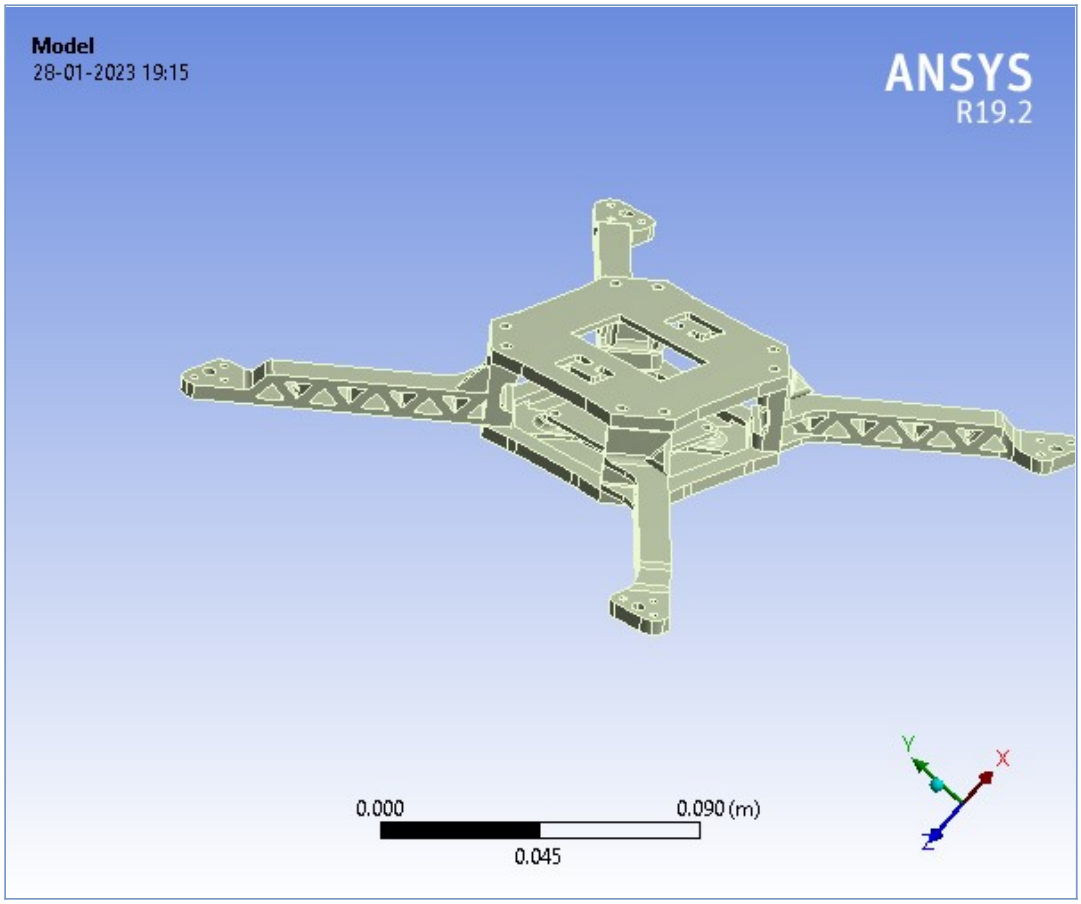
Project

First Saved	Saturday, January 28, 2023
Last Saved	Saturday, January 28, 2023
Product Version	19.2 Release
Save Project Before Solution	No
Save Project After Solution	No



Contents

Units

TABLE 1

Unit System	Metric (m, kg, N, s, V, A) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

Model (A4)

Geometry

TABLE 2
Model (A4) > Geometry

Object Name	*Geometry*
State	Fully Defined
Definition	
Source	C:\Users\Shankar Naik\AppData\Local\Temp\WB_LAPTOP-V72I8C3K_Shankar Naik_27480_2\unsaved_project_files\dp0\SYS\DM\SYS.agdb
Type	DesignModeler
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	
Length X	0.12591 m
Length Y	0.20512 m
Length Z	0.21057 m
Properties	
Volume	5.4342e-005 m³
Mass	0.15053 kg

Scale Factor Value	1.
Statistics	
Bodies	11
Active Bodies	11
Nodes	115928
Elements	61501
Mesh Metric	None
Update Options	
Assign Default Material	No
Basic Geometry Options	
Parameters	Independent
Parameter Key	
Attributes	Yes
Attribute Key	
Named Selections	Yes
Named Selection Key	
Material Properties	Yes
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	Yes
Coordinate System Key	
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Clean Bodies On Import	No
Stitch Surfaces On Import	No
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

TABLE 3
Model (A4) > Geometry > Parts

Object Name	*arm*	*arm*	*arm*	*arm*	*arm*	*arm*	*part2 base*	*arm*	*arm*	*part 11 box*	*part 1 base*
State	Meshed										
Graphics Properties											
Visible	Yes										
Transparency	1										
Definition											
Suppressed	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperature	By Environment										
Behavior	None										
Material											
Assignment	Aluminum Alloy										
Nonlinear Effects	Yes										
Thermal Strain Effects	Yes										
Bounding Box											
Length X	4.0044e-002 m	7.7678e-003 m	5.1463e-002 m	9.74e-003 m	6.4119e-002 m	1.0324e-002 m	4.8785e-002 m	5.2701e-002 m	9.8279e-003 m	2.467e-002 m	4.8397e-002 m

