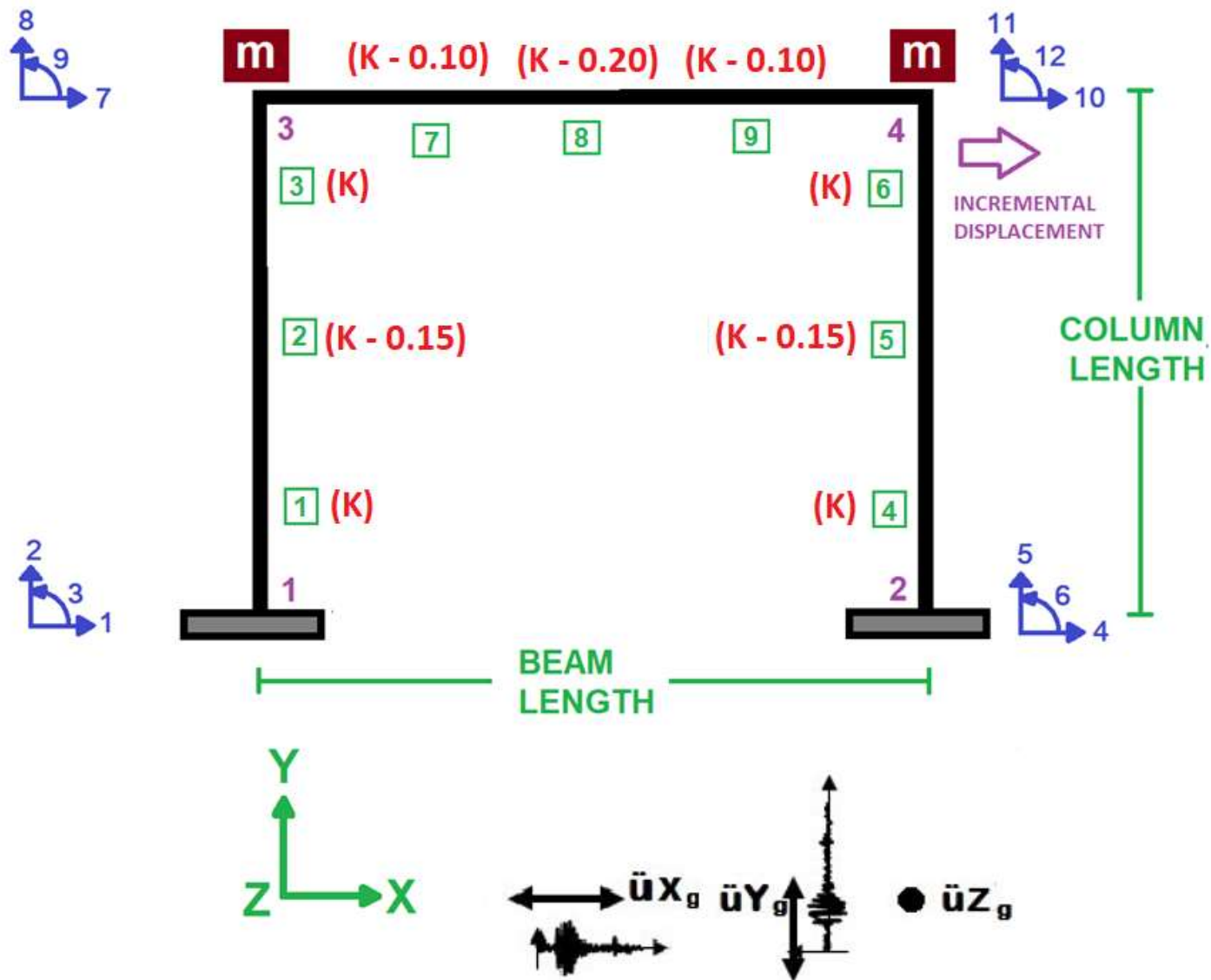


>> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<

SENSITIVITY ANALYSIS OF CONCRETE FRAME BY CHANGING COLUMN REBAR DIAMETER AND CONFINEMENT ENHANCEMENT RATIO. USING OPENSEES FOR STRUCTURAL BEHAVIOR COEFFICIENT CALCULATION

WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

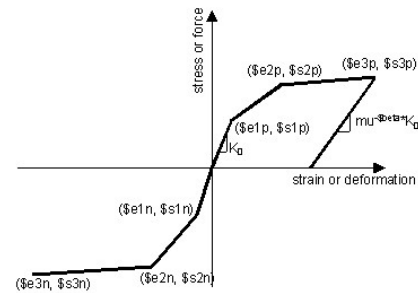




CORE AND COVER CONCRETE RELATION



WITHOUT HARDENING AND ULTIMATE STRAIN



WITH HARDENING AND ULTIMATE STRAIN



COLUMN SECTION



BEAM SECTION

C:\Users\Dell\Desktop\OPENSEES_FILES\CONCRETE_FRA...SITIVITY_CONFINEMENT_ENHANCEMENT_RATIO_&_REBAR.py

SENSITIVITY_CONFIN...T_RATIO_REBAR.py

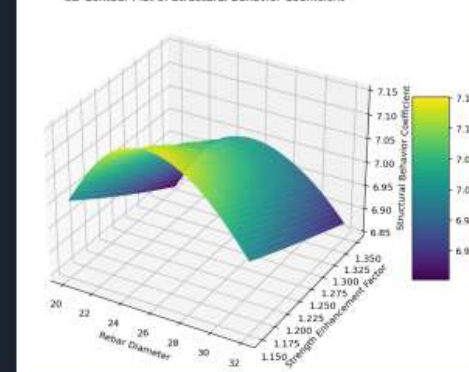
```

1 #####
2 #                               >> IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL <<
3 # SENSITIVITY ANALYSIS OF CONCRETE FRAME BY CHANGING COLUMN REBAR DIAMETER AND CONFINEMENT ENHANCEMENT
4 # USING OPENSEES FOR STRUCTURAL BEHAVIOR COEFFICIENT CALCULATION
5 #-----
6 # THIS PROGRAM WRITTEN BY SALAR DELAVAR GHASHGHAEE (QASHQAI)
7 # EMAIL: salar.d.ghashghaei@gmail.com
8 #####
9 """
10 1. Objective: The code performs a sensitivity analysis on a 2D reinforced concrete frame by varying
11 diameter and confinement enhancement ratios to evaluate structural behavior coefficients using Open.
12
13 2. Model Setup: A nonlinear 2D frame model is created with columns, beams, and distributed plasticity
14 incorporating geometric transformations (Corotational) for large displacements.
15
16 3. Material Modeling: Confined and unconfined concrete behaviors are modeled using modified Kent-Scott
17 formulations, while steel reinforcement follows bilinear or hardening models.
18
19 4. Analysis Types: Both pushover (static) and dynamic analyses are supported, with Rayleigh damping
20
21 5. Key Outputs: The code extracts base shear, displacement, stiffness, ductility ratios, overstrength
22 factors, and structural behavior coefficients (R).
23
24 6. Sensitivity Parameters: Rebar diameters (20-32 mm) and confinement enhancement ratios (1.15-1.35)
25 are systematically varied to assess their impact on performance.
26
27 7. Bilinear Fitting: Pushover curves are post-processed to derive elastic/plastic stiffness, ductility
28 and R factors using a bilinear approximation algorithm.
29
30 8. Visualization: 3D contour plots and 2D graphs illustrate relationships between rebar, confinement
31 and structural responses (e.g., stiffness, R-factors).
32
33 9. Validation: Eigenvalue analysis ensures realistic dynamic properties (periods/damping), while
34 convergence checks enhance numerical robustness.

```

...HANCEMENT_RATIO\SENSITIVITY_CONFINEMENT_ENHANCEMENT_RATIO

3D Contour Plot of Structural Behavior Coefficient



Help Variable Explorer Debugger Plots Files

Console 1/A

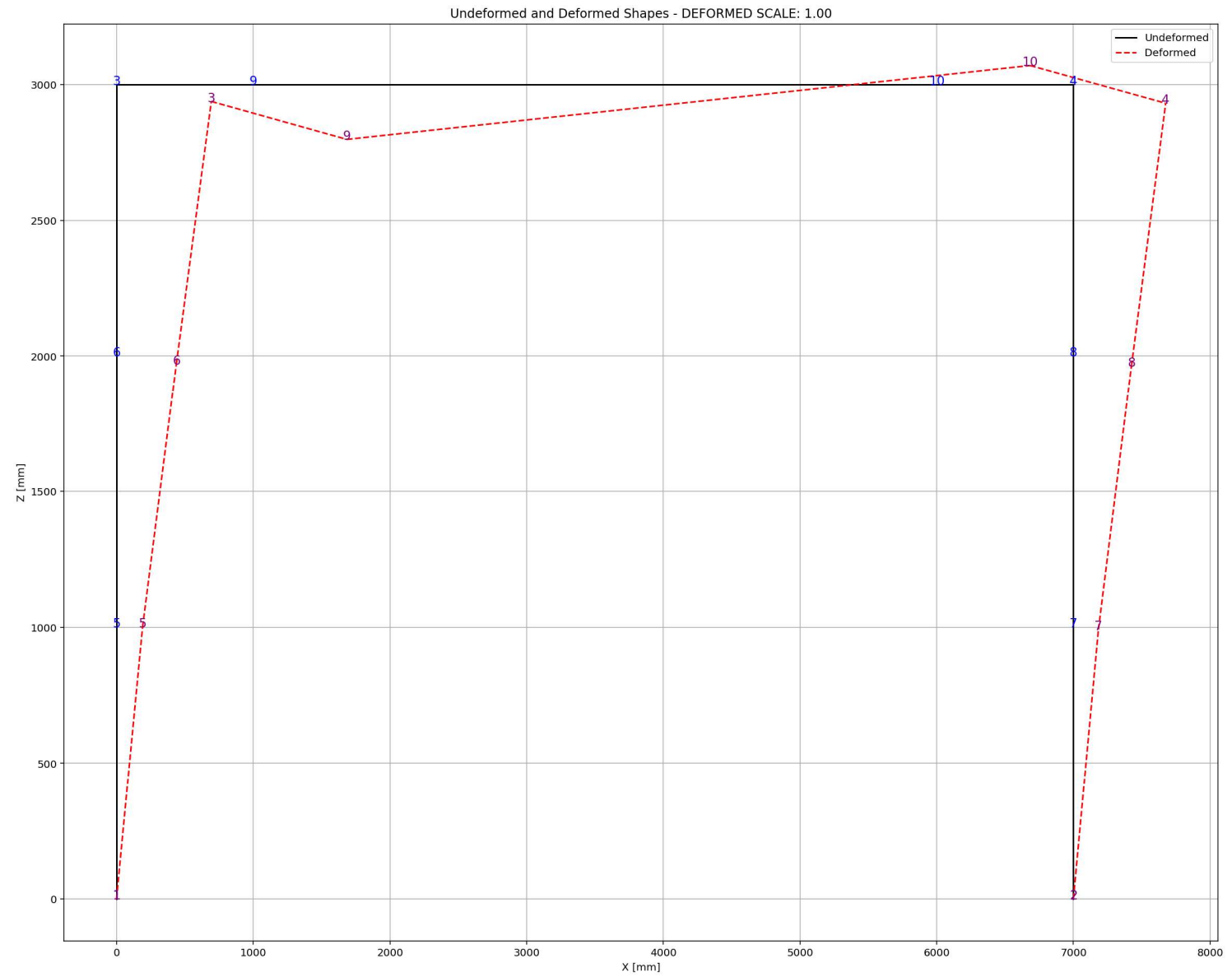
them also appear inline in the console, you need to uncheck "Mute inline plotting" under the options menu of Plots.

