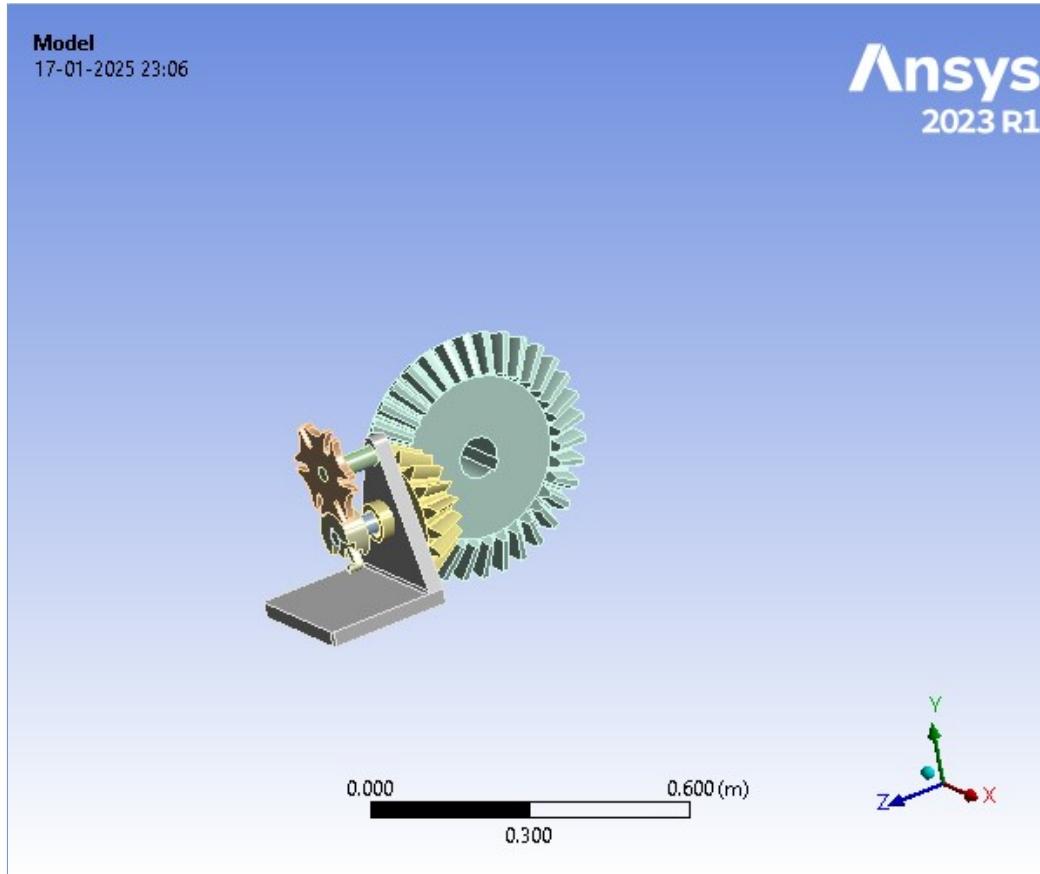




## Project\*

Author	BoondiKeLaddoo
Subject	Analysis on Geneva Mechanism using ANSYS
Prepared for	Solid Edge (PARSEC 5.0)
First Saved	Friday, January 17, 2025
Last Saved	Friday, January 17, 2025
Product Version	2023 R1
Save Project Before Solution	No
Save Project After Solution	No



## Contents

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## 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)

**TABLE 2**

**Model (A4) > Geometry Imports**

Object Name	<u>Geometry Imports</u>
State	Solved

**TABLE 3**

**Model (A4) > Geometry Imports > Geometry Import (A3)**

Object Name	<u>Geometry Import (A3)</u>
State	Solved
<b>Definition</b>	
Source	C:\Users\Anushaa\SOLIDEDGE SOLIDWORKS SUBMISSION.IGS
Type	Iges
<b>Basic Geometry Options</b>	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Independent
Parameter Key	ANS;DS
Attributes	No
Named Selections	No
Material Properties	No
<b>Advanced Geometry Options</b>	

Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	Program Tolerance
Stitch Tolerance	0.000001
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

## Geometry

**TABLE 4**  
**Model (A4) > Geometry**

Object Name	<i>Geometry</i>
State	Fully Defined
<b>Definition</b>	
Source	C:\Users\Anushaa\SOLIDEDGE SOLIDWORKS SUBMISSION.IGS
Type	Iges
Length Unit	Millimeters
Element Control	Program Controlled
Display Style	Body Color
<b>Bounding Box</b>	
Length X	0.48442 m
Length Y	0.68024 m
Length Z	0.83466 m
<b>Properties</b>	
Volume	1.7291e-002 m <sup>3</sup>
Mass	135.73 kg
Scale Factor Value	1.
<b>Statistics</b>	
Bodies	8
Active Bodies	8
Nodes	89904
Elements	44190
Mesh Metric	None
<b>Update Options</b>	
Assign Default Material	No
<b>Basic Geometry Options</b>	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Independent
Parameter Key	ANS;DS
Attributes	No
Named Selections	No
Material Properties	No
<b>Advanced Geometry Options</b>	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D

Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	Program Tolerance
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

**TABLE 5**  
**Model (A4) > Geometry > Parts**

Object Name	base	stift	stift2	wheel 1	<i>straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1</i>	<i>straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1</i>	Pin	wheel 2
State	Meshed							
<b>Graphics Properties</b>								
Visible	Yes							
Transparency	1							
<b>Definition</b>								
Suppressed	No							
Stiffness Behavior	Flexible							
Coordinate System	Default Coordinate System							
Reference Temperature	By Environment							
Treatment	None							
<b>Material</b>								
Assignment	Structural Steel							
Nonlinear Effects	Yes							
Thermal Strain Effects	Yes							
<b>Bounding Box</b>								
Length X	0.25021 m	5.4519e-002 m	4.002e-002 m	0.2592 m	0.22559 m	0.36909 m	9.1562e-003 m	0.14732 m
Length Y	0.32001 m	5.4519e-002 m	4.002e-002 m	0.26407 m	0.68024 m	0.36928 m	9.9157e-003 m	0.15586 m
Length Z	0.25 m	0.14 m	1.5001e-002 m		0.68012 m	0.14208 m	4.5e-002 m	4.5001e-002 m
<b>Properties</b>								
Volume	3.039e-003 m <sup>3</sup>	1.332e-004 m <sup>3</sup>	1.5078e-004 m <sup>3</sup>	3.164e-004 m <sup>3</sup>	1.086e-002 m <sup>3</sup>	2.5073e-003 m <sup>3</sup>	2.16e-006 m <sup>3</sup>	2.8212e-004 m <sup>3</sup>
Mass	23.856 kg	1.0456 kg	1.1836 kg	2.4838 kg	85.251 kg	19.682 kg	1.6956e-002 kg	2.2147 kg
Centroid X	0.25986 m	0.25996 m	0.25967 m	0.25968 m	0.10099 m	0.25987 m	0.25254 m	0.25826 m
Centroid Y	6.0138e-002 m	0.15334 m	0.28343 m	0.28346 m	0.15349 m	0.1535 m	0.16649 m	0.15634 m
Centroid Z	8.285e-002 m	6.7587e-002 m	7.2589e-002 m	0.1325 m	-0.24452 m	-3.0012e-002 m	0.1175 m	0.11574 m
Moment of Inertia I <sub>p1</sub>	0.27284 kg·m <sup>2</sup>	1.4377e-003 kg·m <sup>2</sup>	1.6953e-003 kg·m <sup>2</sup>	4.9863e-003 kg·m <sup>2</sup>	1.5758 kg·m <sup>2</sup>	0.11377 kg·m <sup>2</sup>	2.9518e-006 kg·m <sup>2</sup>	1.9247e-003 kg·m <sup>2</sup>
Moment of Inertia I <sub>p2</sub>	0.31167 kg·m <sup>2</sup>	1.725e-004 kg·m <sup>2</sup>	2.1433e-004 kg·m <sup>2</sup>	9.8847e-003 kg·m <sup>2</sup>	1.0682 kg·m <sup>2</sup>	6.9187e-002 kg·m <sup>2</sup>	1.413e-007 kg·m <sup>2</sup>	3.1243e-003 kg·m <sup>2</sup>
Moment of Inertia I <sub>p3</sub>	0.16444 kg·m <sup>2</sup>	1.4391e-003 kg·m <sup>2</sup>	1.6953e-003 kg·m <sup>2</sup>	4.9915e-003 kg·m <sup>2</sup>	1.0675 kg·m <sup>2</sup>	6.9162e-002 kg·m <sup>2</sup>	2.9122e-006 kg·m <sup>2</sup>	1.883e-003 kg·m <sup>2</sup>
<b>Statistics</b>								
Nodes	3935	4164	5113	6635	42219	24425	261	3152
Elements	1983	2289	2856	870	21811	12716	32	1633

Mesh Metric	None
-------------	------

**TABLE 6**  
**Model (A4) > Materials**

Object Name	Materials
State	Fully Defined
<b>Statistics</b>	
Materials	1
Material Assignments	0

## Coordinate Systems

**TABLE 7**  
**Model (A4) > Coordinate Systems > Coordinate System**

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

## Connections

**TABLE 8**  
**Model (A4) > Connections**

Object Name	Connections
State	Fully Defined
<b>Auto Detection</b>	
Generate Automatic Connection On Refresh	Yes
<b>Transparency</b>	
Enabled	Yes
<b>Statistics</b>	
Contacts	9
Active Contacts	9
Joints	0
Active Joints	0
Beams	0
Active Beams	0
Bearings	0
Active Bearings	0
Springs	0
Active Springs	0
Body Interactions	0
Active Body Interactions	0

