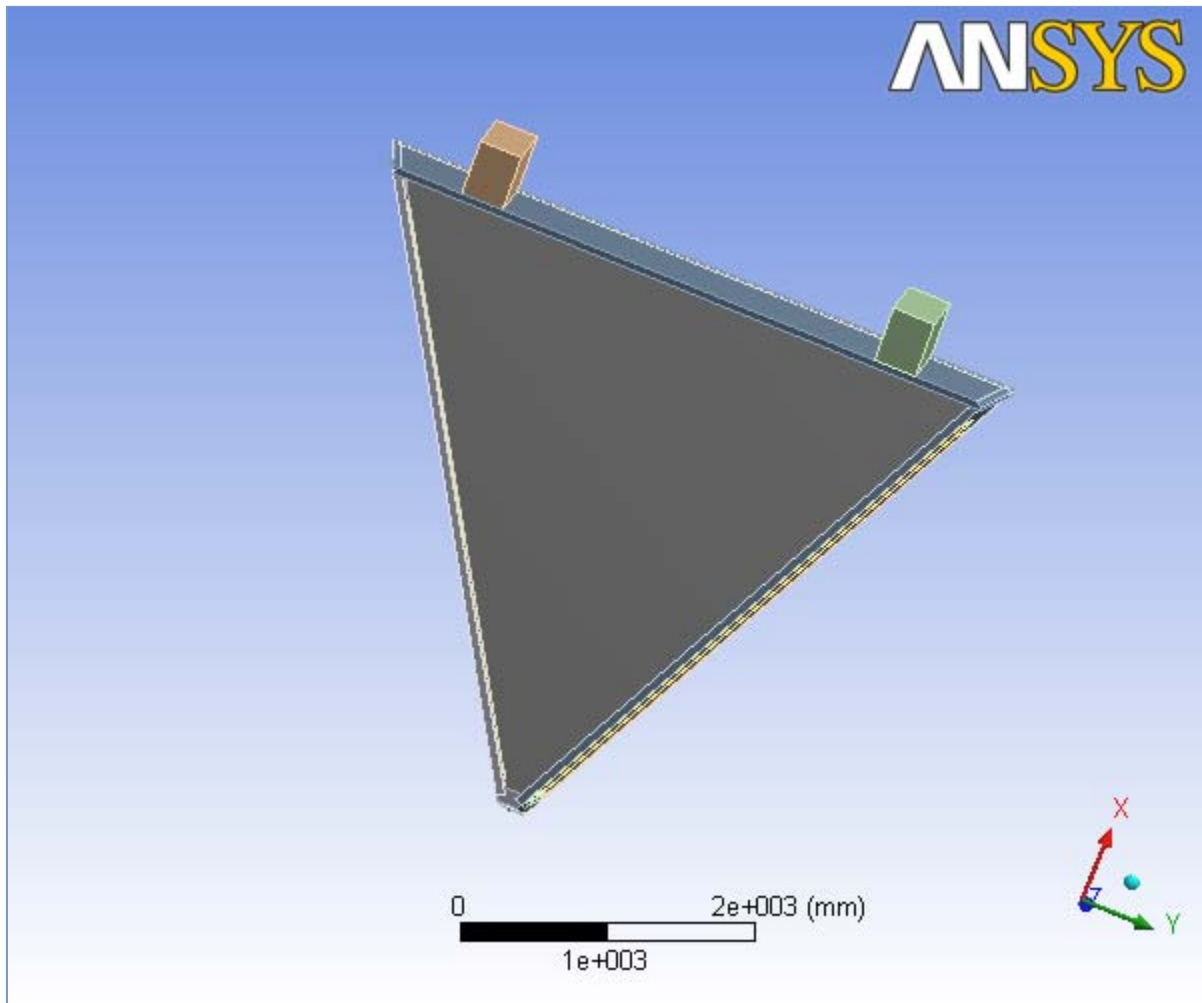




Project

| | |
|------------------------|-----------------------------------|
| <i>First Saved</i> | <i>Tuesday, February 19, 2008</i> |
| <i>Last Saved</i> | <i>Tuesday, March 11, 2008</i> |
| <i>Product Version</i> | <i>11.0 Release</i> |



Contents

- **Analysis 4.2**
 - [Geometry](#)
 - [Parts](#)
 - [Connections](#)
 - [Contact Regions](#)
 - [Mesh](#)
 - [Patch Independent](#)
 - [Named Selections](#)
 - **Static Structural**
 - [Analysis Settings](#)
 - [Acceleration](#)
 - [Loads](#)
 - [Solution](#)
 - [Solution Information](#)
 - [Results](#)
- **Material Data**
 - [Polyurethane](#)
 - [Carbon Fiber](#)
 - [Hexcel sheet](#)
 - [Structural Steel](#)