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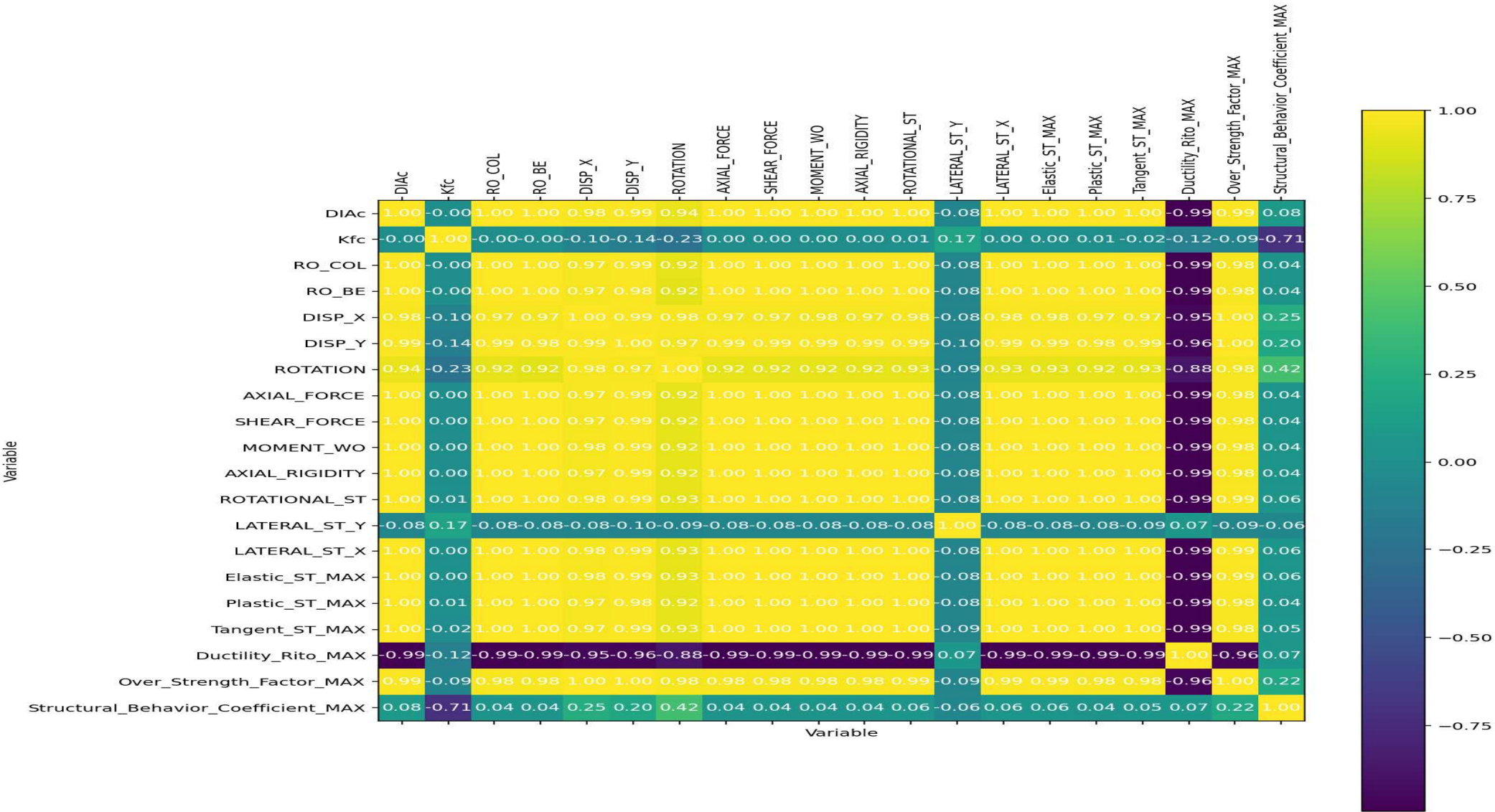
+=====+
= Analysis curve fitted =
= Disp Base Shear
-----
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 [1.25736042e+02 2.61065850e+06]