**TABLE 9**  
**Model (A4) > Connections > Contacts**

Object Name	Contacts
State	Fully Defined
<b>Definition</b>	
Connection Type	Contact
<b>Scope</b>	
Scoping Method	Geometry Selection

	Geometry	All Bodies
<b>Auto Detection</b>		
Tolerance Type	Slider	
Tolerance Slider	0.	
Tolerance Value	2.9517e-003 m	
Use Range	No	
Face/Face	Yes	
Face-Face Angle Tolerance	75. °	
Face Overlap Tolerance	Off	
Cylindrical Faces	Include	
Face/Edge	No	
Priority	Include All	
Group By	Bodies	
Search Across	Bodies	
<b>Statistics</b>		
Connections	9	
Active Connections	9	

**TABLE 10**  
**Model (A4) > Connections > Contacts > Contact Regions**

Object Name	Contact Region 1	Contact Region 2	Contact Region 3	Contact Region 4	Contact Region 5	Contact Region 6	Contact Region 7	Contact Region 8	Contact Region 9																																								
State	Fully Defined																																																
<b>Scope</b>																																																	
Geometry Selection																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Contact</td><td>3 Faces</td><td>1 Face</td><td>4 Faces</td><td>2 Faces</td><td>3 Faces</td><td colspan="3">1 Face</td><td>3 Faces</td></tr> <tr> <td>Target</td><td>3 Faces</td><td>1 Face</td><td colspan="2">4 Faces</td><td>3 Faces</td><td>1 Face</td><td colspan="2">2 Faces</td><td>3 Faces</td></tr> <tr> <td>Contact Bodies</td><td colspan="3">base</td><td colspan="2">stift</td><td>stift2</td><td>wheel 1</td><td>straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1</td><td>Pin</td></tr> <tr> <td>Target Bodies</td><td>stift</td><td>stift2</td><td>straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1</td><td>Pin</td><td>wheel 2</td><td>wheel 1</td><td>wheel 2</td><td>straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1</td><td>wheel 2</td></tr> </table>										Contact	3 Faces	1 Face	4 Faces	2 Faces	3 Faces	1 Face			3 Faces	Target	3 Faces	1 Face	4 Faces		3 Faces	1 Face	2 Faces		3 Faces	Contact Bodies	base			stift		stift2	wheel 1	straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1	Pin	Target Bodies	stift	stift2	straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1	Pin	wheel 2	wheel 1	wheel 2	straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1	wheel 2
Contact	3 Faces	1 Face	4 Faces	2 Faces	3 Faces	1 Face			3 Faces																																								
Target	3 Faces	1 Face	4 Faces		3 Faces	1 Face	2 Faces		3 Faces																																								
Contact Bodies	base			stift		stift2	wheel 1	straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1	Pin																																								
Target Bodies	stift	stift2	straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1	Pin	wheel 2	wheel 1	wheel 2	straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1	wheel 2																																								
Protected	No																																																
<b>Definition</b>																																																	
Type	Bonded																																																
Scope Mode	Automatic																																																
Behavior	Program Controlled																																																
Trim Contact	Program Controlled																																																
Trim Tolerance	2.9517e-003 m																																																
Suppressed	No																																																
<b>Display</b>																																																	
Element Normals	No																																																
<b>Advanced</b>																																																	
Formulation	Program Controlled																																																
Small Sliding	Program Controlled																																																
Detection Method	Program Controlled																																																
Penetration Tolerance	Program Controlled																																																
Elastic Slip	Program Controlled																																																

Tolerance	
Normal Stiffness	Program Controlled
Update Stiffness	Program Controlled
Pinball Region	Program Controlled

## Mesh

**TABLE 11**  
**Model (A4) > Mesh**

Object Name	Mesh
State	Solved
<b>Display</b>	
Display Style	Use Geometry Setting
<b>Defaults</b>	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	Default
<b>Sizing</b>	
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	1.1807 m
Average Surface Area	2.7825e-003 m <sup>2</sup>
Minimum Edge Length	3.1698e-004 m
<b>Quality</b>	
Check Mesh Quality	Mesh Quality Worksheet
Error Limits	Aggressive Mechanical
Target Element Quality	5.e-002
Smoothing	Medium
Mesh Metric	None
<b>Inflation</b>	
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
<b>Advanced</b>	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled
Topology Checking	Yes
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
<b>Statistics</b>	
Nodes	89904
Elements	44190
Show Detailed Statistics	No

