

Detected Resonant Frequencies (0-200 Hz):

8  
16  
52  
68  
90  
128  
150  
188

Estimated Damping Ratios:

Mode near 8.00 Hz  $\rightarrow \zeta = 0.3750$   
Mode near 16.00 Hz  $\rightarrow \zeta = 0.1250$   
Mode near 52.00 Hz  $\rightarrow \zeta = 0.0577$   
Mode near 68.00 Hz  $\rightarrow \zeta = 0.0588$   
Mode near 90.00 Hz  $\rightarrow \zeta = 0.0444$   
Mode near 128.00 Hz  $\rightarrow \zeta = 0.0469$   
Mode near 150.00 Hz  $\rightarrow \zeta = 0.0267$

Normalized Mode Shapes (0-200 Hz):

Mode at 8.00 Hz:

X:  $0.096 \angle -3.0^\circ$   
Y:  $0.152 \angle 10.9^\circ$   
Z:  $1.000 \angle 176.7^\circ$

Mode at 16.00 Hz:

X:  $0.010 \angle -174.6^\circ$   
Y:  $0.142 \angle 9.3^\circ$   
Z:  $1.000 \angle 167.4^\circ$

Mode at 52.00 Hz:

X:  $0.042 \angle 57.4^\circ$   
Y:  $0.053 \angle -91.5^\circ$   
Z:  $1.000 \angle 50.1^\circ$

Mode at 68.00 Hz:

X:  $0.158 \angle 6.4^\circ$   
Y:  $0.415 \angle -89.1^\circ$

Z: 1.000∠-7.6°

Mode at 90.00 Hz:

X: 0.083∠126.1°

Y: 1.000∠-89.4°

Z: 0.115∠-31.4°

Mode at 128.00 Hz:

X: 0.019∠-157.1°

Y: 0.058∠-149.7°

Z: 1.000∠23.1°

Mode at 150.00 Hz:

X: 0.035∠-74.1°

Y: 0.123∠-147.7°

Z: 1.000∠11.5°

Mode at 188.00 Hz:

X: 0.225∠-76.6°

Y: 0.644∠-66.9°

Z: 1.000∠-18.4°

=== Modal Parameter Summary (0-200 Hz) ===

**Freq\_Hz Damping Phi\_X Phi\_Y Phi\_Z**

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8 0.375 0.095502-0.0049988i 0.14917+0.028603i -0.9983+0.058313i  
16 0.125 -0.0094736-0.00088821i 0.14046+0.022911i -0.97598+0.21787i  
52 0.057692 0.022693+0.035506i -0.0013893-0.052762i 0.64187+0.76681i  
68 0.058824 0.1571+0.017636i 0.0065708-0.41533i 0.99124-0.13205i  
90 0.044444 -0.048846+0.067038i 0.0098766-0.99995i 0.097808-0.059754i  
128 0.046875 -0.017496-0.0074082i -0.049693-0.029083i 0.91962+0.3928i  
150 0.026667 0.009534-0.033579i -0.10389-0.065734i 0.98002+0.19891i  
188 NaN 0.052179-0.21907i 0.25202-0.59217i 0.9487-0.31618i

Detected Resonant Frequencies (0-200 Hz):

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150  
188

Estimated Damping Ratios:

0.3750  
0.1250  
0.0577  
0.0588  
0.0444  
0.0469  
0.0267  
NaN

=== Modal Summary (0-200 Hz) ===

Mode 1: f=8.00 Hz, Damping=0.3750, k\_dyn\_X=4935267.49 N/m, k\_dyn\_Y=3107382.67 N/m, k\_dyn\_Z=471974.17 N/m  
Mode Shape (X,Y,Z): 0.096∠-3.0°, 0.152∠10.9°, 1.000∠176.7°  
Mode 2: f=16.00 Hz, Damping=0.1250, k\_dyn\_X=25249679.21 N/m, k\_dyn\_Y=1688125.17 N/m, k\_dyn\_Z=240254.91 N/m  
Mode Shape (X,Y,Z): 0.010∠-174.6°, 0.142∠9.3°, 1.000∠167.4°  
Mode 3: f=52.00 Hz, Damping=0.0577, k\_dyn\_X=98971127.28 N/m, k\_dyn\_Y=79015863.18 N/m, k\_dyn\_Z=4170515.03 N/m  
Mode Shape (X,Y,Z): 0.042∠57.4°, 0.053∠-91.5°, 1.000∠50.1°  
Mode 4: f=68.00 Hz, Damping=0.0588, k\_dyn\_X=238010198.90 N/m, k\_dyn\_Y=90584611.65 N/m, k\_dyn\_Z=37627334.23 N/m  
Mode Shape (X,Y,Z): 0.158∠6.4°, 0.415∠-89.1°, 1.000∠-7.6°  
Mode 5: f=90.00 Hz, Damping=0.0444, k\_dyn\_X=505987613.80 N/m, k\_dyn\_Y=41969837.15 N/m, k\_dyn\_Z=366175451.16 N/m  
Mode Shape (X,Y,Z): 0.083∠126.1°, 1.000∠-89.4°, 0.115∠-31.4°  
Mode 6: f=128.00 Hz, Damping=0.0469, k\_dyn\_X=740219076.76 N/m, k\_dyn\_Y=244261579.43 N/m, k\_dyn\_Z=14064095.39 N/m  
Mode Shape (X,Y,Z): 0.019∠-157.1°, 0.058∠-149.7°, 1.000∠23.1°  
Mode 7: f=150.00 Hz, Damping=0.0267, k\_dyn\_X=1287566289.81 N/m, k\_dyn\_Y=365595671.43 N/m, k\_dyn\_Z=44944741.25 N/m  
Mode Shape (X,Y,Z): 0.035∠-74.1°, 0.123∠-147.7°, 1.000∠11.5°  
Mode 8: f=188.00 Hz, Damping=NaN, k\_dyn\_X=463423170.15 N/m, k\_dyn\_Y=162162251.11

N/m,  $k_{\text{dyn\_Z}}=104361813.17 \text{ N/m}$

Mode Shape (X,Y,Z):  $0.225\angle-76.6^\circ$ ,  $0.644\angle-66.9^\circ$ ,  $1.000\angle-18.4^\circ$