSE SPECTRUM)

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)



$$\text{Structural Ductility Damage Index} = \frac{\Delta_d - \Delta_y}{\Delta_u - \Delta_y}$$

Δ_d = Lateral Displacement from Dynamic Analysis

Δ_y = Lateral Yield Displacement from Pushover Analysis

Δ_u = Lateral Ultimate Displacement from Pushover Analysis

Spyder (Python 3.12)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\Del\Desktop\OPENSEES_FILES\SDOF_RESPONS...CT_OSF\SDOF_RESPONSE_SPECTRUM_SEISMIC_DUCT_OSF.py

SDOF_RESPONSE_SPEC...EISMIC_DUCT_OSF.py x PLOT_3D_CONTOUR_XYZ_FUN.py x

1 #####

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

3 NONLINEAR DYNAMIC ANALYSIS UNDER A SINGLE GROUND MOTION RECORD COMPUTATION AND VISUALIZATION #

4 RESPONSE SPECTRA OF ACCELERATION, VELOCITY, DISPLACEMENT DUCTILITY DAMAGE INDEX USING OPENSEES #

5 ----- #

6 CONSTANT STRUCTURAL DUCTILITY RATIO RESPONSE SPECTRUM #

7 ----- #

8 THIS PROGRAM WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI) #

9 EMAIL: salar.d.ghashghaei@gmail.com #

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11

12

13 code implements a comprehensive nonlinear dynamic analysis framework for

14 ormanance-based earthquake engineering assessment of single-degree-of-freedom

15 F) systems. The methodology combines traditional nonlinear time-history

16 ysis with modern probabilistic and machine learning techniques for advanced

17 ctural performance evaluation.

18

19 ENGINEERING OBJECTIVES:

20 omparative assessment of hysteretic models for seismic response prediction

21 robabilistic seismic demand analysis using multiple ground motions

22 evelopment of fragility curves for performance-based earthquake engineering

23 ntegration of data science methods for structural reliability assessment

24

25 YTICAL FEATURES:

26 nlinear material behavior with pinching and degradation

27 sponse spectrum analysis across period range

28 al-time structural health monitoring metrics

29 atistical characterization of seismic demands

30 chine learning-based damage prediction

31 -----

32 l setup:

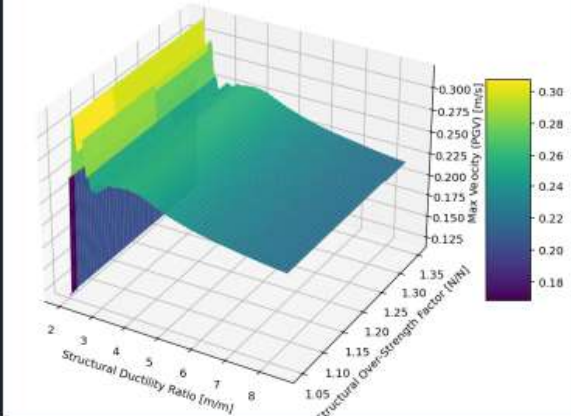
33 DOF properties: mass (m), initial stiffness (k), yield displacement (Dy), ultimate displacement (Du), v

34 ysteresis models: HYSTERETICSM (pinching, stiffness degradation, strength decay).

...top\OPENSEES_FILES\SDOF_RESPONSE_SPECTRUM_SEISMIC_DUCT_OSF

37 %

3D Contour Plot of Max Velocity (PGV) [m/s]