Length Y	8.712e-002 m	1.0539e-002 m	5.1952e-002 m	7.9156e-003 m	4.4015e-002 m	9.8104e-003 m	7.498e-002 m	7.9183e-002 m	7.7942e-003 m	4.0685e-002 m	7.5104e-002 m
Length Z	5.9496e-002 m	9.7878e-003 m	8.6109e-002 m	9.0412e-003 m	8.1978e-002 m	7.7709e-003 m	7.9494e-002 m	6.3627e-002 m	9.5272e-003 m	4.201e-002 m	7.9864e-002 m
Properties											
Volume	7.4036e-006 m³	1.579e-007 m³	7.4035e-006 m³	1.579e-007 m³	7.4035e-006 m³	1.579e-007 m³	1.1024e-005 m³	7.4035e-006 m³	1.579e-007 m³	2.2191e-006 m³	1.0853e-005 m³
Mass	2.0508e-002 kg	4.3739e-004 kg	2.0508e-002 kg	4.3739e-004 kg	2.0508e-002 kg	4.3739e-004 kg	3.0536e-002 kg	2.0508e-002 kg	4.3738e-004 kg	6.147e-003 kg	3.0063e-002 kg
Centroid X	-5.6225e-002 m	-6.1269e-002 m	-4.5578e-002 m	-5.0366e-002 m	-0.11254 m	-9.6618e-002 m	-6.5877e-002 m	-0.1019 m	-8.5714e-002 m	-8.3626e-002 m	-8.5934e-002 m
Centroid Y	0.1191 m	0.14419 m	0.15078 m	0.15877 m	0.19827 m	0.19726 m	0.18314 m	0.22995 m	0.21185 m	0.17164 m	0.17021 m
Centroid Z	0.23192 m	0.23908 m	0.32541 m	0.30052 m	0.2115 m	0.23276 m	0.26359 m	0.30499 m	0.29419 m	0.27 m	0.2707 m
Moment of Inertia Ip1	1.7071e-005 kg·m²	3.2295e-009 kg·m²	1.7148e-005 kg·m²	2.3208e-009 kg·m²	1.7069e-005 kg·m²	2.1348e-009 kg·m²	3.052e-005 kg·m²	1.707e-005 kg·m²	2.1338e-009 kg·m²	1.2922e-006 kg·m²	2.8066e-005 kg·m²
Moment of Inertia Ip2	7.559e-007 kg·m²	2.1344e-009 kg·m²	1.7071e-005 kg·m²	3.2348e-009 kg·m²	1.7147e-005 kg·m²	2.3199e-009 kg·m²	1.514e-005 kg·m²	7.5555e-007 kg·m²	3.2283e-009 kg·m²	6.4999e-007 kg·m²	1.4069e-005 kg·m²
Moment of Inertia Ip3	1.7148e-005 kg·m²	2.3122e-009 kg·m²	7.559e-007 kg·m²	2.1413e-009 kg·m²	7.5562e-007 kg·m²	3.2369e-009 kg·m²	1.5453e-005 kg·m²	1.7147e-005 kg·m²	2.3142e-009 kg·m²	6.4487e-007 kg·m²	1.407e-005 kg·m²
Statistics											
Nodes	16431	386	16375	412	16400	386	20395	16275	379	5926	22563
Elements	8910	178	8875	198	8904	178	10644	8803	173	2844	11794
Mesh Metric	None										

Coordinate Systems

TABLE 4
Model (A4) > Coordinate Systems > Coordinate System

Object Name	*Global Coordinate System*
State	Fully Defined
Definition	
Type	Cartesian
Coordinate System ID	0.
Origin	
Origin X	0. m
Origin Y	0. m
Origin Z	0. m
Directional Vectors	
X Axis Data	[1. 0. 0.]
Y Axis Data	[0. 1. 0.]
Z Axis Data	[0. 0. 1.]

Connections

TABLE 5
Model (A4) > Connections

Object Name	*Connections*
State	Fully Defined
Auto Detection	
Generate Automatic Connection On Refresh	Yes
Transparency	
Enabled	Yes

TABLE 6
Model (A4) > Connections > Contacts

Object Name	*Contacts*
State	Fully Defined
Definition	
Connection Type	Contact
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Auto Detection	
Tolerance Type	Slider
Tolerance Slider	0.
Tolerance Value	7.9947e-004 m
Use Range	No
Face/Face	Yes
Face Overlap Tolerance	Off
Cylindrical Faces	Include
Face/Edge	No
Edge/Edge	No
Priority	Include All
Group By	Bodies
Search Across	Bodies
Statistics	
Connections	13
Active Connections	13

TABLE 7
Model (A4) > Connections > Contacts > Contact Regions

Object Name	*Contact Region*	*Contact Region 2*	*Contact Region 3*	*Contact Region 4*	*Contact Region 5*	*Contact Region 6*	*Contact Region 7*	*Contact Region 8*	*Contact Region 9*	*Contact Region 10*	*Contact Region 11*
State	Fully Defined										
Scope											
Scoping Method	Geometry Selection										
Contact	3 Faces	1 Face		3 Faces	1 Face		3 Faces	1 Face			3 Faces
Target	4 Faces	1 Face		4 Faces	1 Face		4 Faces	1 Face			4 Faces
Contact Bodies	arm									part2 base	arm
Target Bodies	arm	part2 base	part 1 base	arm	part2 base	part 1 base	arm	part2 base	part 1 base	arm	
Protected	No										
Definition											
Type	Bonded										
Scope Mode	Automatic										
Behavior	Program Controlled										
Trim Contact	Program Controlled										
Trim Tolerance	7.9947e-004 m										
Suppressed	No										
Advanced											
Formulation	Program Controlled										
Small Sliding	Program Controlled										
Detection Method	Program Controlled										
Penetration Tolerance	Program Controlled										
Elastic Slip Tolerance	Program Controlled										
Normal Stiffness	Program Controlled										
Update Stiffness	Program Controlled										

Pinball Region	Program Controlled
Geometric Modification	
Contact Geometry Correction	None
Target Geometry Correction	None

