

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: $0.152\angle10.9^\circ$
Z: $1.000\angle176.7^\circ$

Mode at 16.00 Hz:

X: $0.010\angle-174.6^\circ$
Y: $0.142\angle9.3^\circ$
Z: $1.000\angle167.4^\circ$

Mode at 52.00 Hz:

X: $0.042\angle57.4^\circ$
Y: $0.053\angle-91.5^\circ$
Z: $1.000\angle50.1^\circ$

Mode at 68.00 Hz:

X: $0.158\angle6.4^\circ$
Y: $0.415\angle-89.1^\circ$

Z: $1.000\angle-7.6^\circ$

Mode at 90.00 Hz:

X: $0.083\angle126.1^\circ$

Y: $1.000\angle-89.4^\circ$

Z: $0.115\angle-31.4^\circ$

Mode at 128.00 Hz:

X: $0.019\angle-157.1^\circ$

Y: $0.058\angle-149.7^\circ$

Z: $1.000\angle23.1^\circ$

Mode at 150.00 Hz:

X: $0.035\angle-74.1^\circ$

Y: $0.123\angle-147.7^\circ$

Z: $1.000\angle11.5^\circ$

Mode at 188.00 Hz:

X: $0.225\angle-76.6^\circ$

Y: $0.644\angle-66.9^\circ$

Z: $1.000\angle-18.4^\circ$

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

Freq_Hz Damping Phi_X Phi_Y Phi_Z

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

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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_dyn_Z=104361813.17 N/m

Mode Shape (X,Y,Z): 0.225∠-76.6°, 0.644∠-66.9°, 1.000∠-18.4°