 [6.93434250e+02 3.25359115e+06]]

```

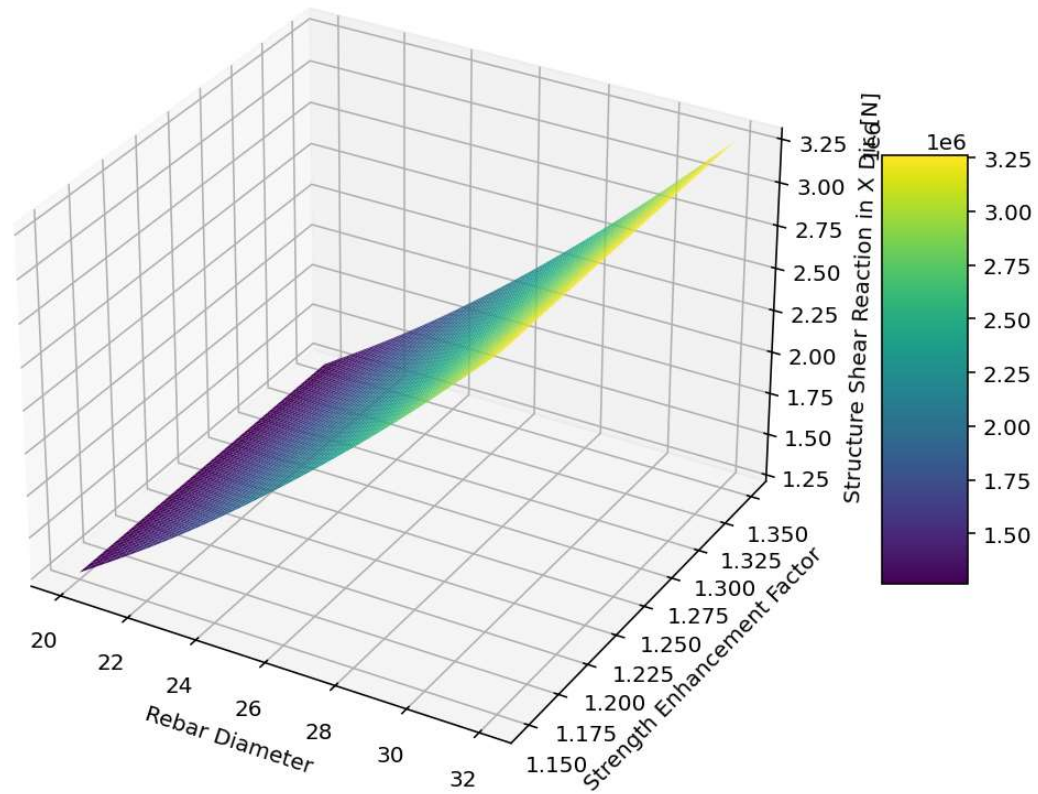
IPython Console History



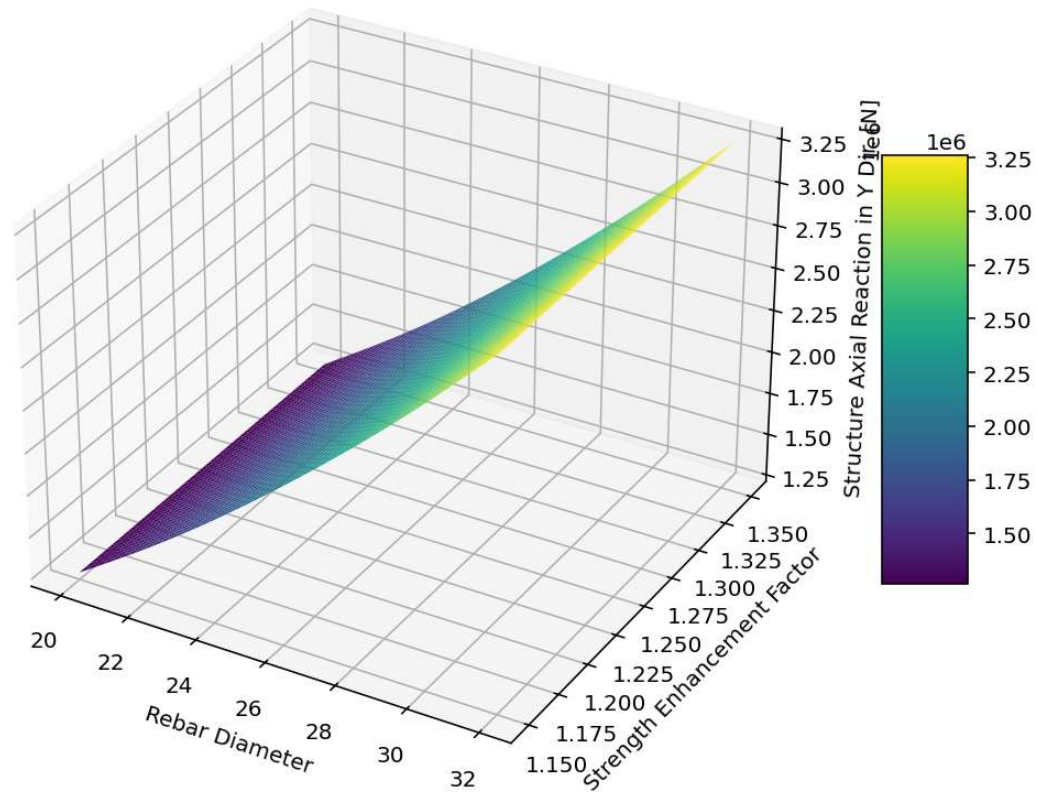
Correlation Heatmap



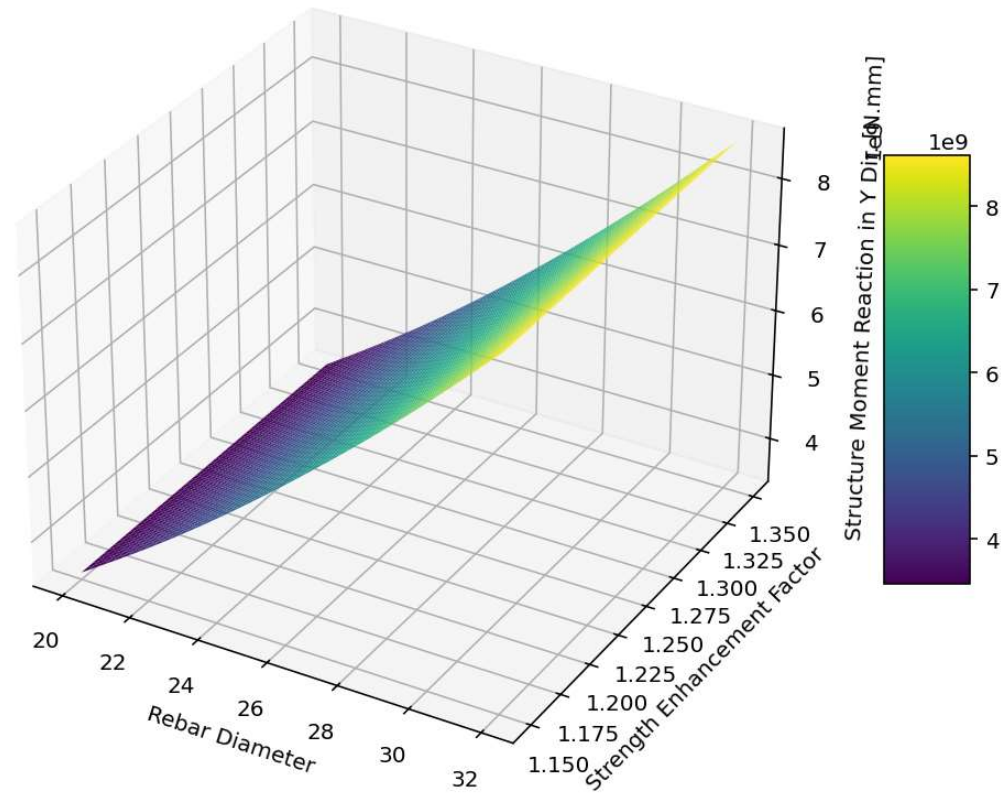
3D Contour Plot of Structure Shear Reaction in X Dir. [N]