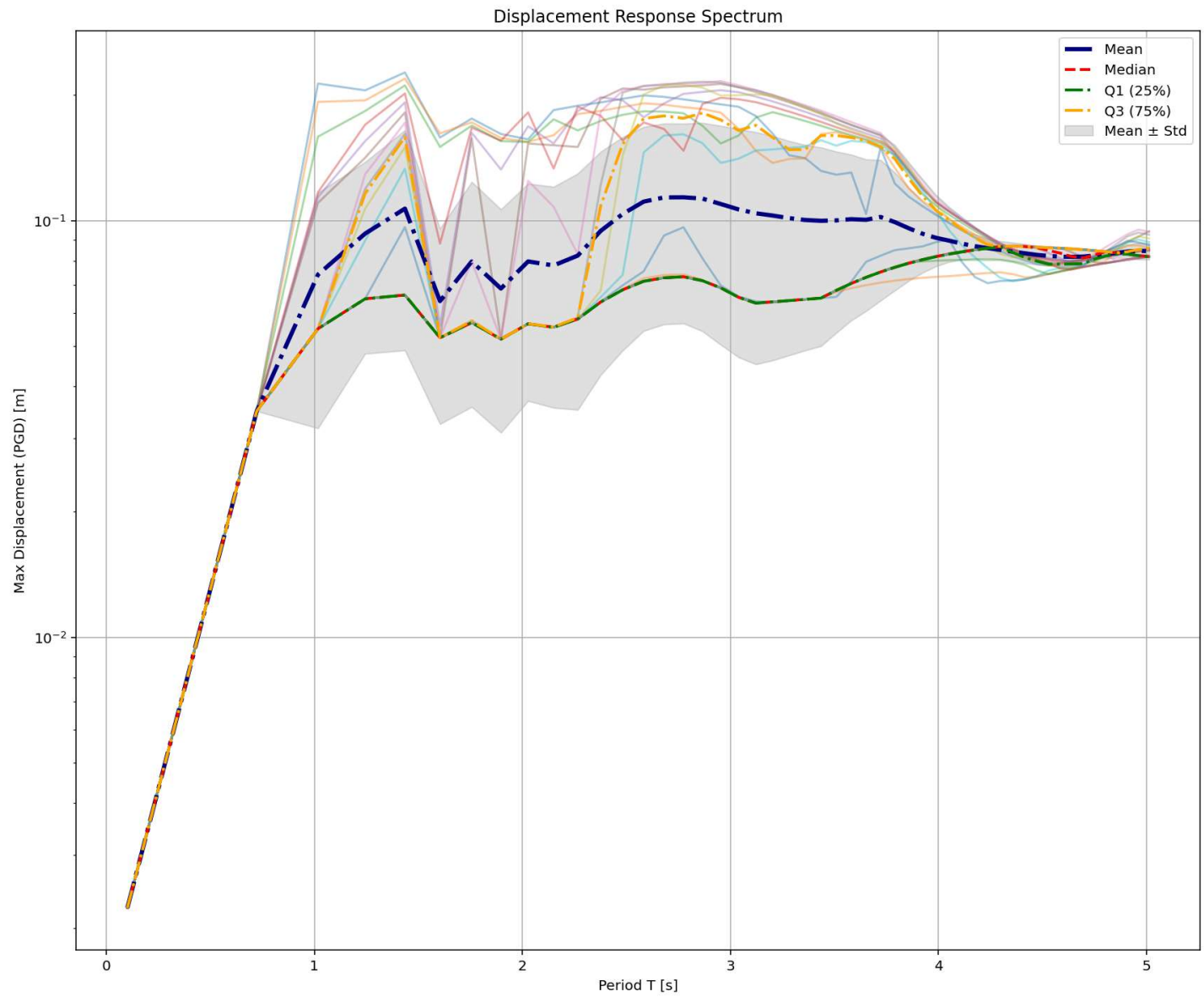


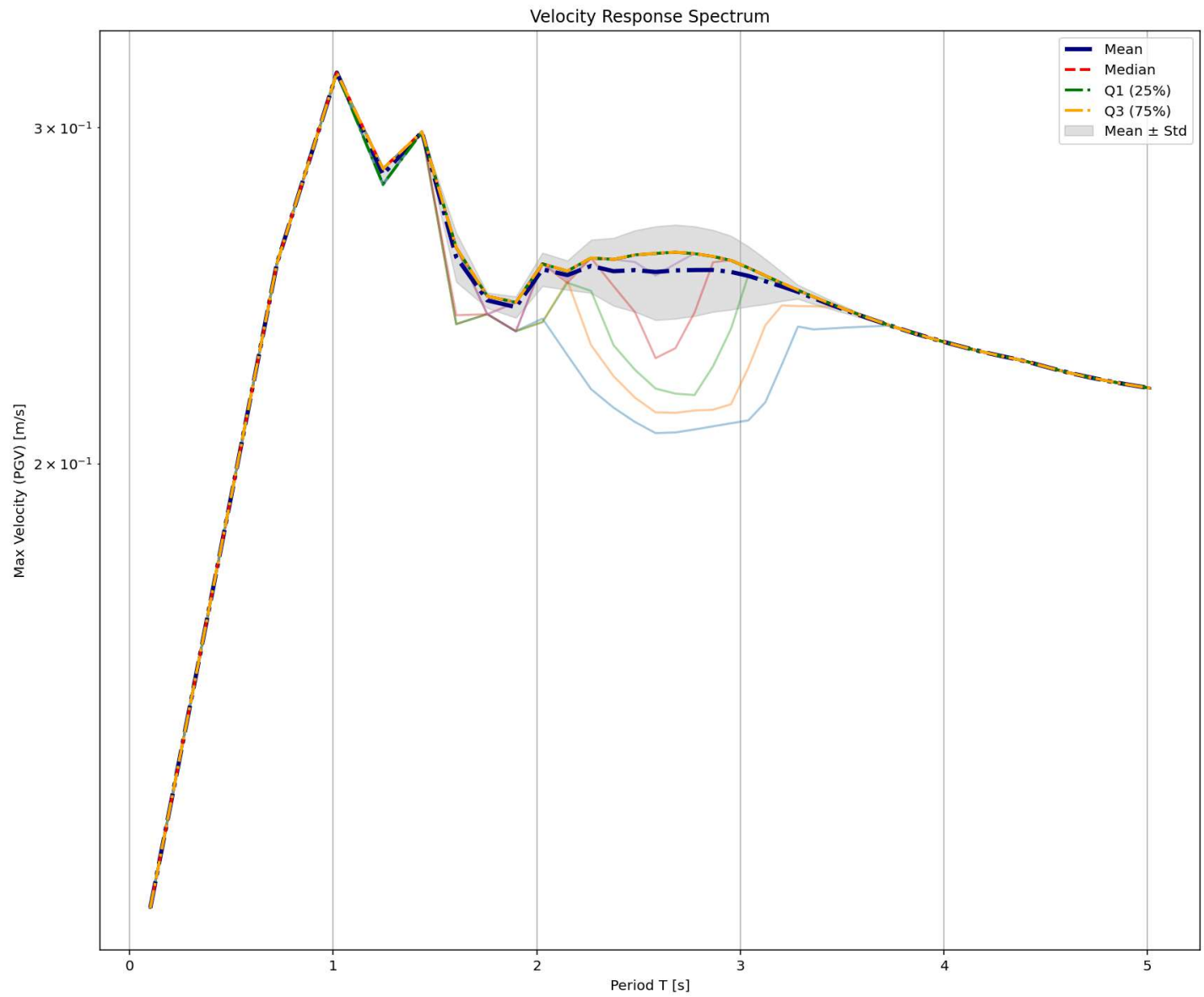
3D Contour Plot of Max Velocity (PGV) [m/s]

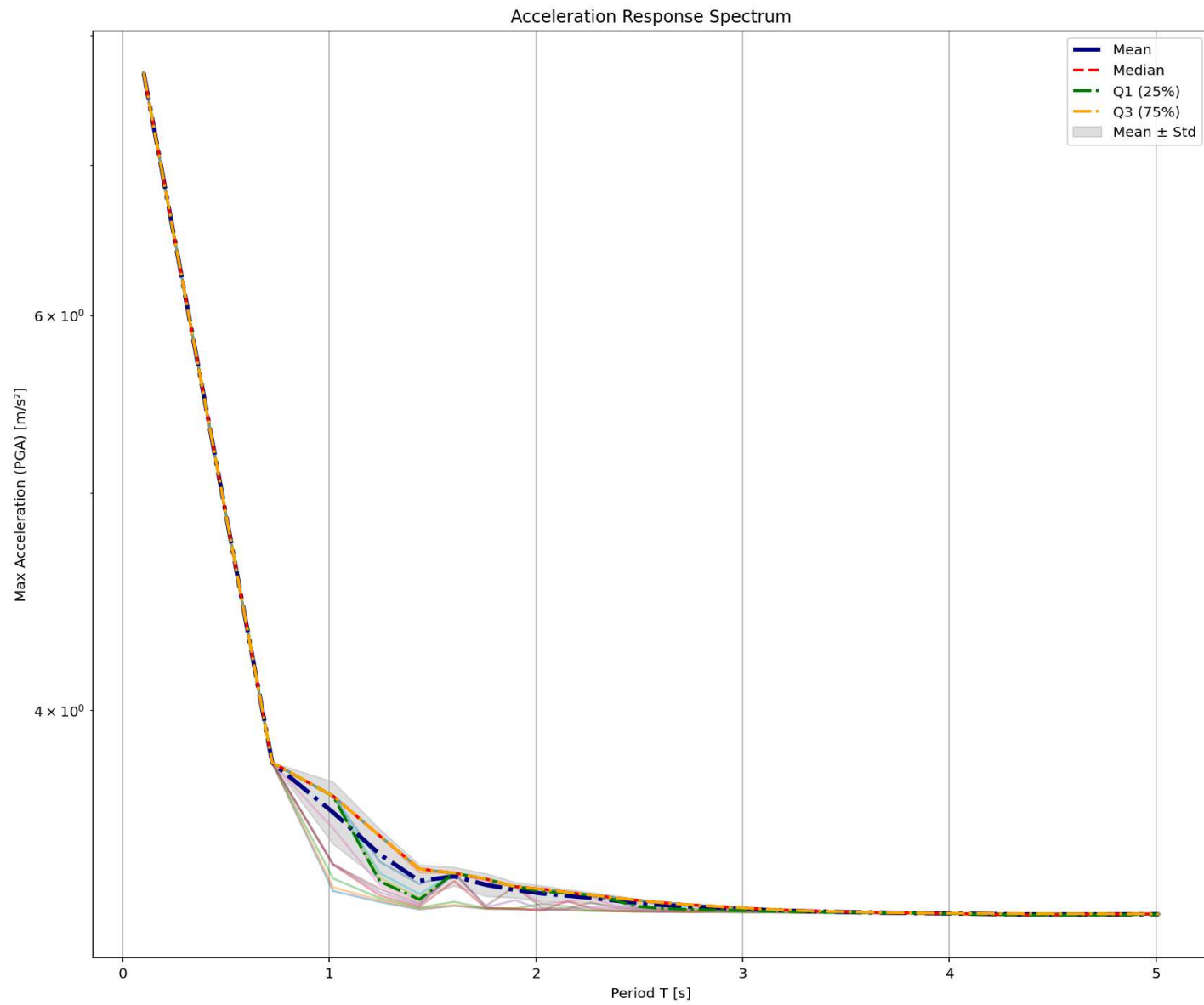
The 3D contour plot displays the relationship between the Structural Ductility Ratio [mm] (x-axis, ranging from 2 to 8) and the Structural Over-Strength Factor [kN/m] (y-axis, ranging from 1.05 to 1.35). The z-axis represents the Max Velocity (PGV) [m/s], with a color scale ranging from 0.18 to 0.30. The plot shows a surface that generally increases in velocity as both ductility and over-strength factors increase, with a prominent ridge at higher ductility values.

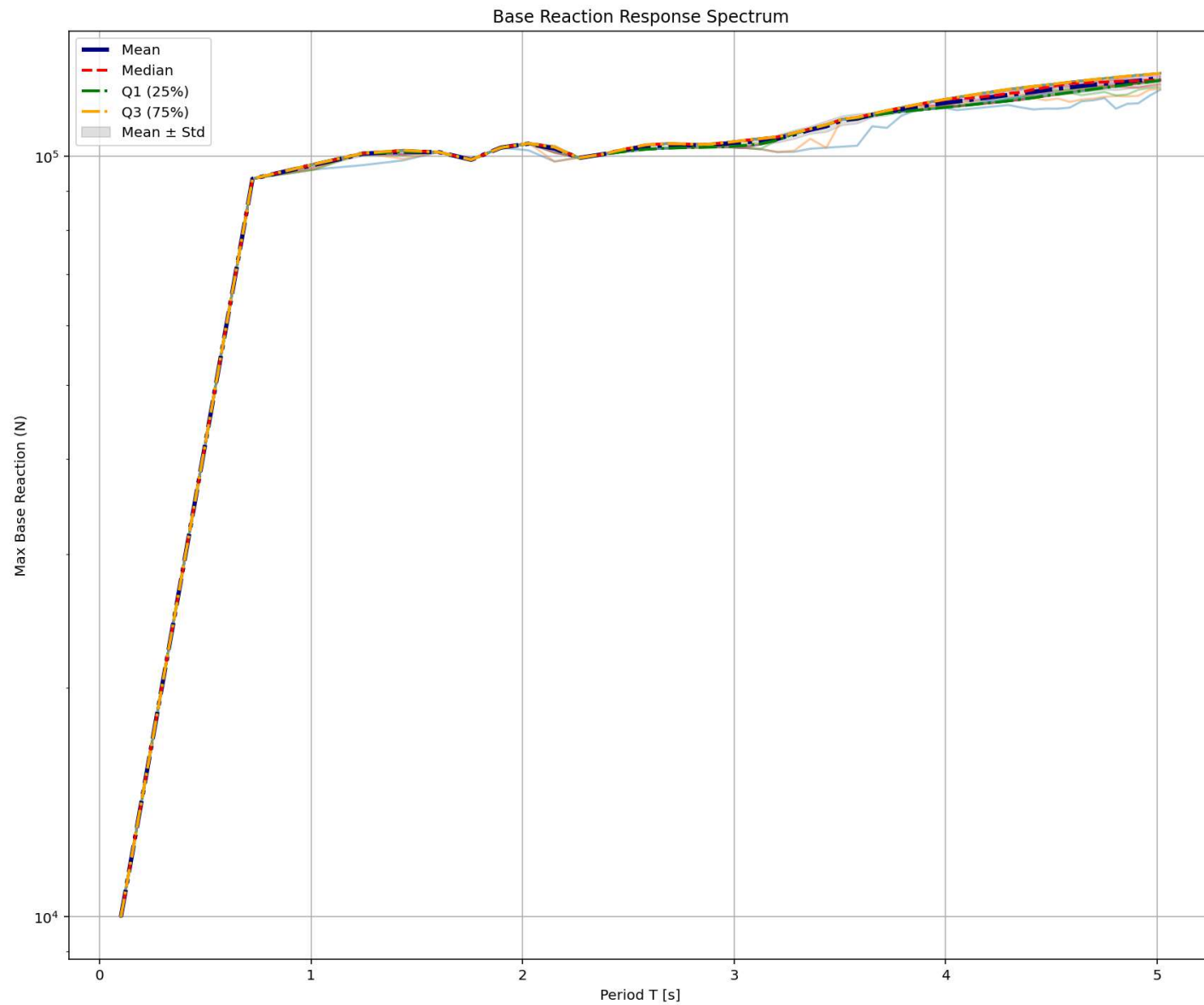
Python Console Files Help Variable Explorer Debugger Plots History