TABLE 8
Model (A4) > Connections > Contacts > Contact Regions

Object Name	*Contact Region 12*	*Contact Region 13*
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Contact	1 Face	
Target	1 Face	4 Faces
Contact Bodies	arm	part 11 box
Target Bodies	part 1 base	
Protected	No	
Definition		
Type	Bonded	
Scope Mode	Automatic	
Behavior	Program Controlled	
Trim Contact	Program Controlled	
Trim Tolerance	7.9947e-004 m	
Suppressed	No	
Advanced		
Formulation	Program Controlled	
Small Sliding	Program Controlled	
Detection Method	Program Controlled	
Penetration Tolerance	Program Controlled	
Elastic Slip Tolerance	Program Controlled	
Normal Stiffness	Program Controlled	
Update Stiffness	Program Controlled	
Pinball Region	Program Controlled	
Geometric Modification		
Contact Geometry Correction	None	
Target Geometry Correction	None	

Mesh

TABLE 9
Model (A4) > Mesh

Object Name	*Mesh*
State	Solved
Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	1.e-003 m
Sizing	
Use Adaptive Sizing	Yes
Resolution	Default (2)
Mesh Defeaturing	Yes
Defeature Size	Default
Transition	Fast
Span Angle Center	Coarse

Initial Size Seed	Assembly
Bounding Box Diagonal	0.31979 m
Average Surface Area	6.7103e-005 m²
Minimum Edge Length	1.1399e-004 m
Quality	
Check Mesh Quality	Yes, Errors
Error Limits	Standard Mechanical
Target Quality	Default (0.050000)
Smoothing	Medium
Mesh Metric	None
Inflation	
Use Automatic Inflation	None
Inflation Option	Smooth Transition
Transition Ratio	0.272
Maximum Layers	5
Growth Rate	1.2
Inflation Algorithm	Pre
View Advanced Options	No
Advanced	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Number of Retries	Default (4)
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled
Topology Checking	Yes
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
Statistics	
Nodes	115928
Elements	61501

TABLE 10
Model (A4) > Mesh > Mesh Controls

Object Name	*Face Sizing*
State	Fully Defined
Scope	
Scoping Method	Geometry Selection
Geometry	745 Faces
Definition	
Suppressed	No
Type	Element Size
Element Size	2.e-003 m
Advanced	
Defeature Size	Default
Behavior	Soft

Static Structural (A5)

TABLE 11
Model (A4) > Analysis

Object Name	*Static Structural (A5)*
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22. °C
Generate Input Only	No

TABLE 12
Model (A4) > Static Structural (A5) > Analysis Settings

Object Name	*Analysis Settings*
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off
Rotordynamics Controls	
Coriolis Effect	Off
Restart Controls	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
Nonlinear Controls	
Newton-Raphson Option	Program Controlled
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
Stabilization	Off
Output Controls	
Stress	Yes
Strain	Yes
Nodal Forces	No
Contact Miscellaneous	No
General Miscellaneous	No
Store Results At	All Time Points
Analysis Data Management	
Solver Files Directory	C:\Users\Shankar Naik\AppData\Local\Temp\WB_LAPTOP-V72I8C3K_Shankar Naik_27480_2\unsaved_project_files\dp0\SYS\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	No
Solver Units	Active System
Solver Unit System	mks

TABLE 13
Model (A4) > Static Structural (A5) > Loads

Object Name	*Force*	*Force 2*	*Force 3*	*Force 4*	*Force 5*	*Force 6*	*Force 7*	*Force 8*	*Fixed Support*
State	Fully Defined								
Scope									
Scoping Method	Geometry Selection								
Geometry	1 Face								

Definition			
Type	Force		Fixed Support
Define By	Vector		
Magnitude	2050. N (ramped)	700. N (ramped)	
Direction	Defined		
Suppressed	No		