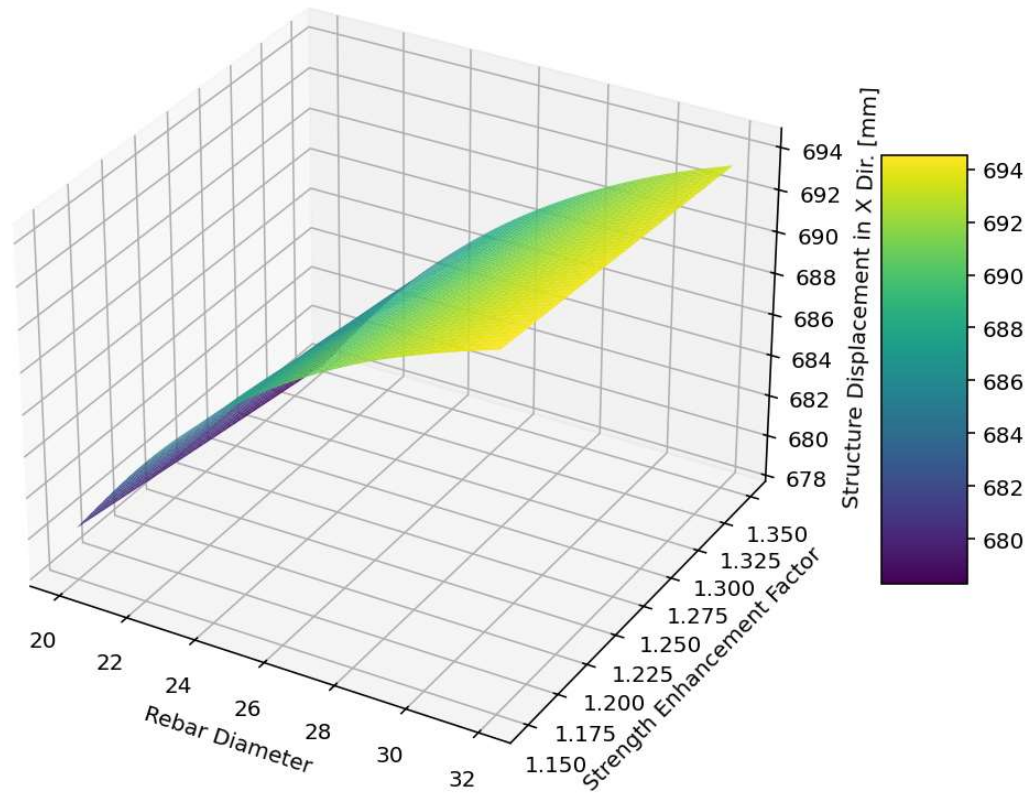
3D Contour Plot of Structure Axial Reaction in Y Dir. [N]



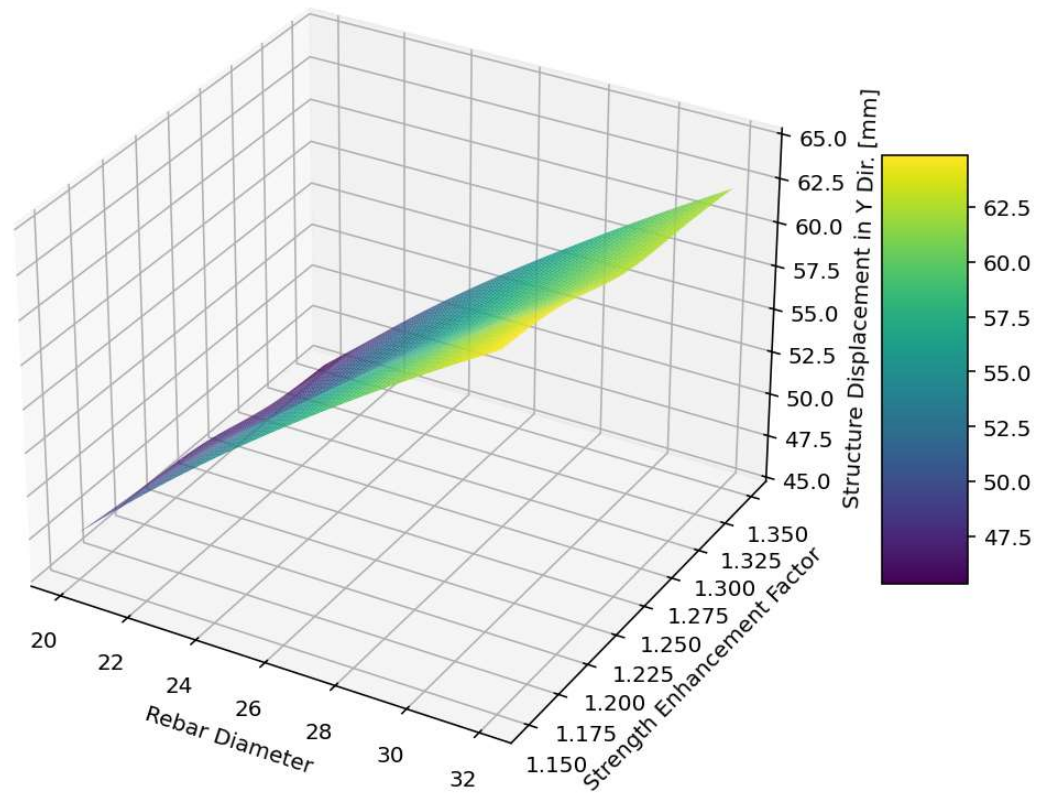
3D Contour Plot of Structure Moment Reaction in Y Dir. [N.mm]