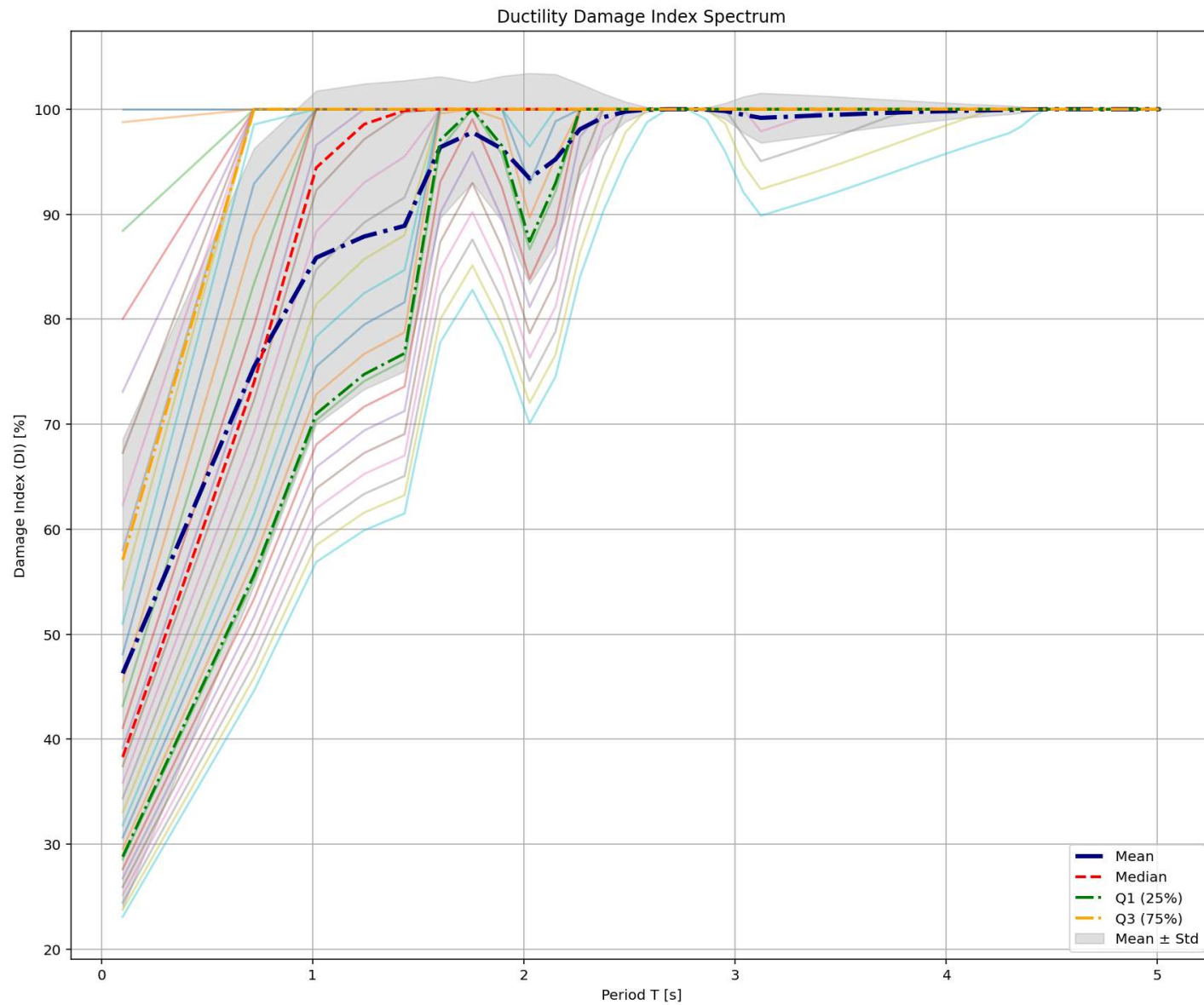
Inline Conda: anaconda3 (Python 3.12.7) LSP: Python Line 6, Col 105 UTF-8 CRLF RW Mem 50%