FIGURE 1
Model (A4) > Static Structural (A5) > Force

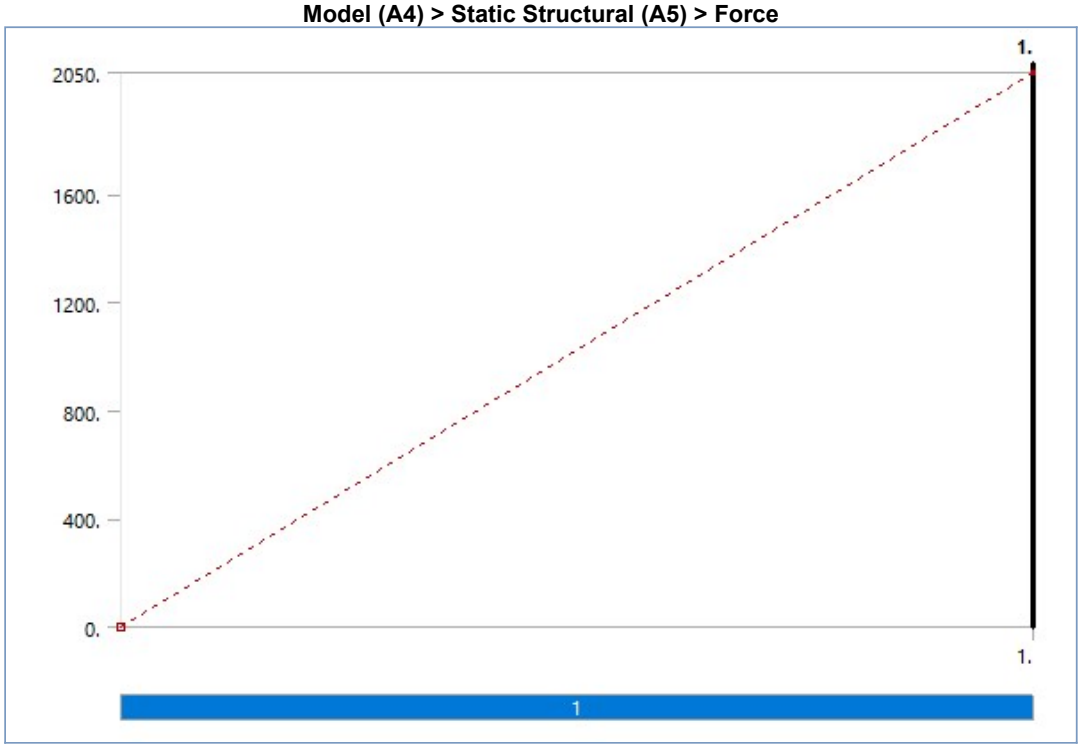


FIGURE 2
Model (A4) > Static Structural (A5) > Force 2

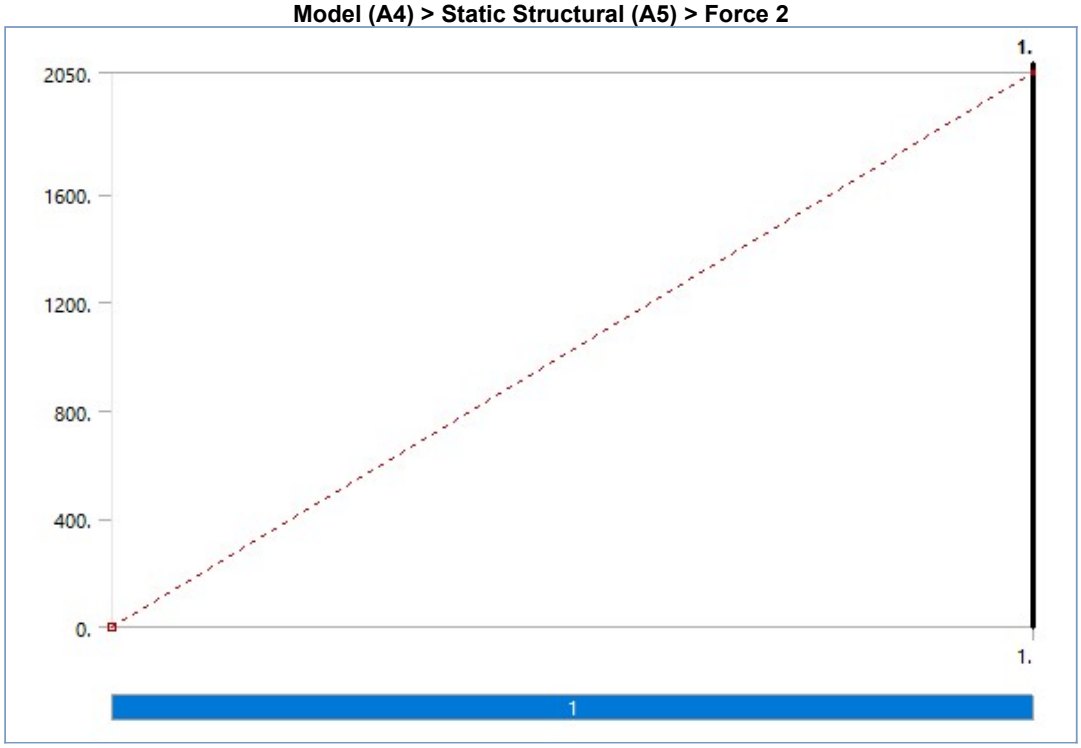


FIGURE 3
Model (A4) > Static Structural (A5) > Force 3