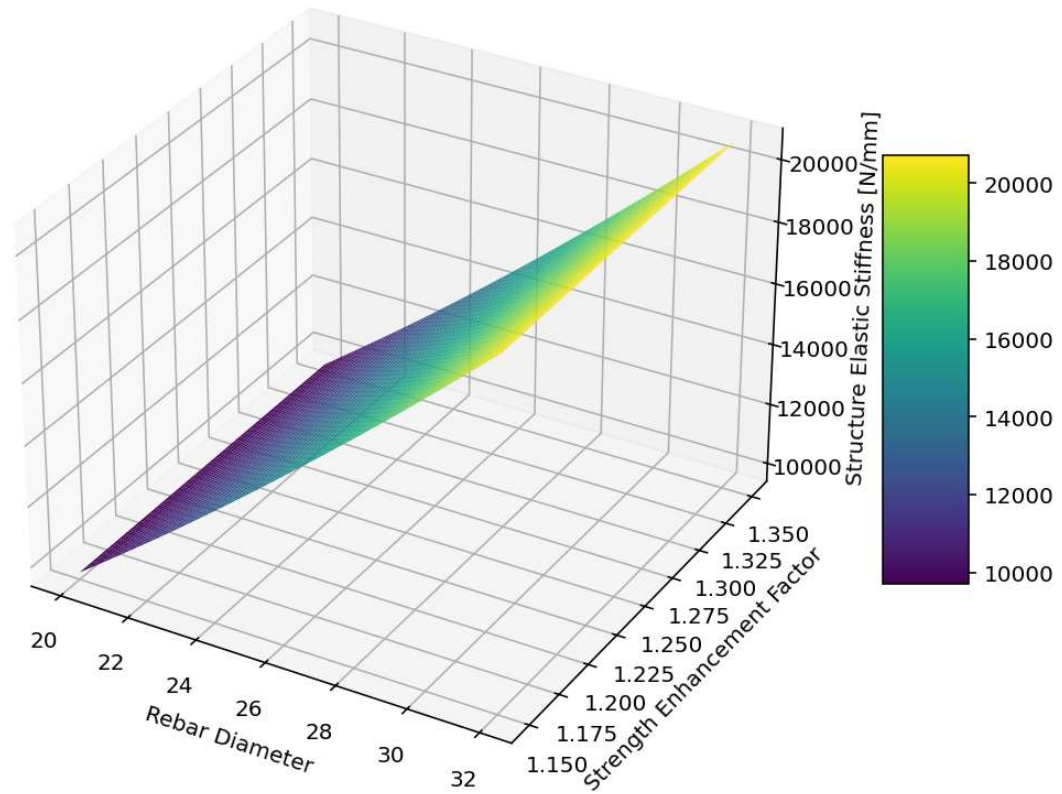
3D Contour Plot of Structure Displacement in X Dir. [mm]



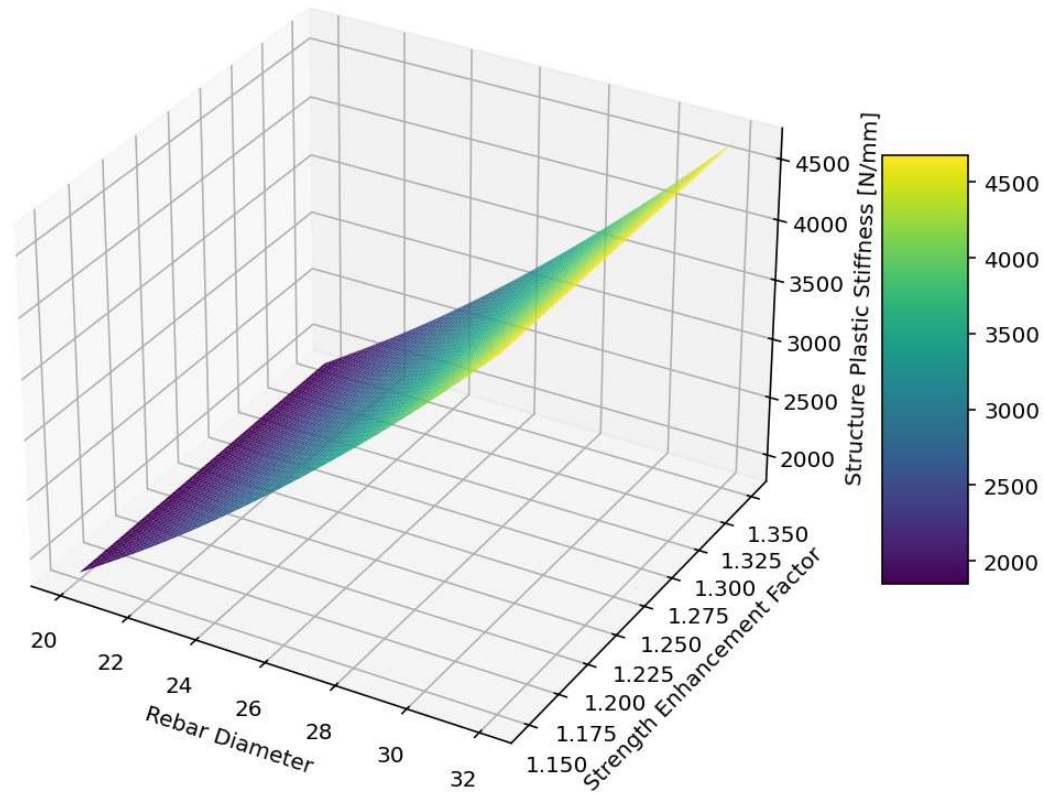
3D Contour Plot of Structure Displacement in Y Dir. [mm]



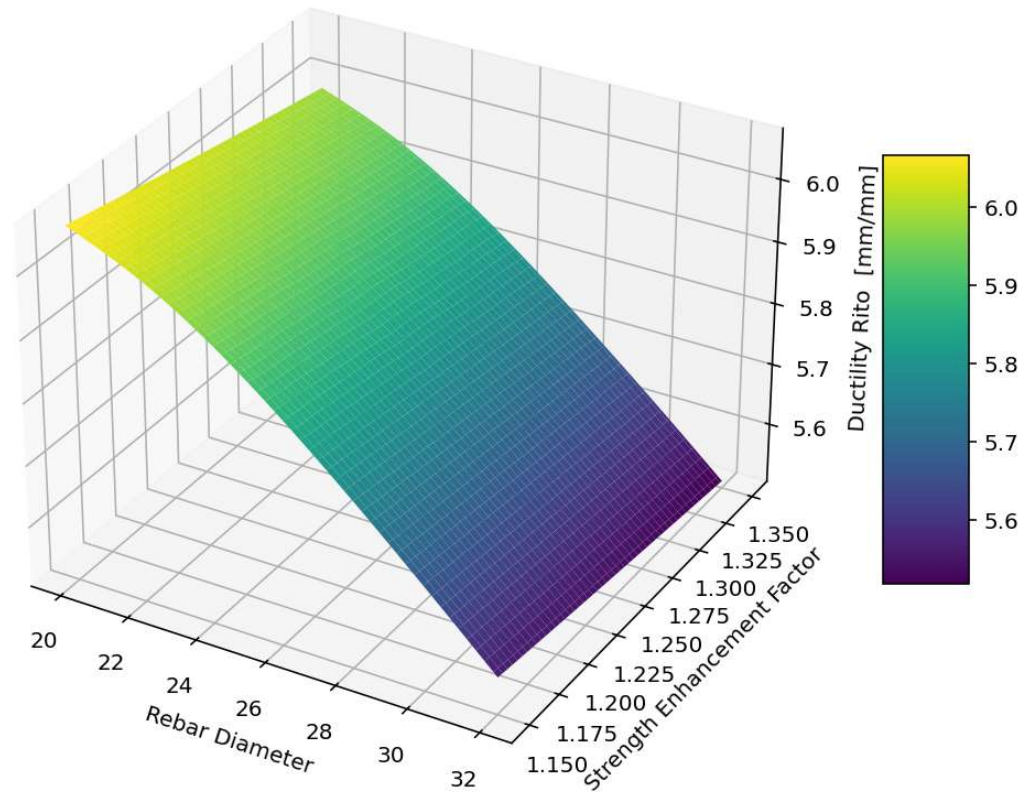