Units

TABLE 1

| | |
|---------------------|-----------------------------------|
| Unit System | Metric (mm, kg, N, °C, s, mV, mA) |
| Angle | Degrees |
| Rotational Velocity | rad/s |

Analysis 4.2

Geometry

TABLE 2
Analysis 4.2 > Geometry

| | |
|---------------------|--|
| Object Name | <i>Geometry</i> |
| State | Fully Defined |
| Definition | |
| Source | C:\Documents and Settings\Jinnuri\Desktop\website\allaxis.agdb |
| Type | DesignModeler |
| Length Unit | Millimeters |
| Element Control | Program Controlled |
| Display Style | Part Color |
| Bounding Box | |
| Length X | 4241.3 mm |
| Length Y | 4560.2 mm |
| Length Z | 2675. mm |
| Properties | |

| | |
|-----------------------------------|-----------------------------|
| Volume | 9.3232e+008 mm ³ |
| Mass | 139.04 kg |
| Statistics | |
| Bodies | 23 |
| Active Bodies | 16 |
| Nodes | 46742 |
| Elements | 156153 |
| Preferences | |
| Import Solid Bodies | Yes |
| Import Surface Bodies | Yes |
| Import Line Bodies | Yes |
| Parameter Processing | Yes |
| Personal Parameter Key | DS |
| CAD Attribute Transfer | No |
| Named Selection Processing | No |
| Material Properties Transfer | No |
| CAD Associativity | Yes |
| Import Coordinate Systems | No |
| Reader Save Part File | No |
| Import Using Instances | Yes |
| Do Smart Update | No |
| Attach File Via Temp File | No |
| Analysis Type | 3-D |
| Mixed Import Resolution | None |
| Enclosure and Symmetry Processing | Yes |

TABLE 3
Analysis 4.2 > Geometry > Parts

| Object Name | <i>nose plate</i> | <i>end plate (1) 1 of 3</i> | <i>endplate(2) 1 of 2</i> | <i>endplate(1) 2 of 3</i> | <i>endplate (1) 3 of 3</i> |
|----------------------------|-----------------------------|---------------------------------|-------------------------------|-----------------------------|--------------------------------|
| State | Meshed | | | | |
| Graphics Properties | | | | | |
| Visible | Yes | | | | |
| Transparency | 1 | | | | |
| Definition | | | | | |
| Suppressed | No | | | | |
| Material | Polyurethane | | | | |
| Stiffness Behavior | Flexible | | | | |
| Nonlinear Material Effects | Yes | | | | |
| Bounding Box | | | | | |
| Length X | 102.03 mm | 221.42 mm | | 3819.7 mm | 184.3 mm |
| Length Y | 180.6 mm | 160.89 mm | | 2238.4 mm | 139.46 mm |
| Length Z | 581.2 mm | | | 2414.9 mm | 233.38 mm |
| Properties | | | | | |
| Volume | 7.6673e+006 mm ³ | 2.4963e+006 mm ³ | 3.7036e+006 mm ³ | 3.6841e+007 mm ³ | 1.2073e+006 mm ³ |
| Mass | 1.8401 kg | 0.59912 kg | 0.88887 kg | 8.8418 kg | 0.28975 kg |
| Centroid X | 46.019 mm | 91.538 mm | 108.97 mm | 2247.1 mm | 145.03 mm |
| Centroid Y | 8.0978e-016 mm | 92.546 mm | -102.61 mm | 1337.1 mm | 123.43 mm |

| | | | | | |
|-----------------------|---------------------------|--------------------------|---------------------------|--------------------------------|---------------------------|
| Centroid Z | 288.77 mm | 346.17 mm | 352.87 mm | -890.99 mm | 366.72 mm |
| Moment of Inertia Ip1 | 54197 kg·mm ² | 13573 kg·mm ² | 14824 kg·mm ² | 3.3883e+005 kg·mm ² | 1152.9 kg·mm ² |
| Moment of Inertia Ip2 | 52807 kg·mm ² | 14538 kg·mm ² | 16681 kg·mm ² | 2.0698e+007 kg·mm ² | 1315.2 kg·mm ² |
| Moment of Inertia Ip3 | 4657.9 kg·mm ² | 1293. kg·mm ² | 2342.5 kg·mm ² | 2.0364e+007 kg·mm ² | 320.6 kg·mm ² |
| Statistics | | | | | |
| Nodes | 378 | 151 | 125 | 5821 | 93 |
| Elements | 1368 | 407 | 352 | 17624 | 253 |