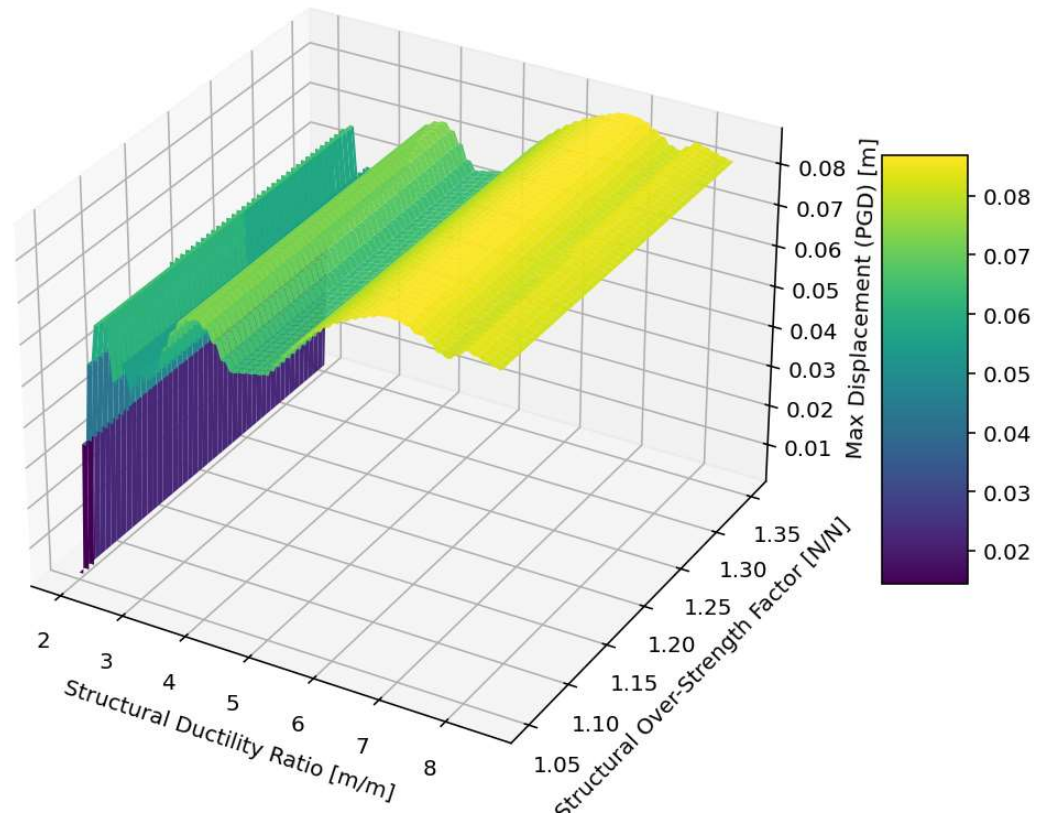




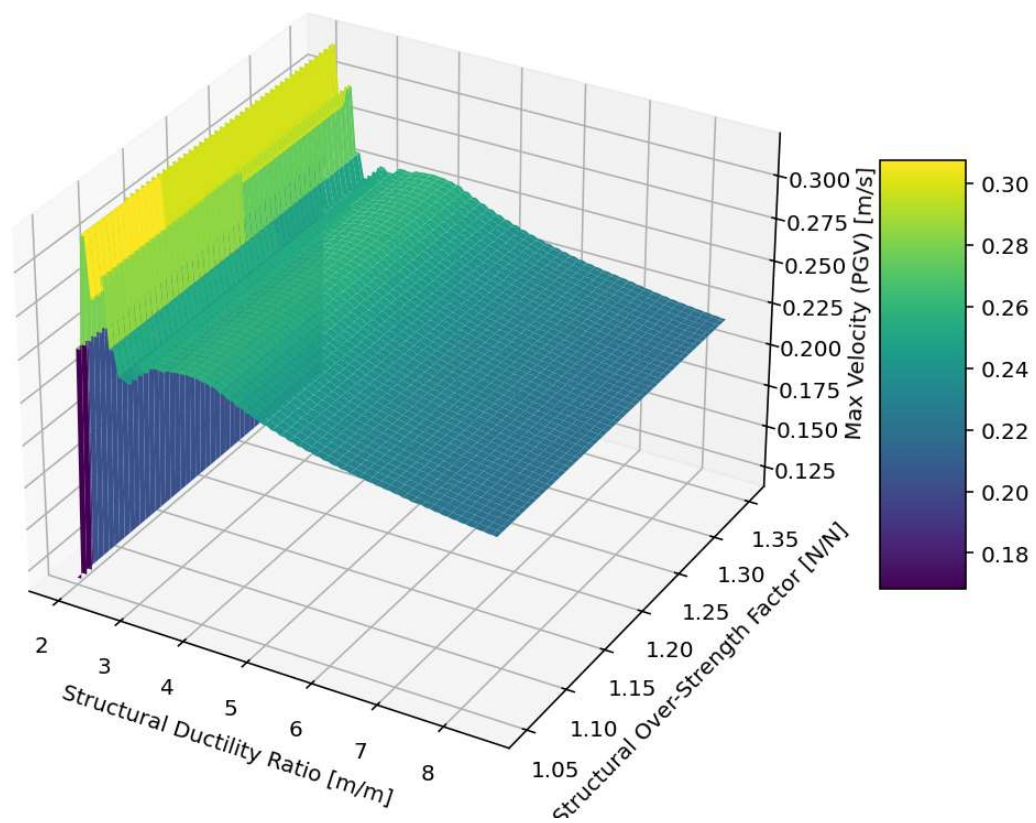




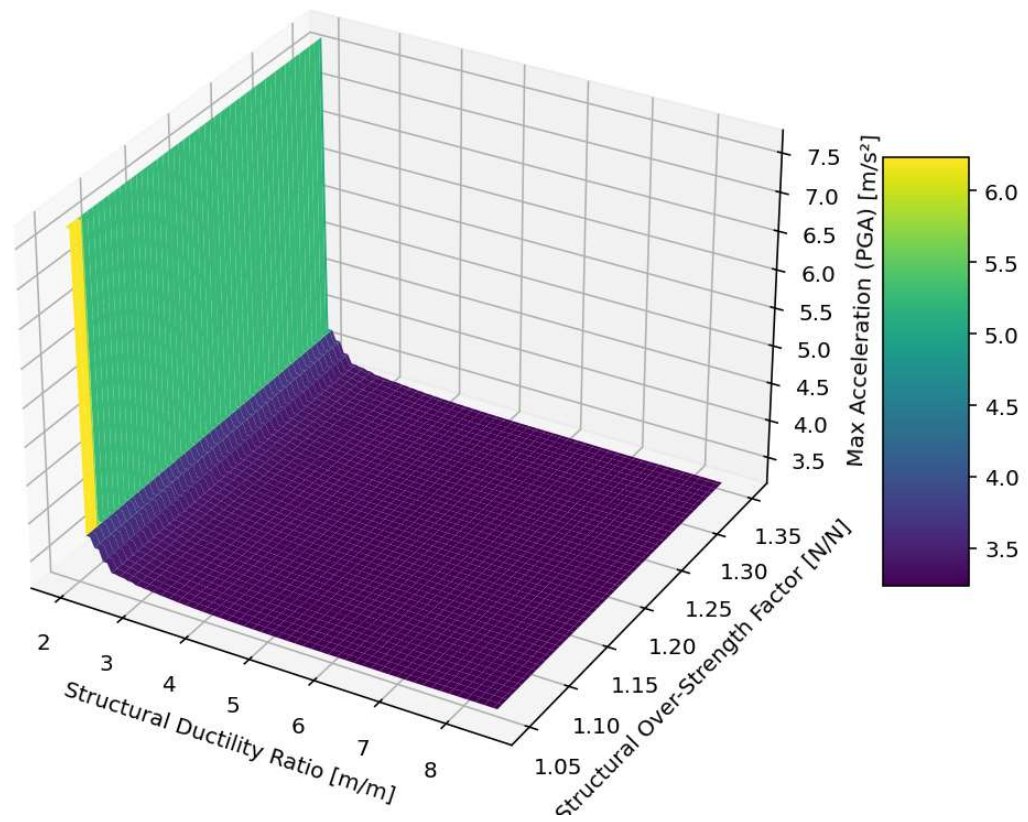
3D Contour Plot of Max Displacement (PGD) [m]



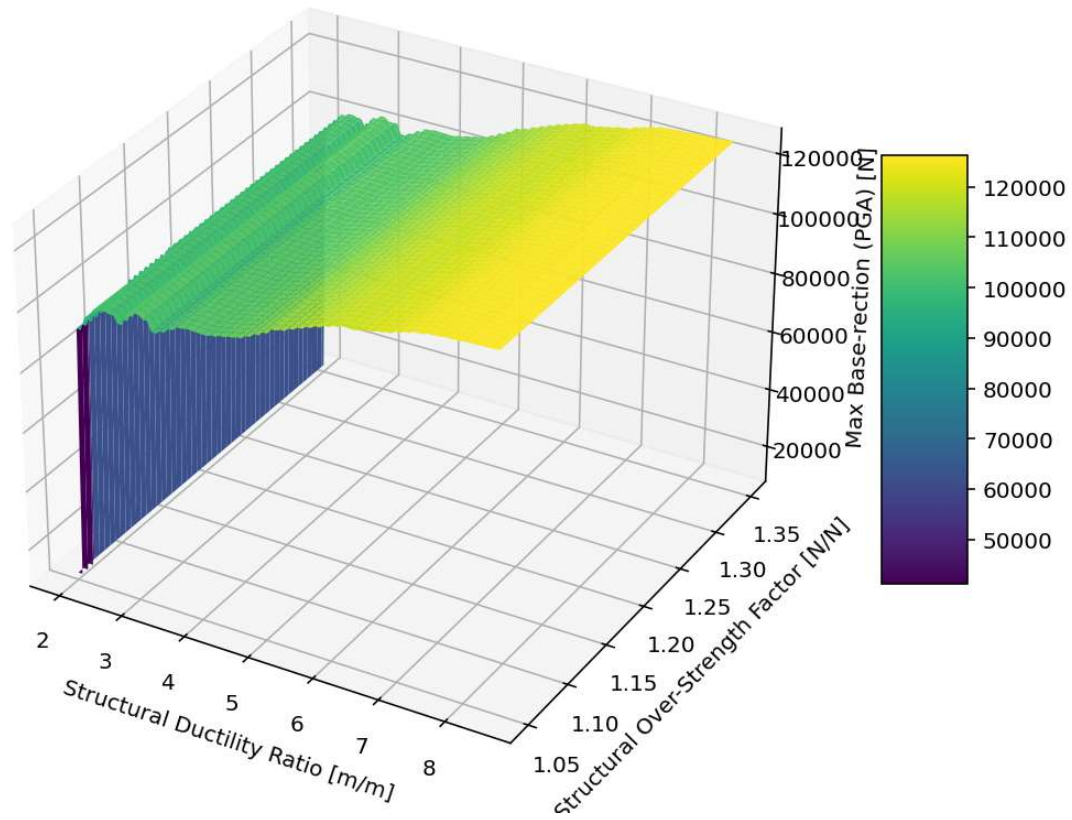
3D Contour Plot of Max Velocity (PGV) [m/s]



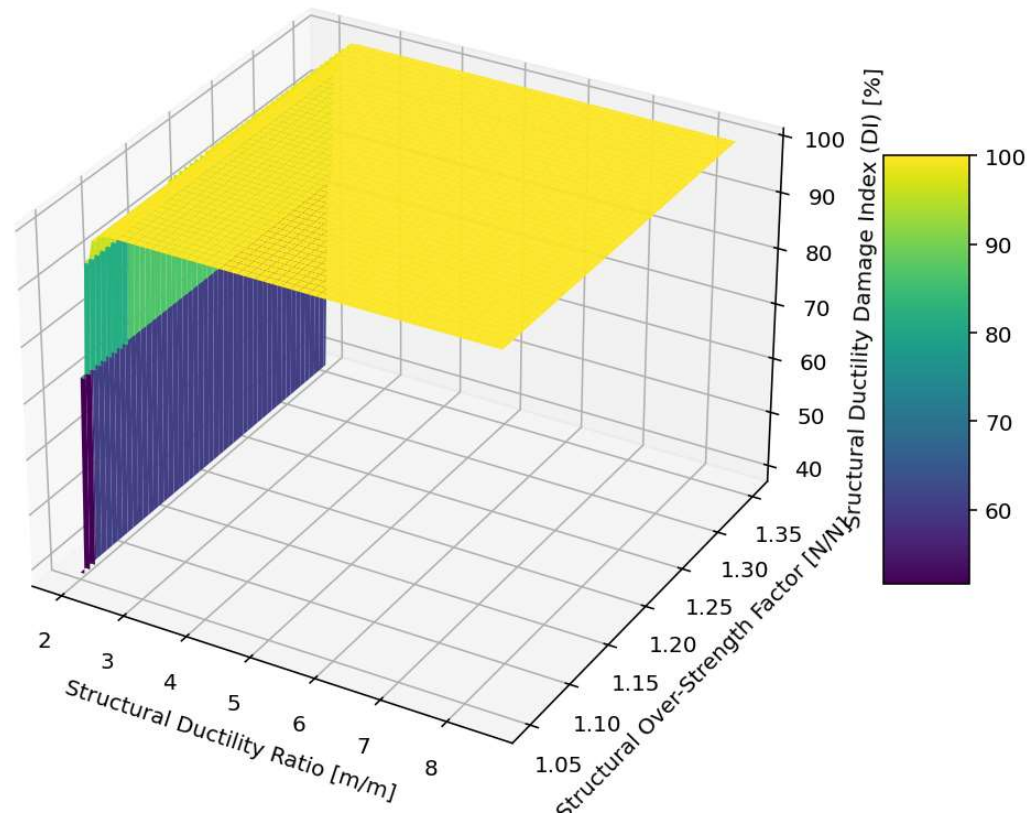
3D Contour Plot of Max Acceleration (PGA) [m/s^2]