3D Contour Plot of Structure Elastic Stiffness [N/mm]



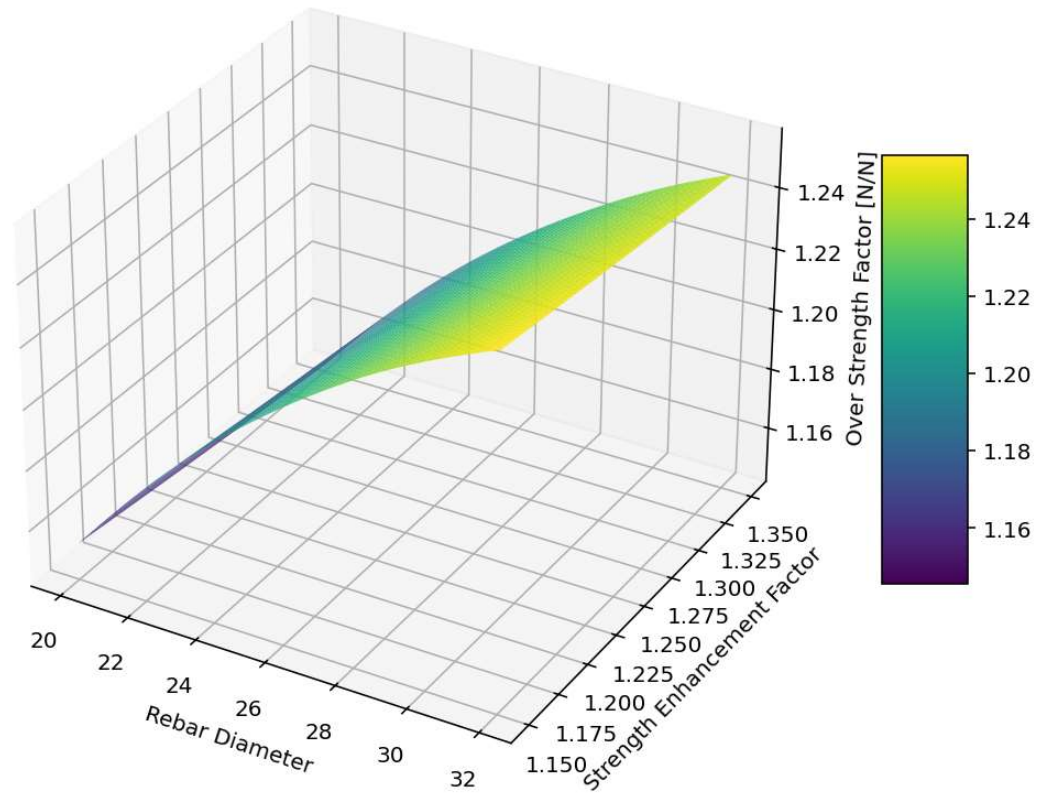
3D Contour Plot of Structure Plastic Stiffness [N/mm]



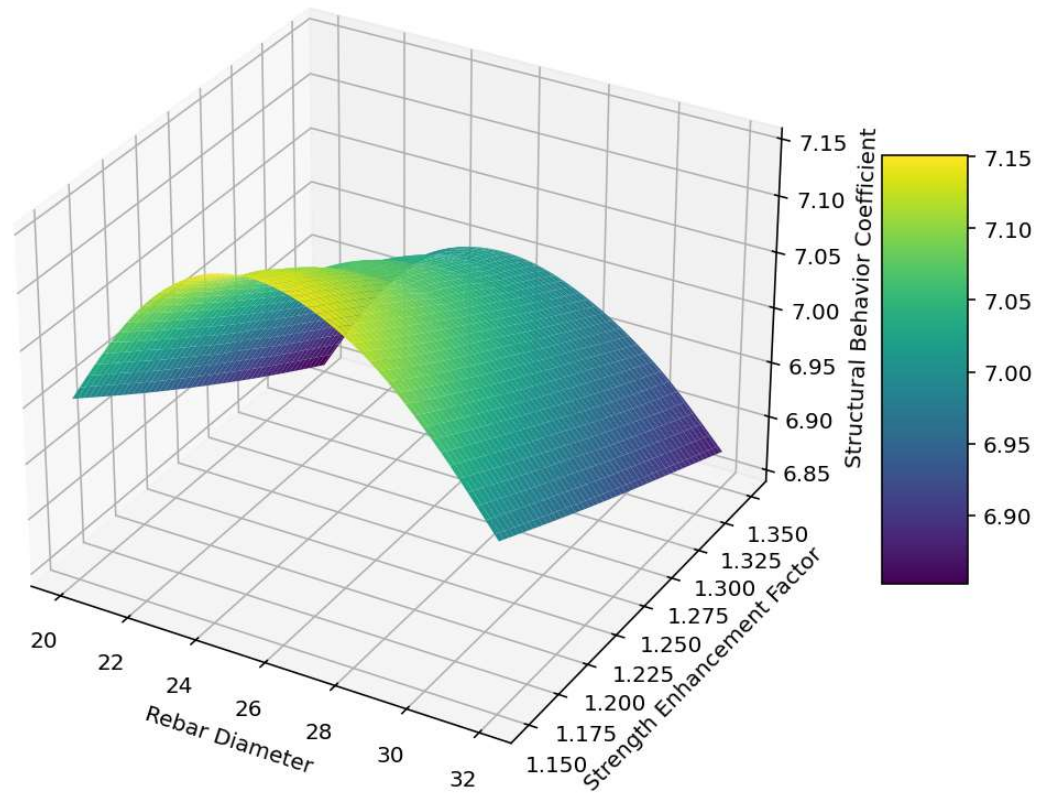
3D Contour Plot of Ductility Rito [mm/mm]



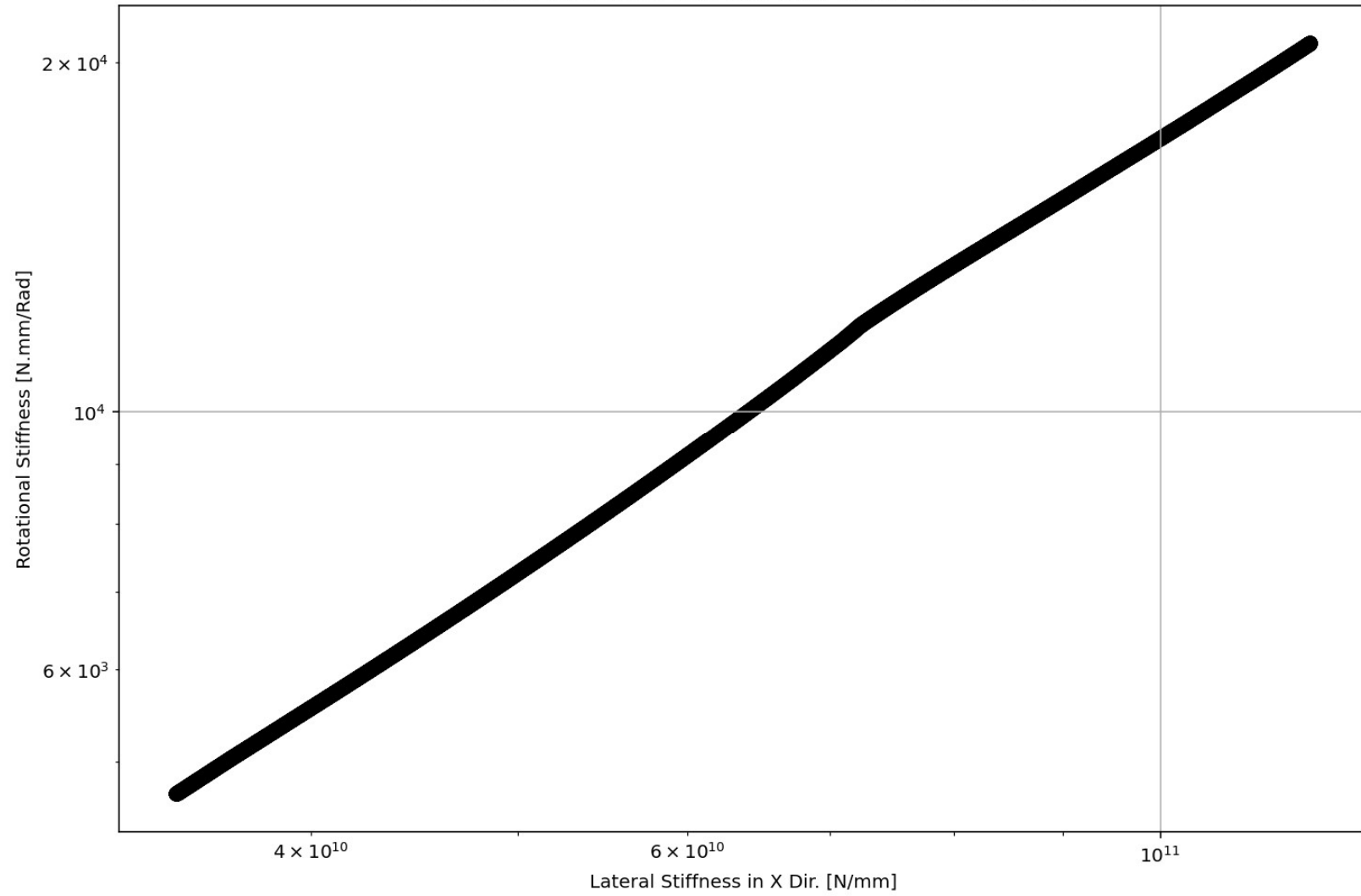
3D Contour Plot of Over Strength Factor [N/N]



3D Contour Plot of Structural Behavior Coefficient



ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM (X Dir)



ROTATIONAL STIFFNESS-LATERAL STIFFNESS DIAGRAM (Y Dir)