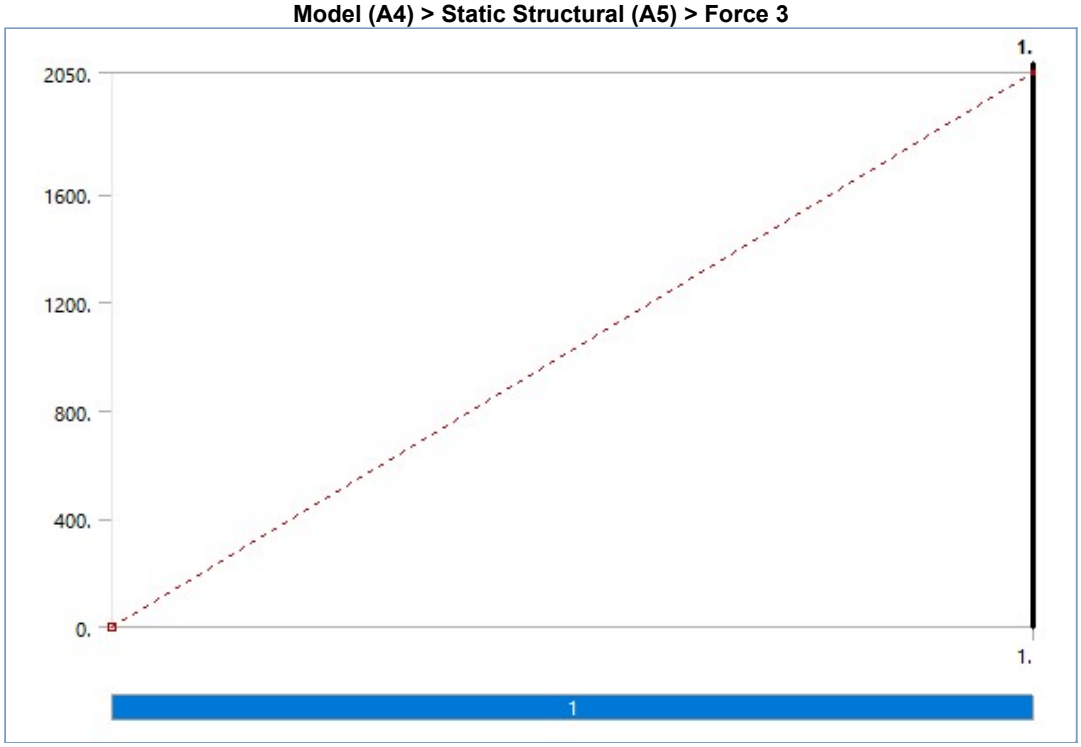


FIGURE 4
Model (A4) > Static Structural (A5) > Force 4

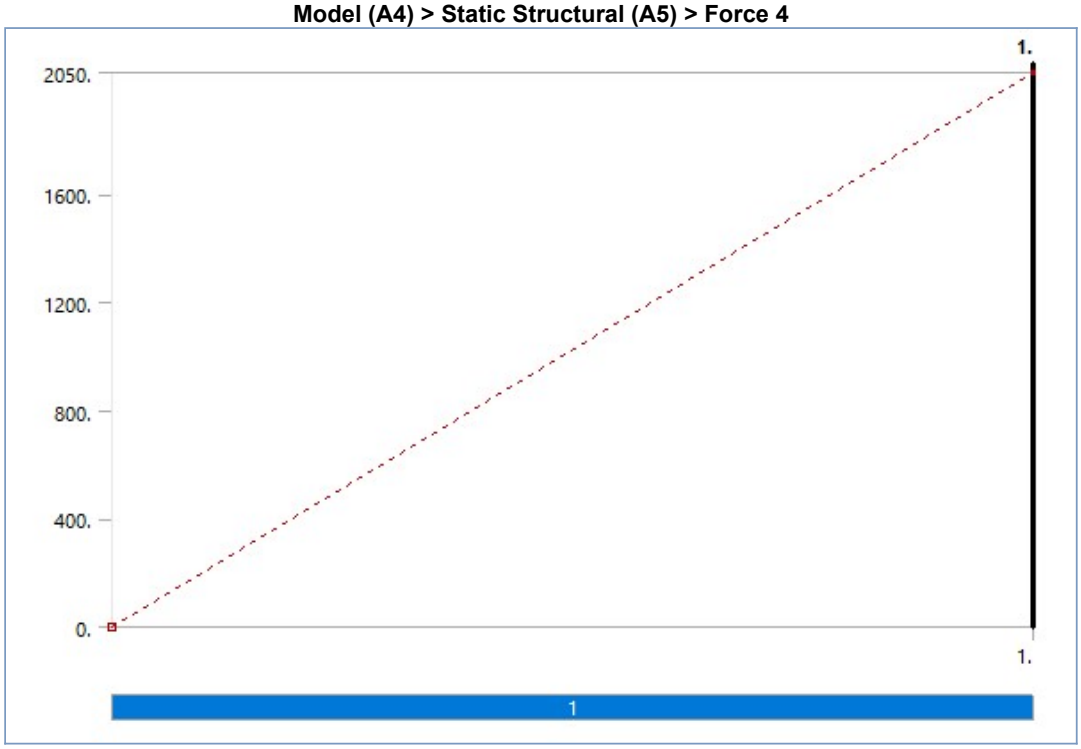


FIGURE 5
Model (A4) > Static Structural (A5) > Force 5

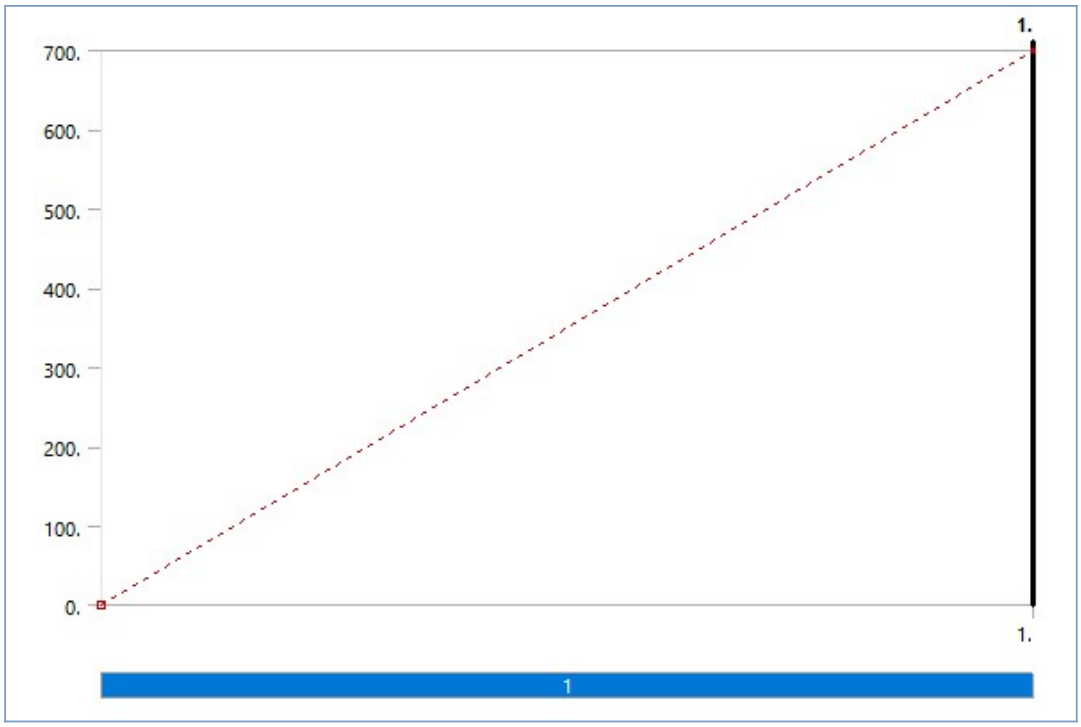