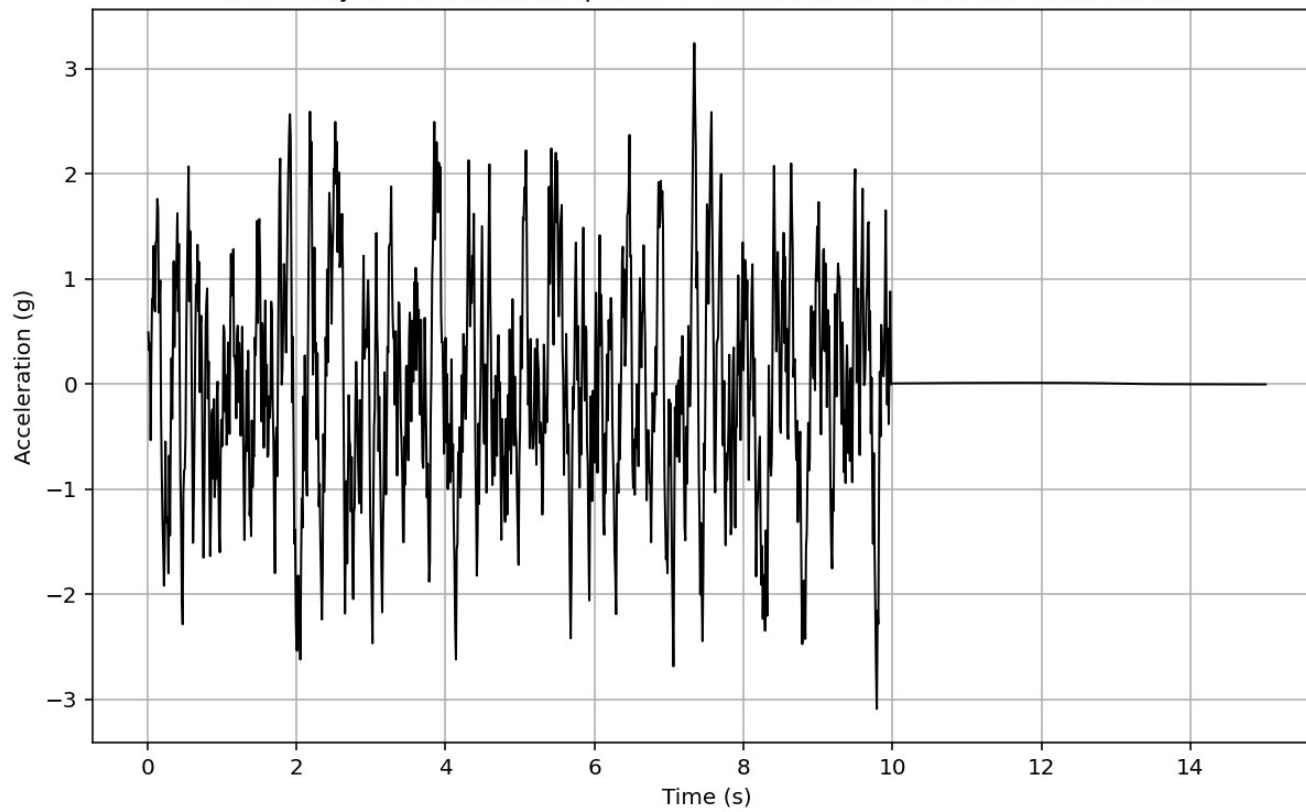
3D Contour Plot of Max Base-rection (PGA) [N]

