

Detected Resonant Frequencies (0-200 Hz):

52  
82  
124  
146  
186

Estimated Damping Ratios:

Mode near 52.00 Hz  $\rightarrow \zeta = 0.0577$   
Mode near 82.00 Hz  $\rightarrow \zeta = 0.0366$   
Mode near 124.00 Hz  $\rightarrow \zeta = 0.0484$   
Mode near 146.00 Hz  $\rightarrow \zeta = 0.0274$   
Mode near 186.00 Hz  $\rightarrow \zeta = 0.0376$

Normalized Mode Shapes (0-200 Hz):

Mode at 52.00 Hz:

X:  $0.072 \angle -138.4^\circ$   
Y:  $0.040 \angle 36.1^\circ$   
Z:  $1.000 \angle 34.0^\circ$

Mode at 82.00 Hz:

X:  $0.133 \angle -118.5^\circ$   
Y:  $0.035 \angle -107.6^\circ$   
Z:  $1.000 \angle -128.7^\circ$

Mode at 124.00 Hz:

X:  $0.070 \angle -145.4^\circ$   
Y:  $0.104 \angle 50.1^\circ$   
Z:  $1.000 \angle -132.0^\circ$

Mode at 146.00 Hz:

X:  $0.101 \angle -135.2^\circ$   
Y:  $1.000 \angle -63.2^\circ$   
Z:  $0.718 \angle -145.2^\circ$

Mode at 186.00 Hz:

X:  $0.274 \angle 166.5^\circ$   
Y:  $0.640 \angle 134.2^\circ$

Z: 1.000∠152.6°

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

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

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52	0.057692	-0.053543-0.047564i	0.032438+0.023631i	0.82859+0.55985i
82	0.036585	-0.063379-0.11668i	-0.010432-0.032965i	-0.6247-0.78087i
124	0.048387	-0.057491-0.039686i	0.066447+0.079408i	-0.66861-0.74361i
146	0.027397	-0.071823-0.071425i	0.45097-0.89254i	-0.5898-0.40991i
186	0.037634	-0.26636+0.063717i	-0.44623+0.45877i	-0.8879+0.46004i

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Estimated Damping Ratios:

0.0577  
0.0366  
0.0484  
0.0274  
0.0376

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

Mode 1: f=52.00 Hz, Damping=0.0577, k\_dyn\_X=35875137.23 N/m, k\_dyn\_Y=64020797.02 N/m, k\_dyn\_Z=2569322.03 N/m

Mode Shape (X,Y,Z): 0.072∠-138.4°, 0.040∠36.1°, 1.000∠34.0°

Mode 2: f=82.00 Hz, Damping=0.0366, k\_dyn\_X=52577512.79 N/m, k\_dyn\_Y=201907161.86 N/m, k\_dyn\_Z=6981200.86 N/m

Mode Shape (X,Y,Z): 0.133∠-118.5°, 0.035∠-107.6°, 1.000∠-128.7°

Mode 3: f=124.00 Hz, Damping=0.0484, k\_dyn\_X=133340371.74 N/m, k\_dyn\_Y=89964023.67 N/m, k\_dyn\_Z=9314976.07 N/m

Mode Shape (X,Y,Z): 0.070∠-145.4°, 0.104∠50.1°, 1.000∠-132.0°

Mode 4: f=146.00 Hz, Damping=0.0274, k\_dyn\_X=443624737.76 N/m, k\_dyn\_Y=44935678.33 N/m, k\_dyn\_Z=62562402.44 N/m

Mode Shape (X,Y,Z): 0.101∠-135.2°, 1.000∠-63.2°, 0.718∠-145.2°

Mode 5:  $f=186.00$  Hz, Damping= $0.0376$ ,  $k_{\text{dyn\_X}}=546162749.70$  N/m,  
 $k_{\text{dyn\_Y}}=233720003.30$  N/m,  $k_{\text{dyn\_Z}}=149579716.95$  N/m  
Mode Shape (X,Y,Z):  $0.274\angle 166.5^\circ$ ,  $0.640\angle 134.2^\circ$ ,  $1.000\angle 152.6^\circ$