Bottom Tray Buckling - Using the "Detailed" Bottom Tray FEM:

Assembly View of Buckling Analysis Model:

Loading Applied at Static Test Location representing effective CG of Tower

Applied Load at Effective CG Location:

\[ F_{\text{applied}} := 1000 \text{N} \]

Results of Buckling Analysis:

First Buckling Eigenvalue (from NASTRAN Run):

\[ \text{Eigenvalue}_1 := 37.14 \]
Buckling Results Cont.

Buckling Capability of Bottom Tray Assembly:

\[ F_{b,\text{capability}} := F_{\text{applied}} \cdot \text{Eigenvalue}_1 \]

\[ F_{b,\text{capability}} = 37140 \, \text{N} \]

Capability In terms of G's:

\[ W_{\text{tower}} := 32.48 \, \text{kg} \]

\[ G_{\text{buckling_assy}} := \frac{F_{b,\text{capability}}}{W_{\text{tower}}} \quad G_{\text{buckling_assy}} = 116.6 \, \text{g} \]

Maximum Expected G's during Random Vibe in Lateral Direction:

\[ G_{\text{max}} := 27 \, \text{g} \]

Margin of Safety to Buckling:

\[ M_{S_{\text{buckling_assy}}} := \frac{G_{\text{buckling_assy}}}{G_{\text{max}} \cdot 1.4 \cdot 1.15} - 1 \quad M_{S_{\text{buckling_assy}}} = 1.68 \]

The Side Flexure Buckling is not shown to be the critical buckling mode, also only the first 3 buckling modes were run due to the long run time for solving a buckling solution with 700,000 DOF model.

To determine the Side Flexure Buckling capability a detailed small model was used and the Maximum Loads at the Side Flexure from the Random Analysis were applied.
Side Flexure Buckling - Individual Bracket FEM:

Maximum Loading on Flexure RV in Y:

\[ F_{\text{normal}} := 23N \]
\[ F_z := -1668N \]

Eigenvalue := 12.36

\[ MS_{RV,Y} := \frac{\text{Eigenvalue}}{1.4 \cdot 1.15} - 1 \]

\[ MS_{RV,Y} = 6.68 \]

This is with the Side Flexure Constrained in rotations at the Close-out Interface.
BUCKLING ANALYSIS - Maximum Compression Load combined with offset of .014 inches.

An analysis was run with an enforced displacement of .014 inches due to an offset from mis-alignment.

The view to the right shows the buckling mode for the first eigenvalue when under compression and combined with the .014 inch offset.

The first eigenvalue is:

\[ F_1 := 3.428 \]

this is smaller than the Eigenvalue of 5.14 without the enforced displacement.

\[ MS_{\text{corner}} := \frac{F_1}{1.4 \cdot 1.15} - 1 \]

For the Corner Bracket:

\[ MS_{\text{corner}} = 1.129 \]

For the Side Flexure:

\[ \text{Eigenvalue}_{\text{enf},\text{displ}} := 2.46 \]

\[ MS_{\text{side}} := \frac{\text{Eigenvalue}_{\text{enf},\text{displ}}}{1.4 \cdot 1.15} - 1 \]

\[ MS_{\text{side}} = 0.53 \]

Summary of Analysis Margins:

Corner Bracket: Min MS is when the Enforced Displacements are applied

\[ MS_{\text{min}} := 1.13 \]

Side Flexure: The unconstrained condition is a worst case scenario, the full assembly model shows that the minimum MS is at the Corner Bracket,

\[ MS_{\text{side}} = 0.53 \]

These Margins are worst case, when modelling a flexure by itself, they are sensitive to the boundary conditions.