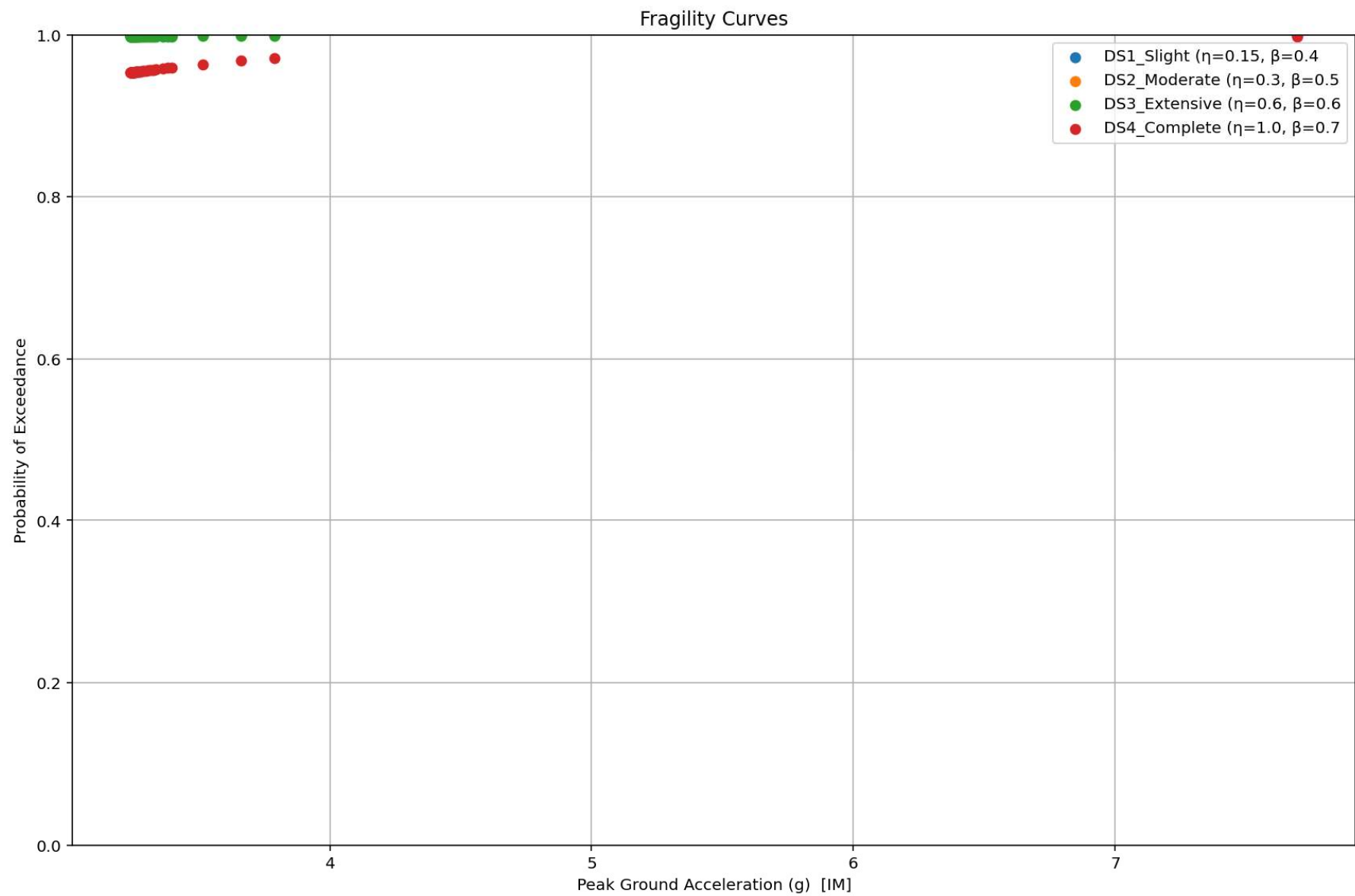


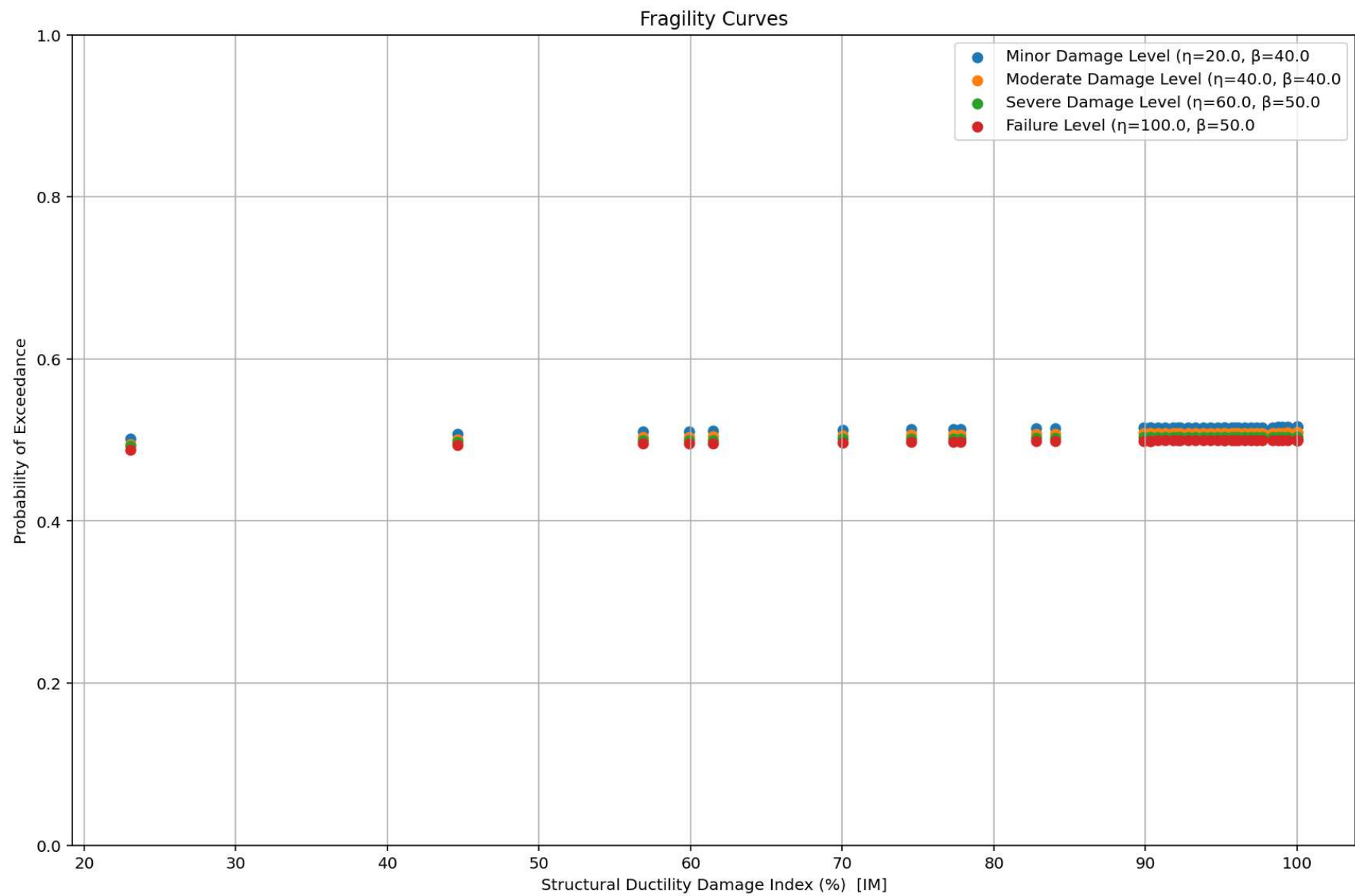
3D Contour Plot of Structural Ductility Damage Index (DI) [%]



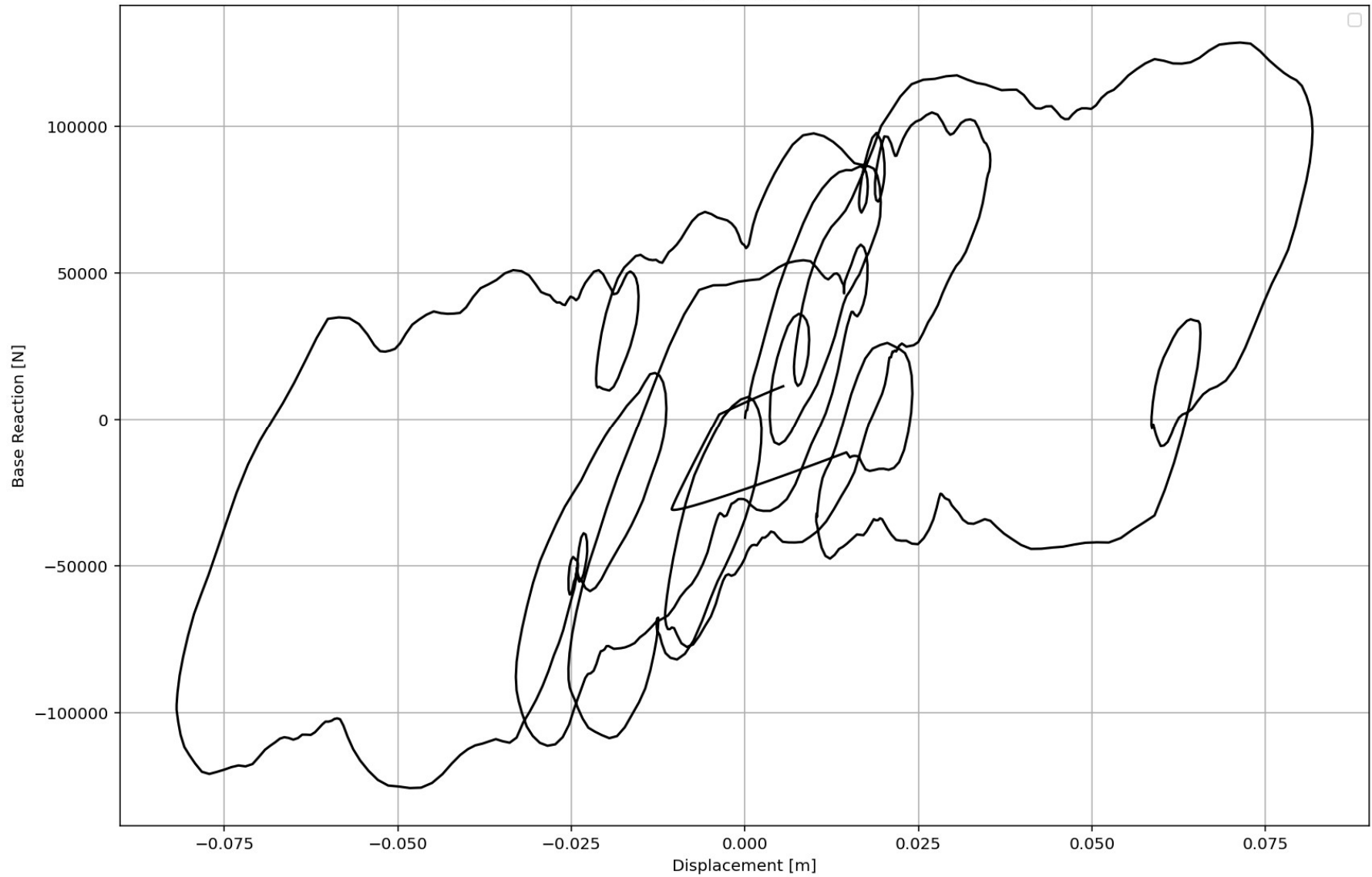
Last Analysis Structural Response + Ground Motion ::: MAX. ABS. : 3.2421