## Static Structural (A5)

**TABLE 12**  
**Model (A4) > Analysis**

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

**TABLE 13**  
**Model (A4) > Static Structural (A5) > Analysis Settings**

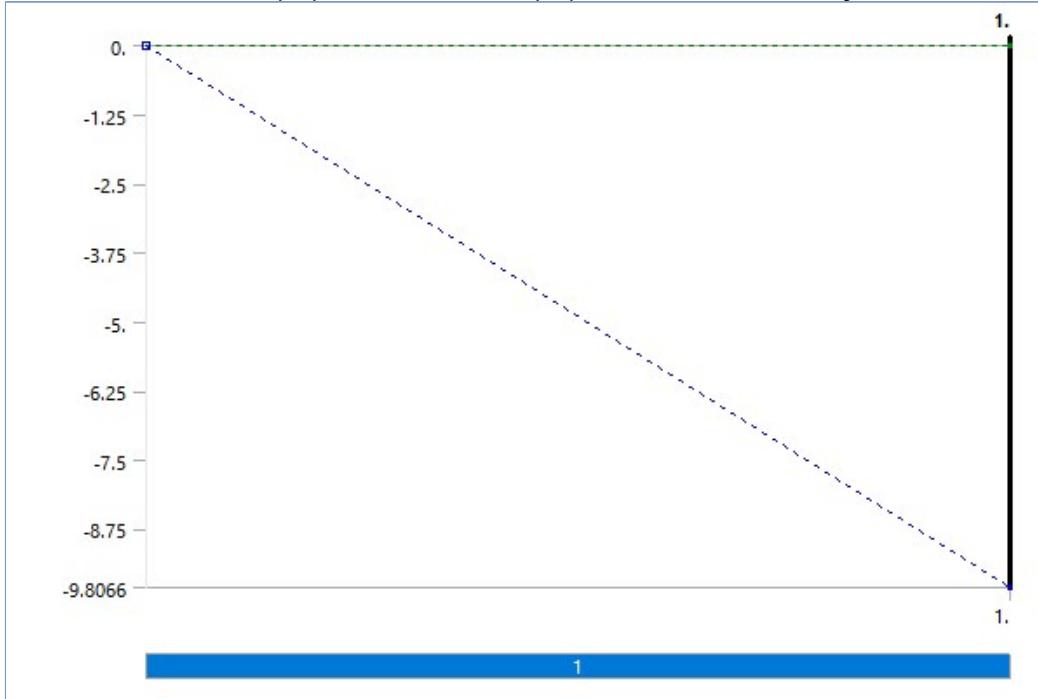
Object Name	Analysis Settings
State	Fully Defined
<b>Step Controls</b>	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
<b>Solver Controls</b>	
Solver Type	Direct
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Inertia Relief	Off
Quasi-Static Solution	Off
<b>Restart Controls</b>	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
<b>Nonlinear Controls</b>	
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
<b>Advanced</b>	
Inverse Option	No
Contact Split (DMP)	Off
<b>Output Controls</b>	
Stress	Yes
Back Stress	No
Strain	Yes
Contact Data	Yes
Nonlinear Data	No
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	Yes
Contact Miscellaneous	Yes
Store Results At	All Time Points
Result File Compression	Program Controlled
<b>Analysis Data Management</b>	
Solver Files Directory	C:\Users\Anushaa\AppData\Local\Temp\WB_Anushaa_4620_7\wbnew_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 14**  
**Model (A4) > Static Structural (A5) > Accelerations**

Object Name	Standard Earth Gravity
State	Fully Defined
<b>Scope</b>	
Geometry	All Bodies
<b>Definition</b>	
Coordinate System	Global Coordinate System
X Component	0. m/s <sup>2</sup> (ramped)
Y Component	0. m/s <sup>2</sup> (ramped)
Z Component	-9.8066 m/s <sup>2</sup> (ramped)
Suppressed	No
Direction	-Z Direction