FIGURE 6
Model (A4) > Static Structural (A5) > Force 6

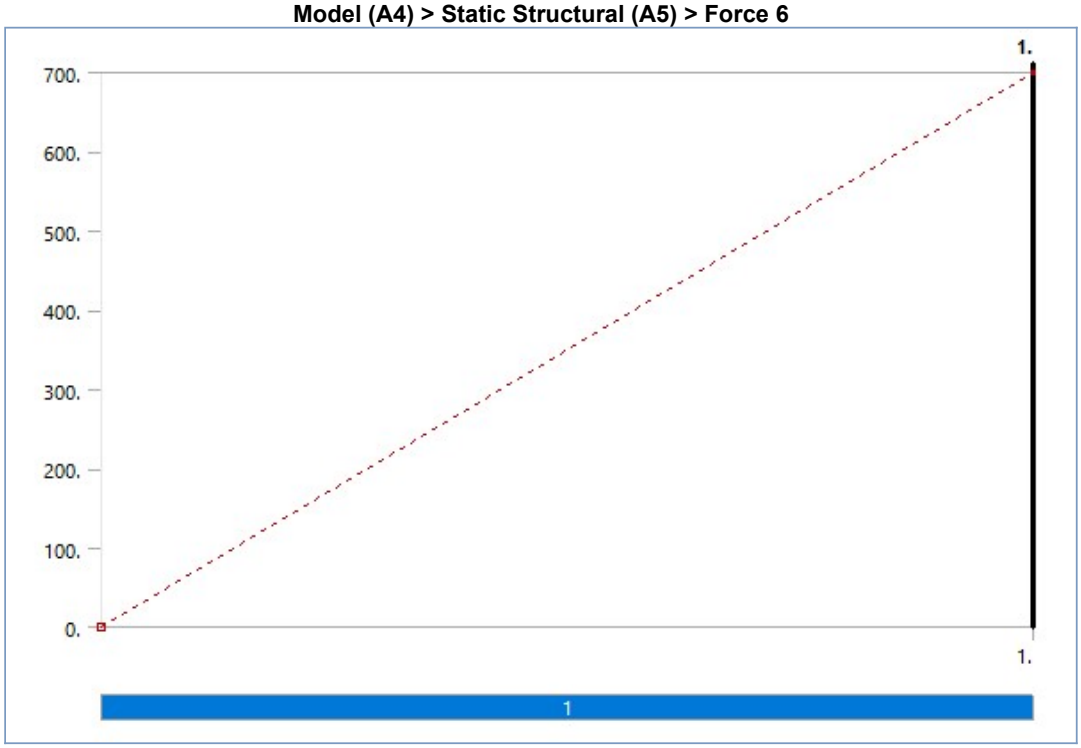


FIGURE 7
Model (A4) > Static Structural (A5) > Force 7

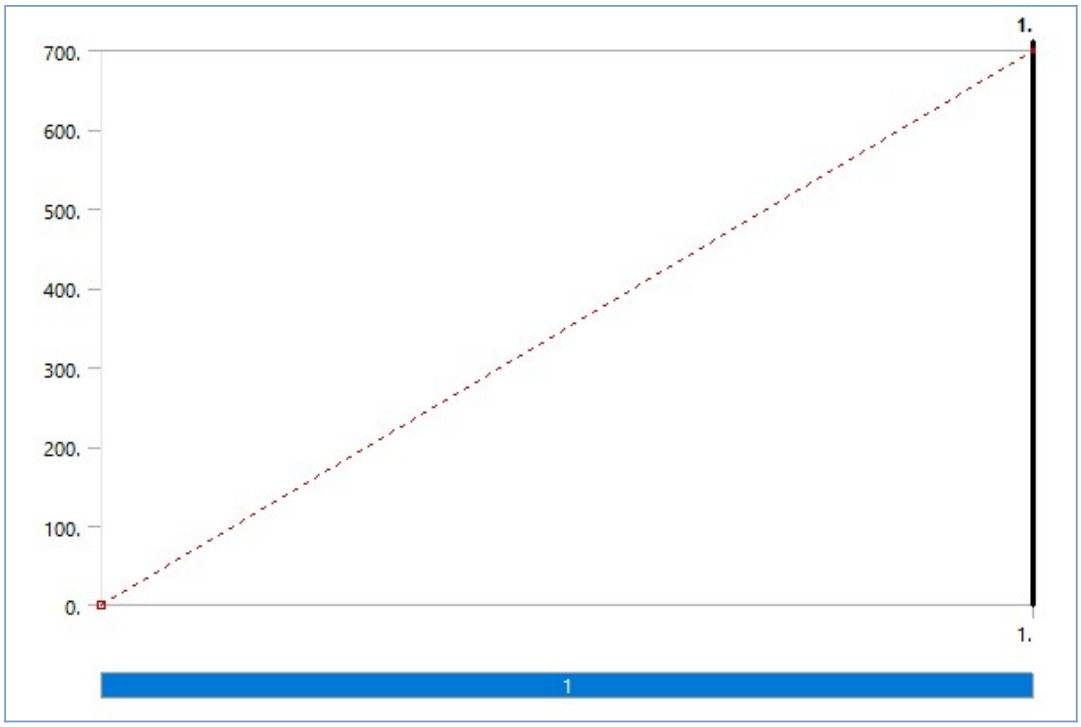
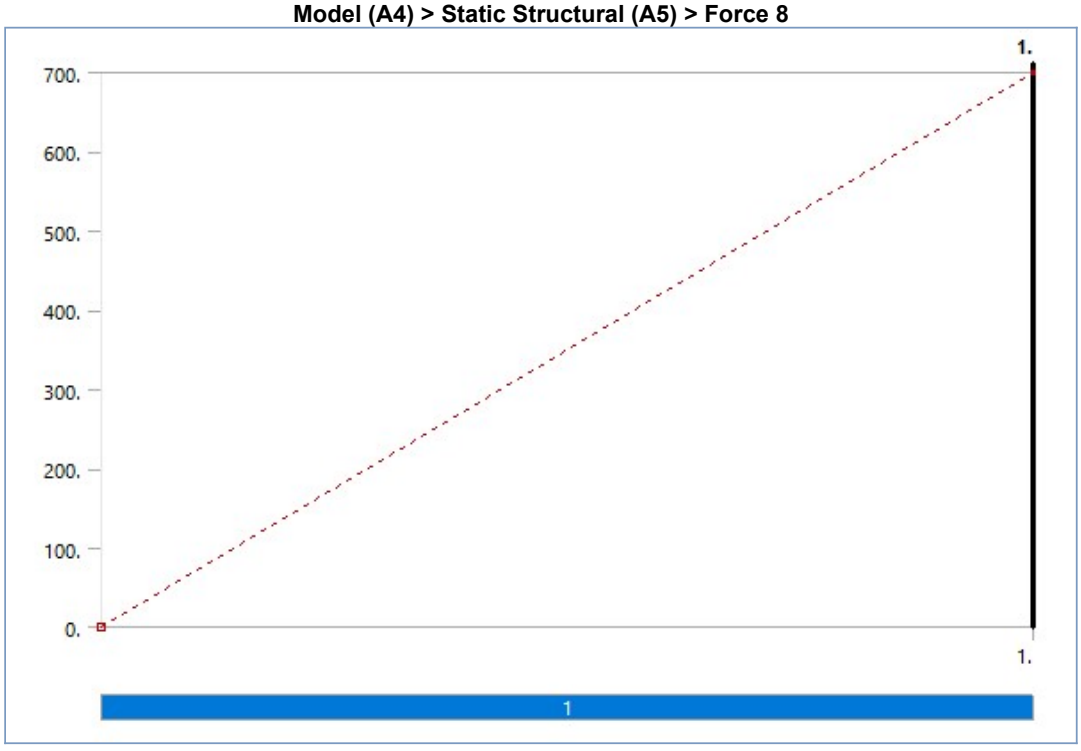