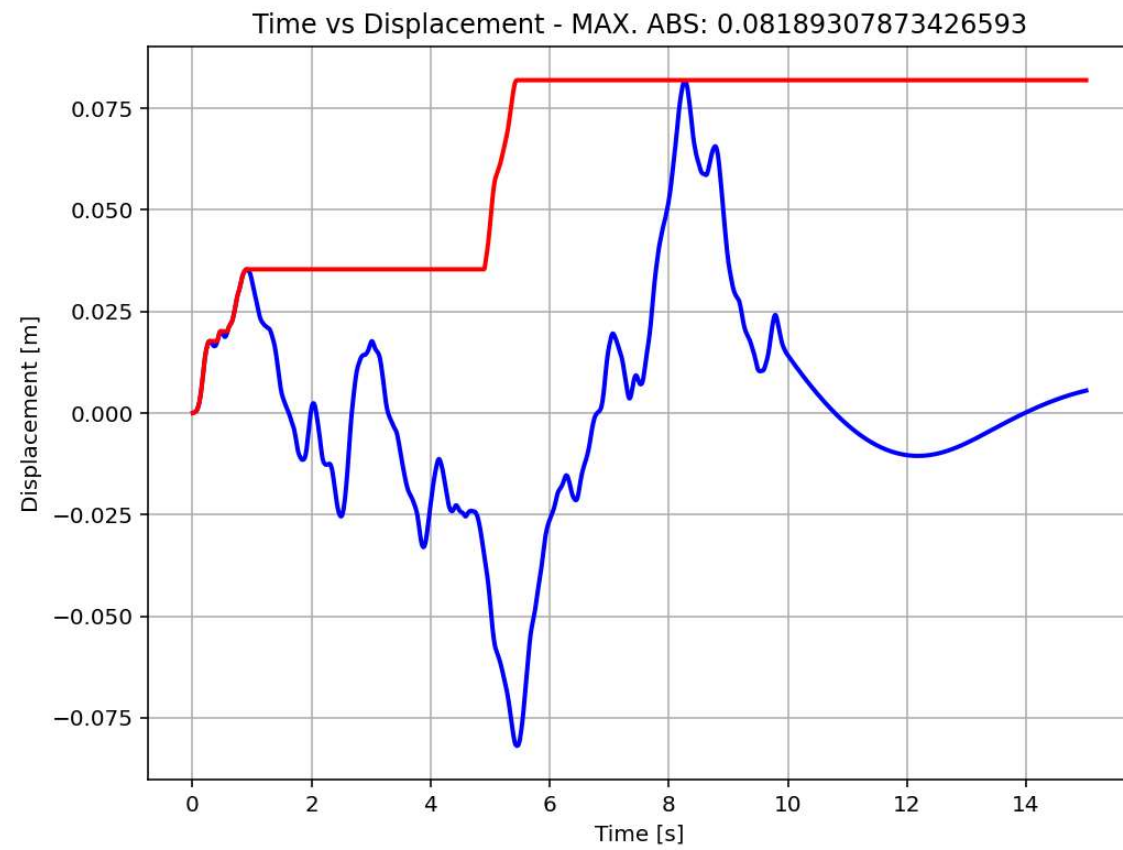




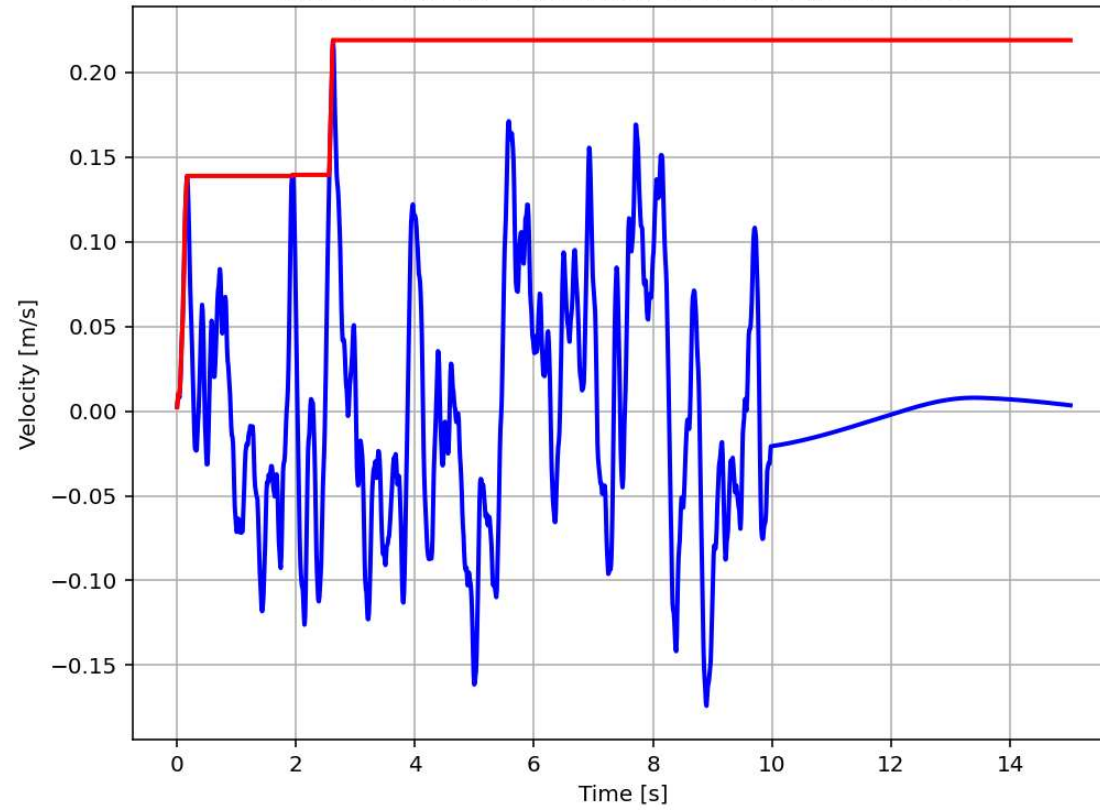


Displacement & Base Reaction Relation From Last Dynamic Analysis

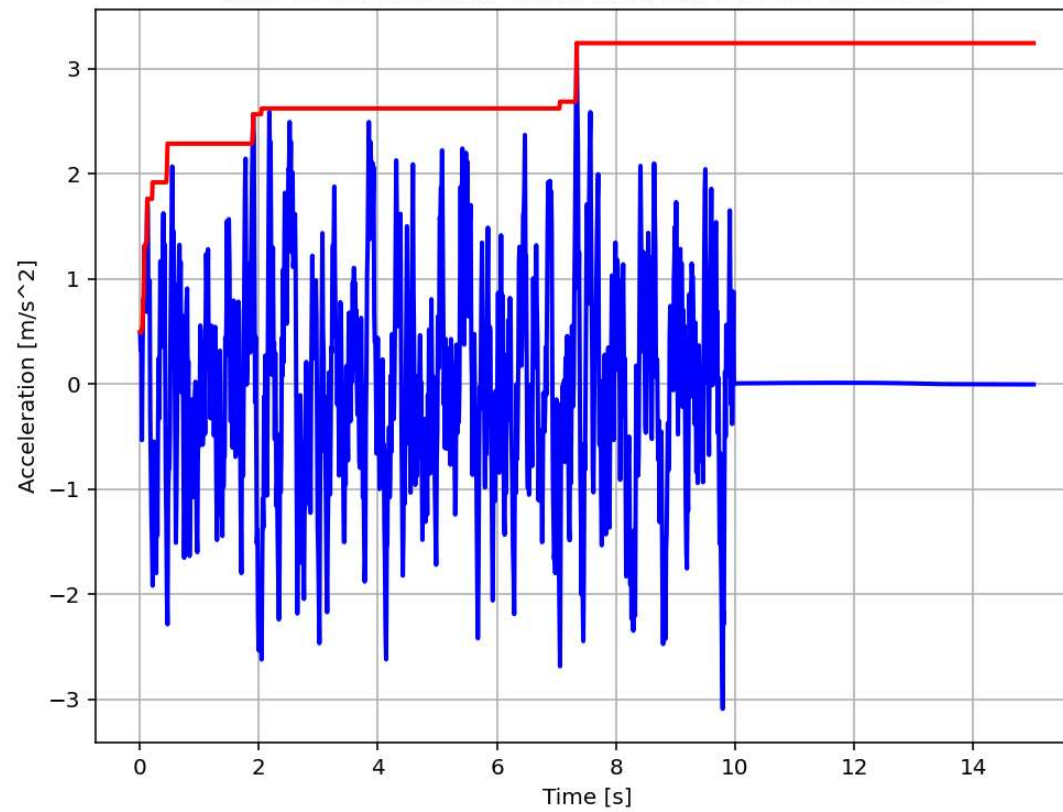




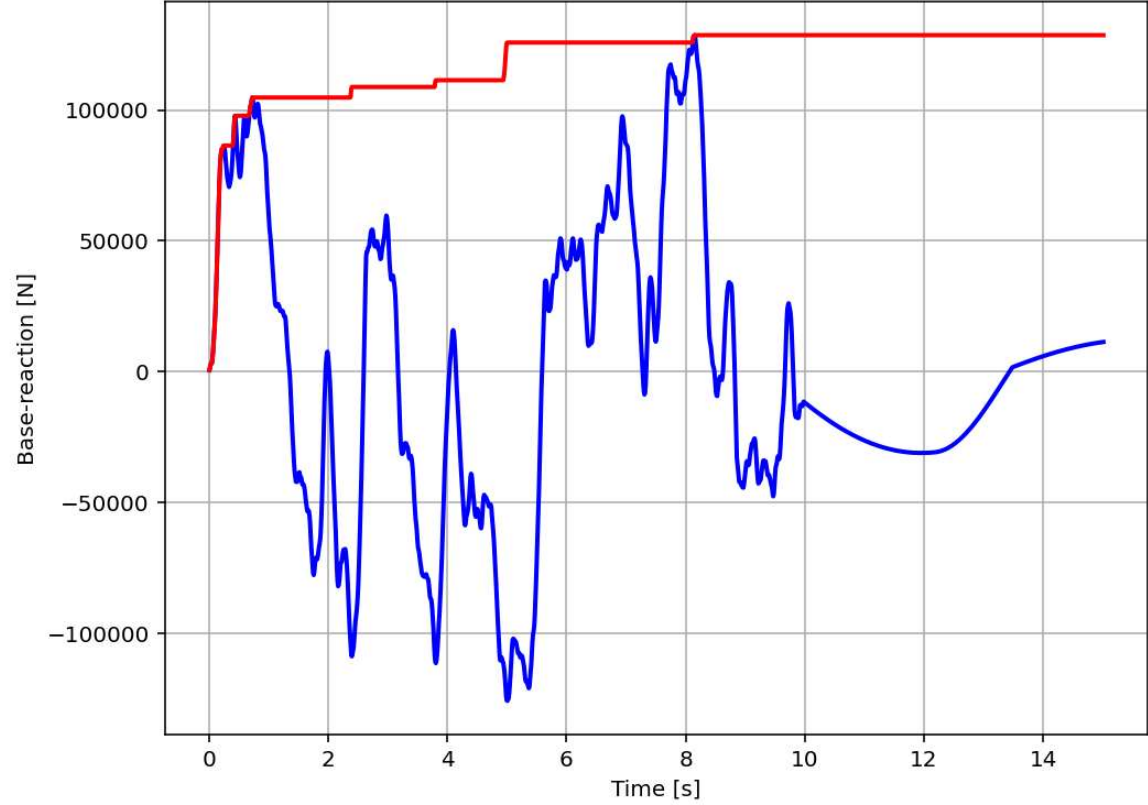
Time vs Velocity - MAX. ABS: 0.21900761742872593