**FIGURE 1**  
**Model (A4) > Static Structural (A5) > Standard Earth Gravity**



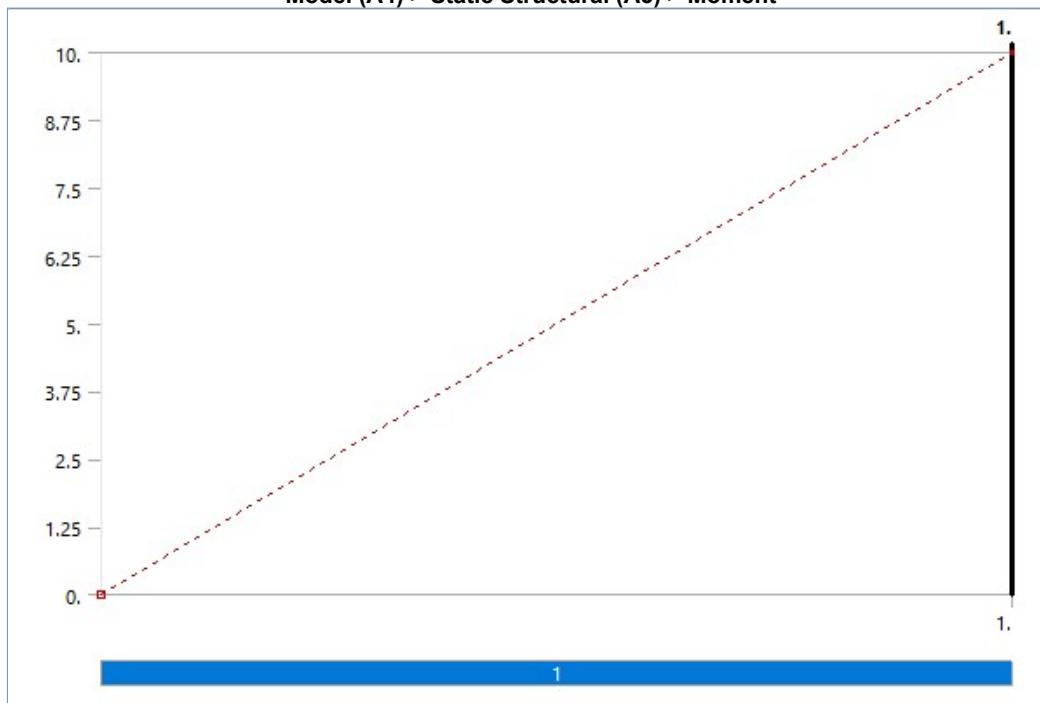
**TABLE 15**  
**Model (A4) > Static Structural (A5) > Loads**

Object Name	Moment	Force	Pressure	Fixed Support	Fixed Support 2		
State	Fully Defined						
<b>Scope</b>							
Scoping Method	Geometry Selection						
Geometry	1 Face	34 Edges	1 Face	1 Edge			
<b>Definition</b>							
Type	Moment	Force	Pressure	Fixed Support			
Define By	Vector		Normal To				
Magnitude	10. N·m (ramped)	50. N (ramped)	10. Pa (ramped)				
Direction	Defined						
Suppressed	No						
Behavior	Deformable						
Applied By		Surface Effect					
Loaded Area			Deformed				
<b>Advanced</b>							