FIGURE 8
Model (A4) > Static Structural (A5) > Force 8



Solution (A6)

TABLE 14
Model (A4) > Static Structural (A5) > Solution

Object Name	*Solution (A6)*
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1.

Refinement Depth	2.
Information	
Status	Done
MAPDL Elapsed Time	15. s
MAPDL Memory Used	588. MB
MAPDL Result File Size	51.688 MB
Post Processing	
Beam Section Results	No
On Demand Stress/Strain	No

TABLE 15
Model (A4) > Static Structural (A5) > Solution (A6) > Solution Information

Object Name	*Solution Information*
State	Solved
Solution Information	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2.5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

TABLE 16
Model (A4) > Static Structural (A5) > Solution (A6) > Results

Object Name	*Total Deformation*	*Directional Deformation*
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Total Deformation	Directional Deformation
By	Time	
Display Time	Last	
Calculate Time History	Yes	
Identifier		
Suppressed	No	
Orientation		Z Axis
Coordinate System		Global Coordinate System
Results		
Minimum	0. m	-2.7677e-003 m
Maximum	8.1104e-003 m	1.8995e-004 m
Average	1.2625e-003 m	-3.3191e-004 m
Minimum Occurs On	part 1 base	arm
Maximum Occurs On	arm	
Information		
Time	1. s	
Load Step	1	
Substep	1	
Iteration Number	1	

FIGURE 9
Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation

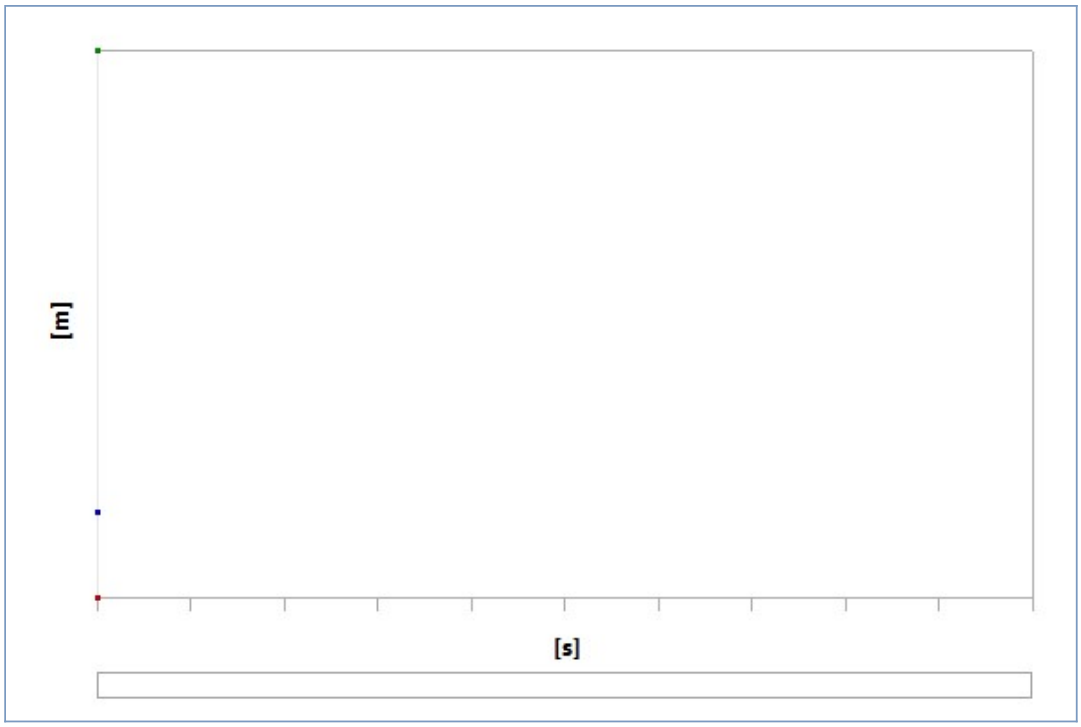


TABLE 17
Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	0.	8.1104e-003	1.2625e-003

