Detected Resonant Frequencies (0-200 Hz):
16
52
82
90
120
148
188

Estimated Damping Ratios:
Mode near 16.00 Hz → ζ = 0.1250
Mode near 52.00 Hz → ζ = 0.0385
Mode near 82.00 Hz → ζ = 0.0244
Mode near 90.00 Hz → ζ = 0.0444
Mode near 120.00 Hz → ζ = 0.0417
Mode near 148.00 Hz → ζ = 0.0270

Normalized Mode Shapes (0-200 Hz):

Mode at 16.00 Hz:
X: 0.015∠178.9°
Y: 0.085∠29.0°
Z: 1.000∠169.7°

Mode at 52.00 Hz:
X: 0.066∠50.0°
Y: 0.040∠48.2°
Z: 1.000∠44.3°

Mode at 82.00 Hz:
X: 0.739∠-92.6°
Y: 0.130∠80.6°
Z: 1.000∠54.2°

Mode at 90.00 Hz:
X: 0.506∠-176.9°
Y: 1.000∠1.9°
Z: 0.792∠10.3°

Mode at 120.00 Hz:
X: 0.004∠-113.6°
Y: 0.072∠72.9°
Z: 1.000∠87.7°

Mode at 148.00 Hz:
X: 0.044∠-44.7°
Y: 0.230∠-62.8°
Z: 1.000∠16.9°

Mode at 188.00 Hz:
X: 0.341∠-87.2°
Y: 0.637∠-70.1°
Z: 1.000∠-3.0°
=== Modal Parameter Summary (0-200 Hz) ===

Freq_Hz	Damping	Phi_X	Phi_Y	Phi_Z
16	0.125	-0.014615+0.00028988i	0.074631+0.04144i	-0.98384+0.17908i
52	0.038462	0.042592+0.050771i	0.026988+0.030174i	0.71579+0.69831i
82	0.02439	-0.033447-0.73831i	0.021201+0.12845i	0.58515+0.81092i
90	0.044444	-0.50478-0.027661i	0.99943+0.033848i	0.77897+0.14181i
120	0.041667	-0.0016978-0.0038913i	0.021014+0.068506i	0.040067+0.9992i
148	0.027027	0.031157-0.030784i	0.10552-0.20491i	0.95664+0.29128i
188	NaN	0.016764-0.34064i	0.21705-0.59865i	0.99861-0.052688i

Detected Resonant Frequencies (0-200 Hz):
16
52
82
90
120
148
188

Estimated Damping Ratios:
0.1250
0.0385
0.0244

0.0444
0.0417
0.0270
NaN

=== Modal Summary (0-200 Hz) ===
Mode 1: f=16.00 Hz, Damping=0.1250, k_dyn_X=16753947.96 N/m, k_dyn_Y=2868967.00 N/m, k_dyn_Z=244907.68 N/m
Mode Shape (X,Y,Z): 0.015∠178.9°, 0.085∠29.0°, 1.000∠169.7°
Mode 2: f=52.00 Hz, Damping=0.0385, k_dyn_X=95442128.84 N/m, k_dyn_Y=156239742.70 N/m, k_dyn_Z=6324974.21 N/m
Mode Shape (X,Y,Z): 0.066∠50.0°, 0.040∠48.2°, 1.000∠44.3°
Mode 3: f=82.00 Hz, Damping=0.0244, k_dyn_X=40399357.49 N/m, k_dyn_Y=229337689.86 N/m, k_dyn_Z=29857974.59 N/m
Mode Shape (X,Y,Z): 0.739∠-92.6°, 0.130∠80.6°, 1.000∠54.2°
Mode 4: f=90.00 Hz, Damping=0.0444, k_dyn_X=551359658.91 N/m, k_dyn_Y=278734493.04 N/m, k_dyn_Z=352037164.99 N/m
Mode Shape (X,Y,Z): 0.506∠-176.9°, 1.000∠1.9°, 0.792∠10.3°
Mode 5: f=120.00 Hz, Damping=0.0417, k_dyn_X=1215268022.09 N/m, k_dyn_Y=72003388.29 N/m, k_dyn_Z=5159501.54 N/m
Mode Shape (X,Y,Z): 0.004∠-113.6°, 0.072∠72.9°, 1.000∠87.7°
Mode 6: f=148.00 Hz, Damping=0.0270, k_dyn_X=901464892.72 N/m, k_dyn_Y=171311248.25 N/m, k_dyn_Z=39483900.09 N/m
Mode Shape (X,Y,Z): 0.044∠-44.7°, 0.230∠-62.8°, 1.000∠16.9°
Mode 7: f=188.00 Hz, Damping=NaN, k_dyn_X=383169779.87 N/m, k_dyn_Y=205218933.21 N/m, k_dyn_Z=130680673.21 N/m
Mode Shape (X,Y,Z): 0.341∠-87.2°, 0.637∠-70.1°, 1.000∠-3.0°