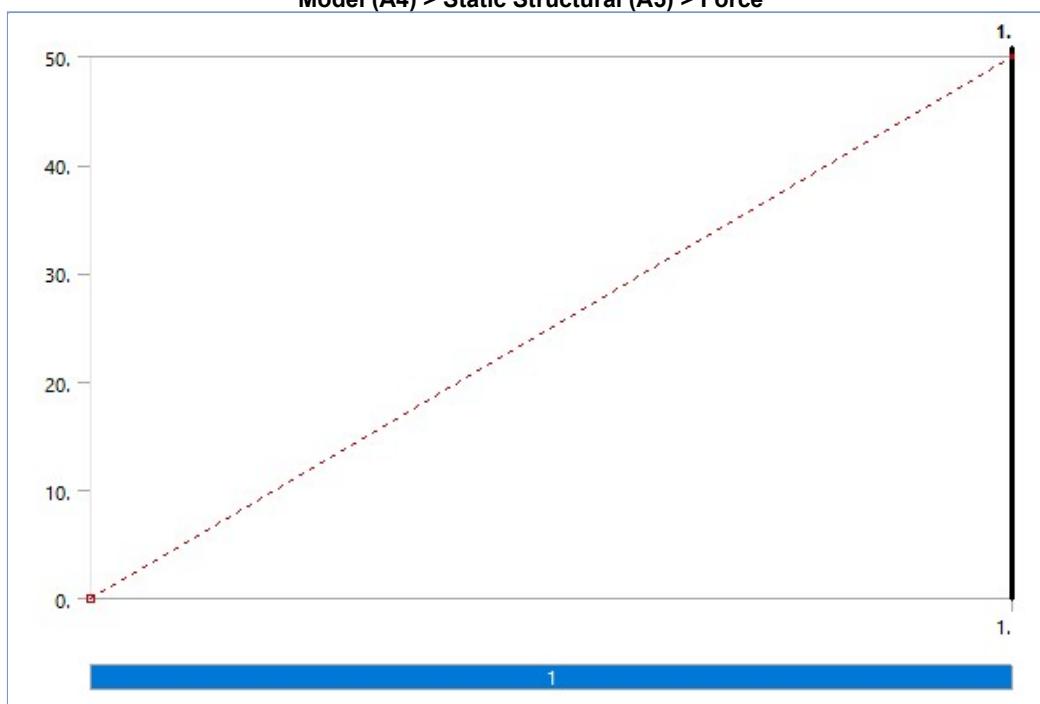
Pinball Region

All

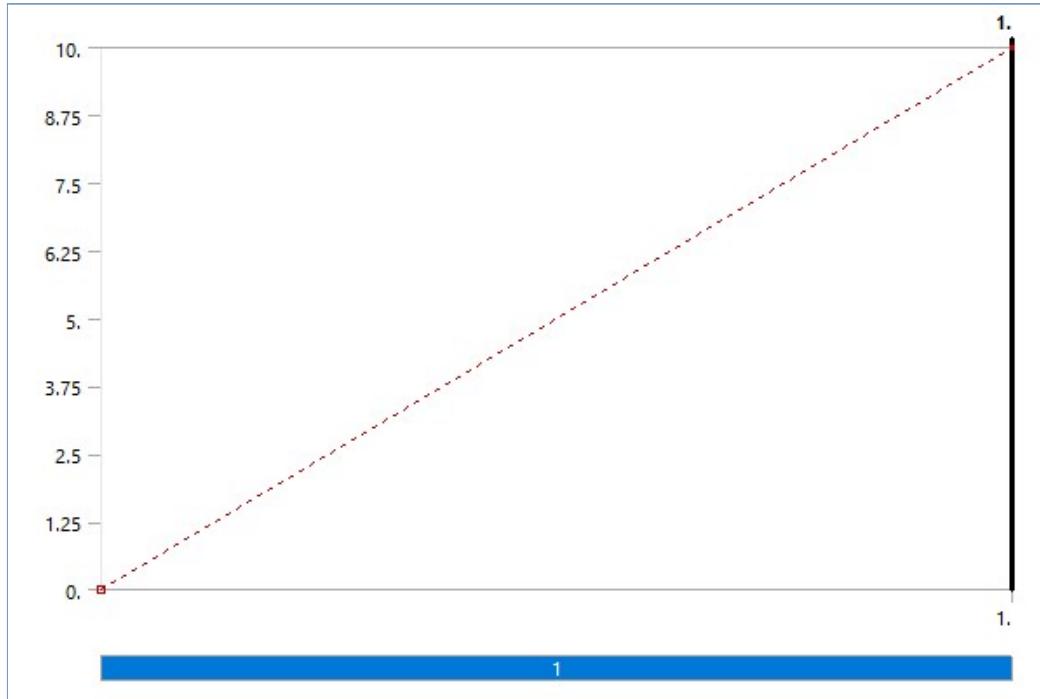
**FIGURE 2**  
Model (A4) > Static Structural (A5) > Moment



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



**FIGURE 4**  
Model (A4) > Static Structural (A5) > Pressure



### Solution (A6)

**TABLE 16**  
Model (A4) > Static Structural (A5) > Solution

Object Name	Solution (A6)
State	Solved
<b>Adaptive Mesh Refinement</b>	
Max Refinement Loops	1.
Refinement Depth	2.
<b>Information</b>	
Status	Done
MAPDL Elapsed Time	8. s
MAPDL Memory Used	1.3984 GB
MAPDL Result File Size	31.813 MB
<b>Post Processing</b>	
Beam Section Results	No
On Demand Stress/Strain	No

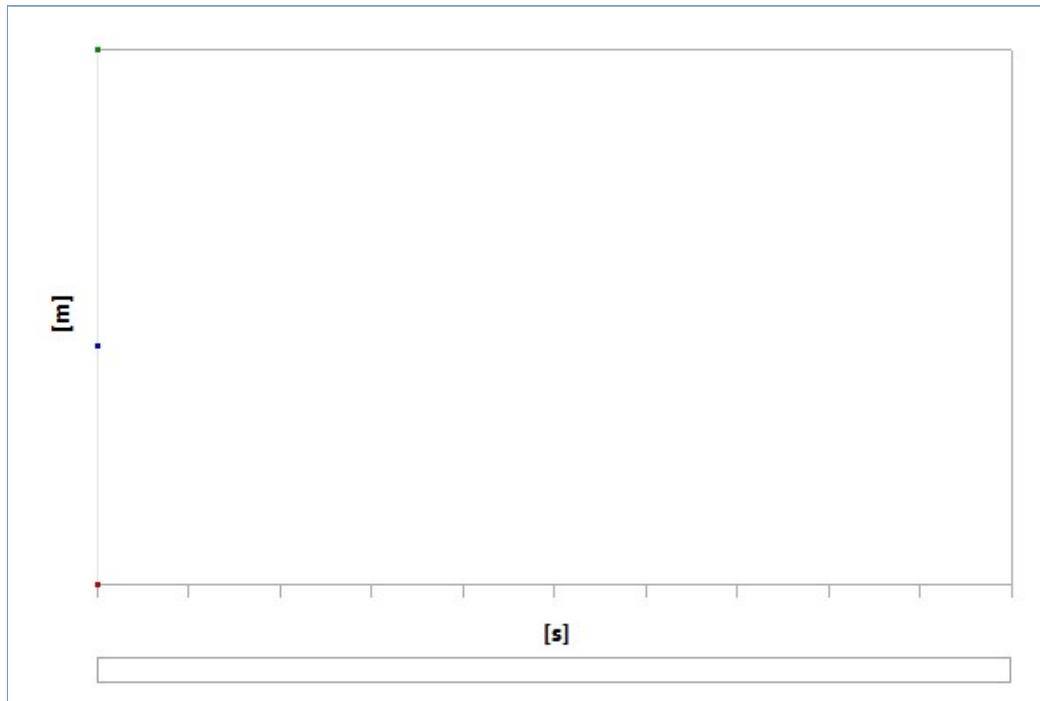
**TABLE 17**  
Model (A4) > Static Structural (A5) > Solution (A6) > Solution Information