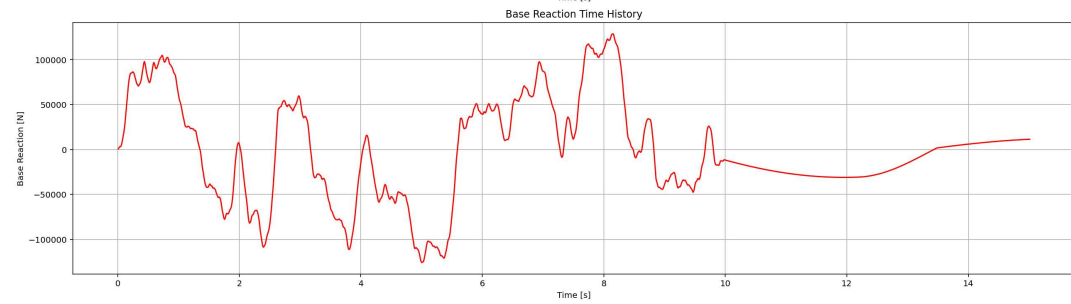
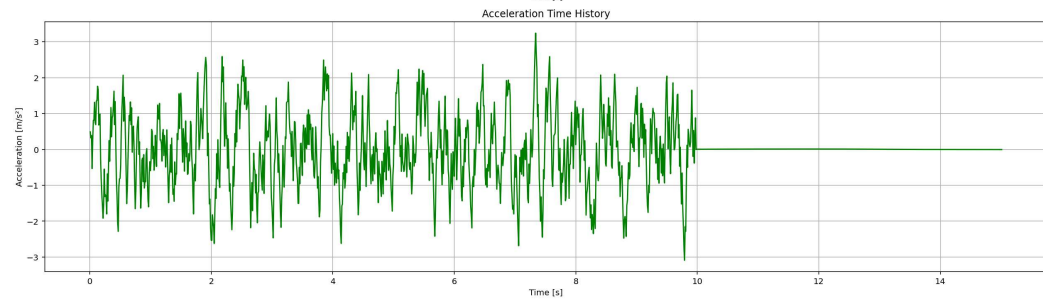
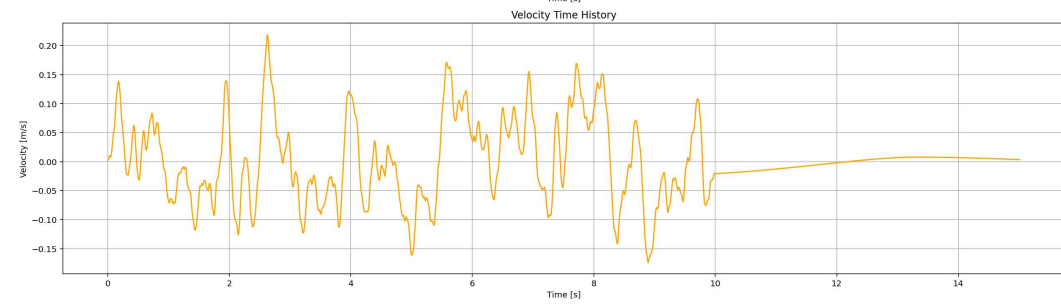
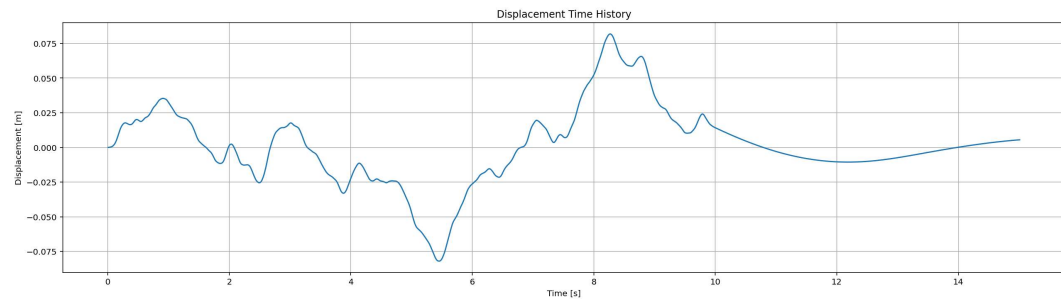


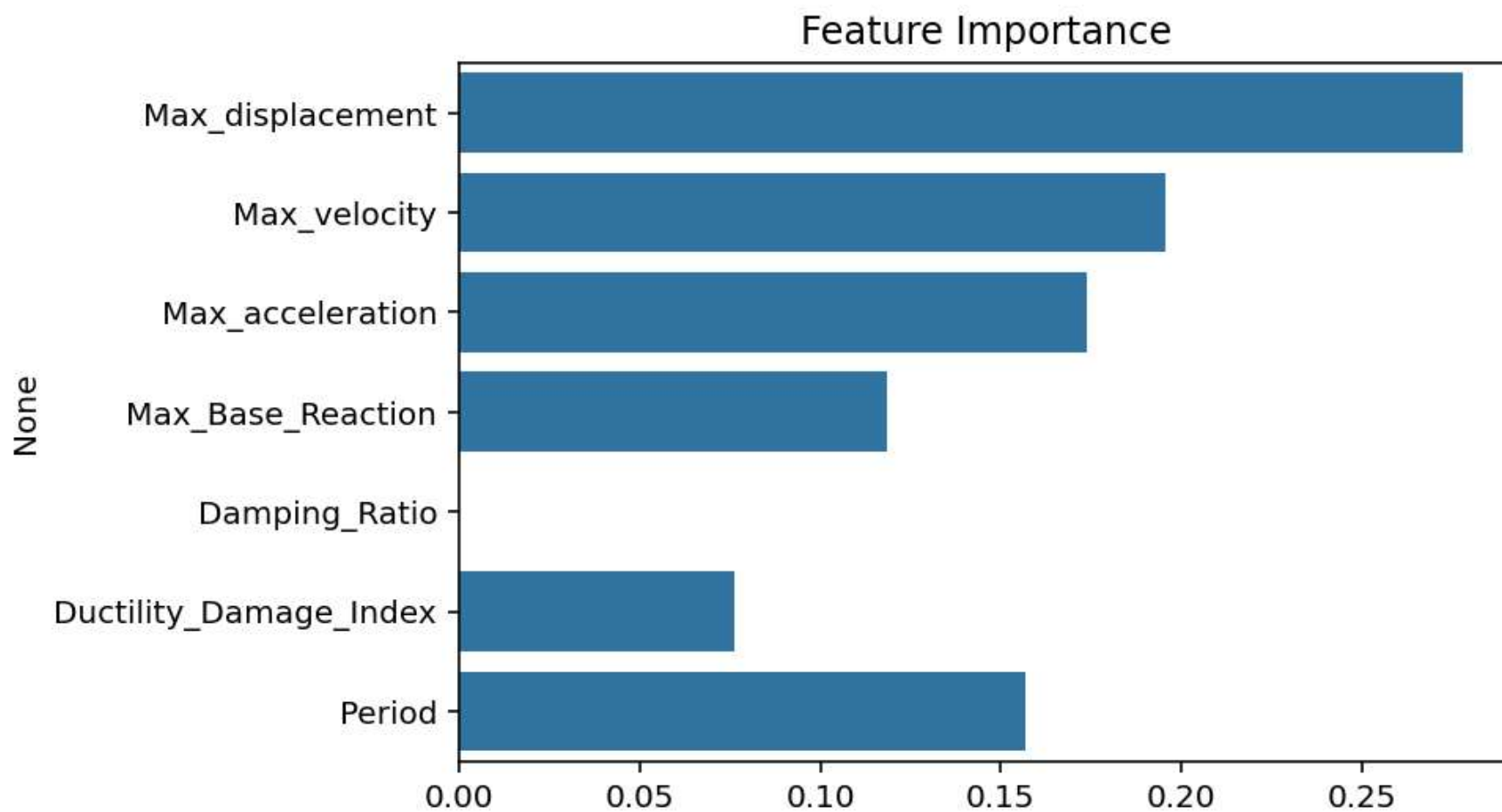
Time vs Acceleration - MAX. ABS: 3.2420845246828245



Time vs Base-reaction - MAX. ABS: 128596.94751427331







Correlation Heatmap