FIGURE 10
Model (A4) > Static Structural (A5) > Solution (A6) > Directional Deformation

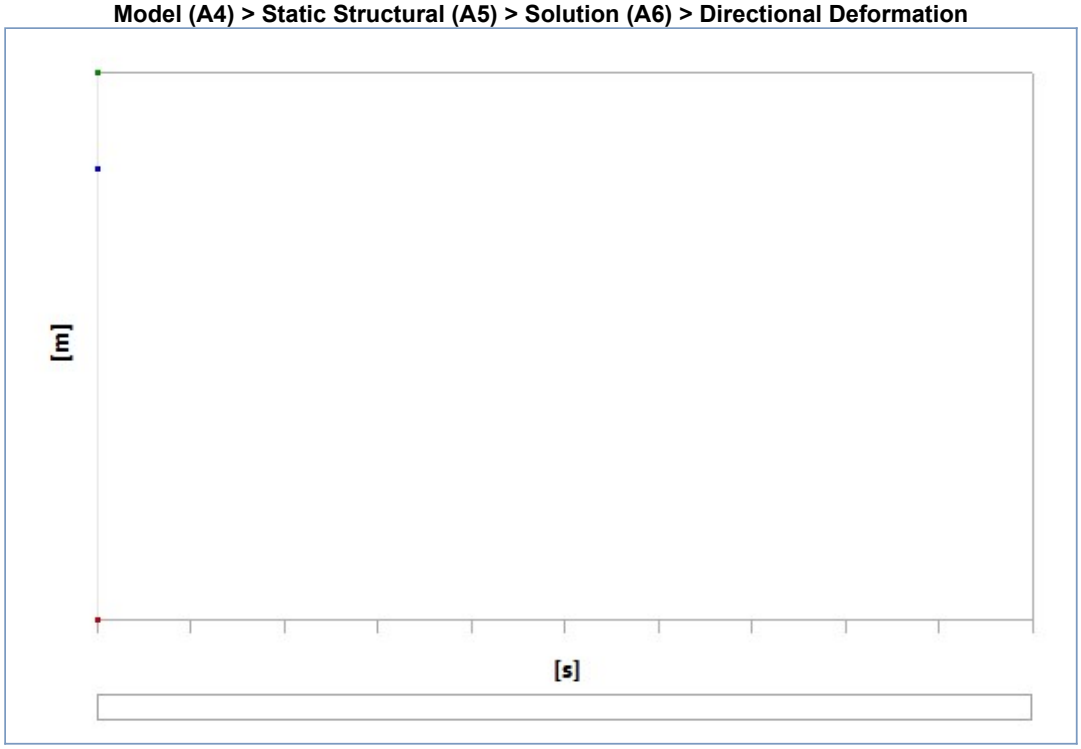


TABLE 18
Model (A4) > Static Structural (A5) > Solution (A6) > Directional Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	-2.7677e-003	1.8995e-004	-3.3191e-004

Material Data

Aluminum Alloy

TABLE 19
Aluminum Alloy > Constants

Density	2770 kg m^-3
Coefficient of Thermal Expansion	2.3e-005 C^-1
Specific Heat	875 J kg^-1 C^-1

TABLE 20
Aluminum Alloy > Color

Red	Green	Blue
138	104	46

TABLE 21
Aluminum Alloy > Compressive Ultimate Strength

Compressive Ultimate Strength Pa
0

TABLE 22
Aluminum Alloy > Compressive Yield Strength

Compressive Yield Strength Pa
2.8e+008

TABLE 23
Aluminum Alloy > Tensile Yield Strength

Tensile Yield Strength Pa
2.8e+008

TABLE 24
Aluminum Alloy > Tensile Ultimate Strength

Tensile Ultimate Strength Pa
3.1e+008

TABLE 25
Aluminum Alloy > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22

TABLE 26
Aluminum Alloy > Isotropic Thermal Conductivity

Thermal Conductivity W m^-1 C^-1	Temperature C
114	-100
144	0
165	100
175	200

TABLE 27
Aluminum Alloy > S-N Curve

Alternating Stress Pa	Cycles	R-Ratio
2.758e+008	1700	-1
2.413e+008	5000	-1
2.068e+008	34000	-1
1.724e+008	1.4e+005	-1
1.379e+008	8.e+005	-1
1.172e+008	2.4e+006	-1
8.963e+007	5.5e+007	-1
8.274e+007	1.e+008	-1

1.706e+008	50000	-0.5
1.396e+008	3.5e+005	-0.5
1.086e+008	3.7e+006	-0.5
8.791e+007	1.4e+007	-0.5
7.757e+007	5.e+007	-0.5
7.239e+007	1.e+008	-0.5
1.448e+008	50000	0
1.207e+008	1.9e+005	0
1.034e+008	1.3e+006	0
9.308e+007	4.4e+006	0
8.618e+007	1.2e+007	0
7.239e+007	1.e+008	0
7.412e+007	3.e+005	0.5
7.067e+007	1.5e+006	0.5
6.636e+007	1.2e+007	0.5
6.205e+007	1.e+008	0.5

TABLE 28
Aluminum Alloy > Isotropic Resistivity

Resistivity ohm m	Temperature C
2.43e-008	0
2.67e-008	20
3.63e-008	100

TABLE 29
Aluminum Alloy > Isotropic Elasticity

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
7.1e+010	0.33	6.9608e+010	2.6692e+010	

TABLE 30
Aluminum Alloy > Isotropic Relative Permeability

Relative Permeability
1