Object Name	Solution Information
State	Solved
<b>Solution Information</b>	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2.5 s
Display Points	All
<b>FE Connection Visibility</b>	
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 18**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Results**

Object Name	Directional Deformation	Equivalent Stress	Total Deformation
State	Solved		
<b>Scope</b>			
Scoping Method	Geometry Selection		
Geometry	All Bodies		
<b>Definition</b>			
Type	Directional Deformation	Equivalent (von-Mises) Stress	Total Deformation
Orientation	X Axis		
By	Time		
Display Time	Last		
Separate Data by Entity	No		
Coordinate System	Global Coordinate System		
Calculate Time History	Yes		
Identifier			
Suppressed	No		
<b>Results</b>			
Minimum	-5.3787e-005 m	5.8858 Pa	0. m
Maximum	7.9277e-005 m	3.3065e+007 Pa	7.9865e-005 m
Average	5.5825e-006 m	1.9606e+005 Pa	2.6338e-005 m
Minimum Occurs On	straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1	wheel 2	base
Maximum Occurs On	straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1	straight bevel pinion_iso_ISO - Straight bevel pinion 14M17PT 34GT 20PA 80FW --- 17O75H300MD48.0R1	straight bevel gear_iso_ISO - Straight bevel gear 14M 34GT 17PT 20PA 80FW --- 34O200H300MD80.0R1
<b>Information</b>			
Time	1. s		
Load Step	1		
Substep	1		
Iteration Number	1		
<b>Integration Point Results</b>			
Display Option		Averaged	
Average Across Bodies		No	

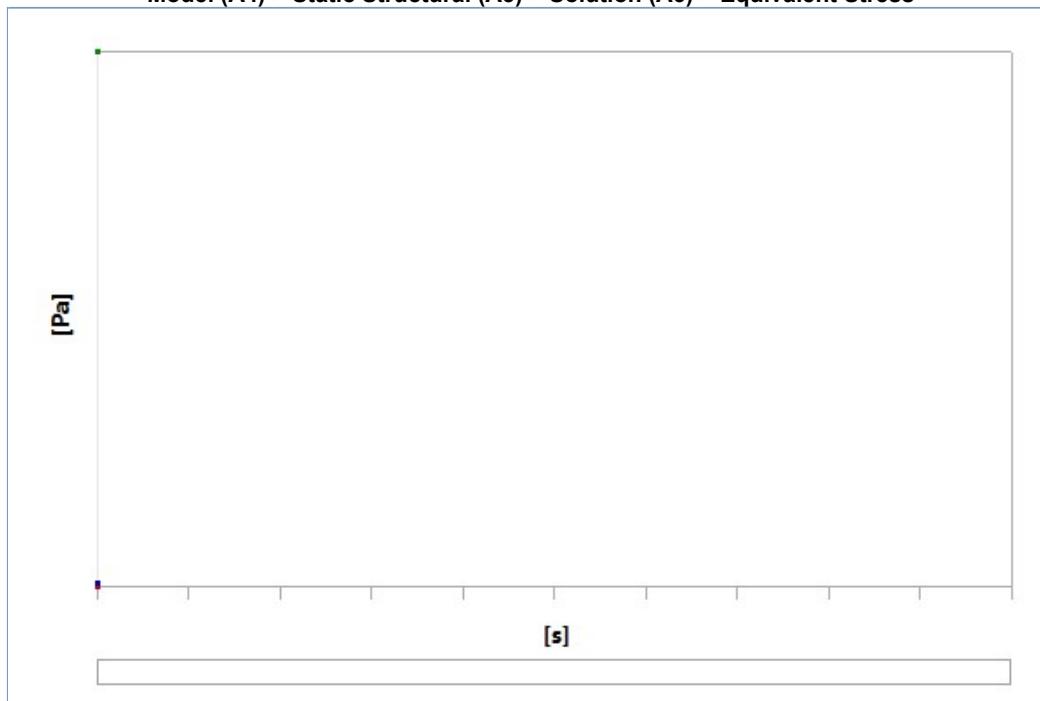
**FIGURE 5**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Directional Deformation**



**TABLE 19**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Directional Deformation**

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	-5.3787e-005	7.9277e-005	5.5825e-006

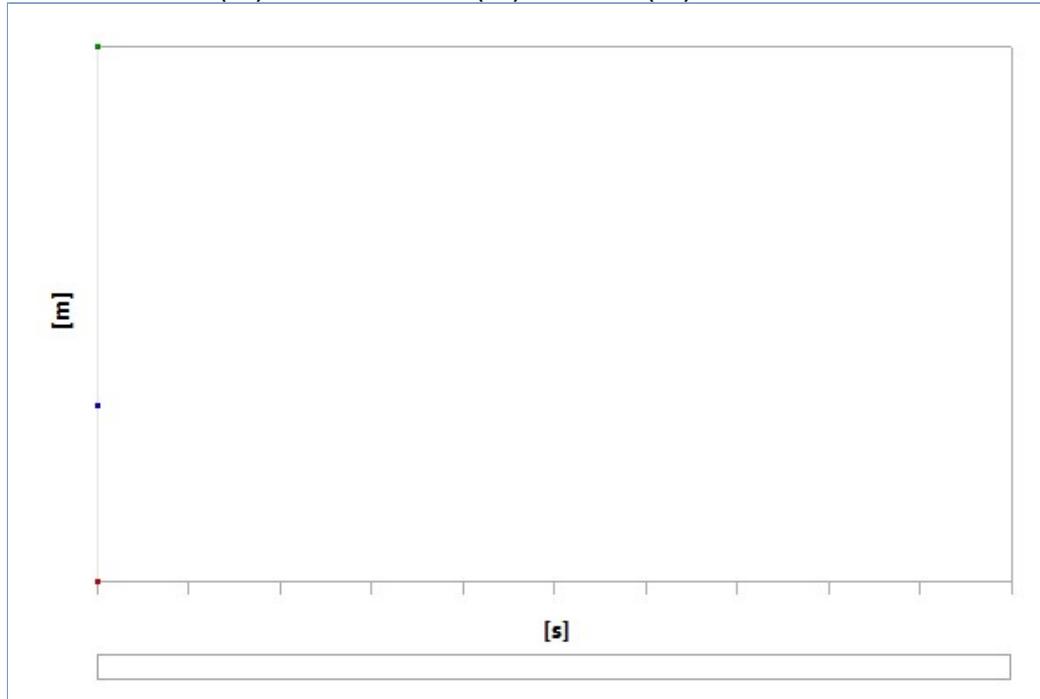
**FIGURE 6**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Stress**



**TABLE 20**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Stress**

Time [s]	Minimum [Pa]	Maximum [Pa]	Average [Pa]
1.	5.8858	3.3065e+007	1.9606e+005

**FIGURE 7**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation**



**TABLE 21**  
**Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation**

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	0.	7.9865e-005	2.6338e-005

## Material Data

### Structural Steel

**TABLE 22**  
**Structural Steel > Constants**

Density	7850 kg m <sup>-3</sup>
Coefficient of Thermal Expansion	1.2e-005 C <sup>-1</sup>
Specific Heat	434 J kg <sup>-1</sup> C <sup>-1</sup>
Thermal Conductivity	60.5 W m <sup>-1</sup> C <sup>-1</sup>
Resistivity	1.7e-007 ohm m

**TABLE 23**  
**Structural Steel > Color**

Red	Green	Blue
132	139	179

**TABLE 24**  
**Structural Steel > Compressive Ultimate Strength**

Compressive Ultimate Strength Pa
0

**TABLE 25**  
**Structural Steel > Compressive Yield Strength**

Compressive Yield Strength Pa
2.5e+008

**TABLE 26**  
**Structural Steel > Tensile Yield Strength**

Tensile Yield Strength Pa
2.5e+008

**TABLE 27**  
**Structural Steel > Tensile Ultimate Strength**

Tensile Ultimate Strength Pa
4.6e+008

**TABLE 28**  
**Structural Steel > Isotropic Secant Coefficient of Thermal Expansion**

Zero-Thermal-Strain Reference Temperature C
22

**TABLE 29**  
**Structural Steel > S-N Curve**

Alternating Stress Pa	Cycles	Mean Stress Pa
3.999e+009	10	0
2.827e+009	20	0
1.896e+009	50	0
1.413e+009	100	0
1.069e+009	200	0
4.41e+008	2000	0
2.62e+008	10000	0
2.14e+008	20000	0
1.38e+008	1.e+005	0
1.14e+008	2.e+005	0
8.62e+007	1.e+006	0

**TABLE 30**  
**Structural Steel > Strain-Life Parameters**

Strength Coefficient Pa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient Pa	Cyclic Strain Hardening Exponent
9.2e+008	-0.106	0.213	-0.47	1.e+009	0.2

**TABLE 31**  
**Structural Steel > Isotropic Elasticity**

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
2.e+011	0.3	1.6667e+011	7.6923e+010	

**TABLE 32**  
**Structural Steel > Isotropic Relative Permeability**

Relative Permeability
10000