TABLE 4
Analysis 4.2 > Geometry > Parts

| Object Name | <i>end plate 1 hole area non target end</i> | <i>end plate 1 hole area target end 1</i> | <i>end plate 1 hole area target end2</i> | <i>endplate(2) 2 of 2</i> | <i>end plate 2 hole area target end</i> |
|----------------------------|---|---|--|--------------------------------|---|
| State | Meshed | | | | |
| Graphics Properties | | | | | |
| Visible | Yes | | | | |
| Transparency | 1 | | | | |
| Definition | | | | | |
| Suppressed | No | | | | |
| Material | Polyurethane | | | | |
| Stiffness Behavior | Flexible | | | | |
| Nonlinear Material Effects | Yes | | | | |
| Bounding Box | | | | | |
| Length X | 3363.1 mm | 184.3 mm | 3441.6 mm | 3819.7 mm | 3441.6 mm |
| Length Y | 1974.7 mm | 139.46 mm | 2020. mm | 2238.4 mm | 2020. mm |
| Length Z | 1945. mm | 233.38 mm | 1987.3 mm | 2414.9 mm | 1987.3 mm |
| Properties | | | | | |
| Volume | 5.0102e+007 mm ³ | 1.2073e+006 mm ³ | 5.131e+007 mm ³ | 3.4426e+007 mm ³ | 5.131e+007 mm ³ |
| Mass | 12.025 kg | 0.28975 kg | 12.314 kg | 8.2623 kg | 12.314 kg |
| Centroid X | 1812.9 mm | 137.19 mm | 1844.3 mm | 2274.8 mm | 1765.8 mm |
| Centroid Y | 1086.4 mm | 118.9 mm | 1104.5 mm | -1353. mm | -1059.2 mm |
| Centroid Z | -531.35 mm | 110.68 mm | -808.51 mm | -914.74 mm | -766.25 mm |
| Moment of Inertia Ip1 | 47846 kg·mm ² | 1152.9 kg·mm ² | 48999 kg·mm ² | 3.3023e+005 kg·mm ² | 48999 kg·mm ² |
| Moment of Inertia Ip2 | 1.7302e+007 kg·mm ² | 1315.2 kg·mm ² | 1.8581e+007 kg·mm ² | 1.8e+007 kg·mm ² | 1.8581e+007 kg·mm ² |
| Moment of Inertia Ip3 | 1.7261e+007 kg·mm ² | 320.6 kg·mm ² | 1.8539e+007 kg·mm ² | 1.7674e+007 kg·mm ² | 1.8539e+007 kg·mm ² |
| Statistics | | | | | |
| Nodes | 871 | 275 | 902 | 5853 | 896 |
| Elements | 2337 | 36 | 2424 | 17702 | 2400 |

TABLE 5
Analysis 4.2 > Geometry > Parts

| Object Name | <i>endplate 2 hole area non target end</i> | <i>back plate</i> | <i>rod4</i> | <i>rod5</i> | <i>rod1</i> |
|-------------|--|-------------------|-------------|-------------|-------------|
| State | Meshed | | | Suppressed | |

| Graphics Properties | | | | | |
|----------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|-----------------------------|
| Visible | Yes | | | No | |
| Transparency | 1 | | | | |
| Definition | | | | | |
| Suppressed | No | | | Yes | |
| Material | Polyurethane | | | Carbon Fiber | |
| Stiffness Behavior | Flexible | | | | |
| Nonlinear Material Effects | Yes | | | | |
| Bounding Box | | | | | |
| Length X | 3520.1 mm | 238.63 mm | 50.8 mm | | |
| Length Y | 2065.4 mm | 4557.2 mm | 2558. mm | 3167.6 mm | 729.16 mm |
| Length Z | 2029.5 mm | 493.29 mm | 50.8 mm | | |
| Properties | | | | | |
| Volume | 5.2517e+007 mm ³ | 1.1556e+008 mm ³ | 4.9963e+005 mm ³ | 6.2009e+005 mm ³ | 1.3828e+005 mm ³ |
| Mass | 12.604 kg | 27.734 kg | 0.28979 kg | 0.35965 kg | 8.0201e-002 kg |
| Centroid X | 1891.4 mm | 3726.9 mm | 2178.5 mm | 2706.4 mm | 595.07 mm |
| Centroid Y | -1131.7 mm | 0.19075 mm | -6.2893e-010 mm | 9.3264e-009 mm | 1.3118e-010 mm |
| Centroid Z | -573.61 mm | -1695.4 mm | -1126.3 mm | -1411.4 mm | -271.02 mm |
| Moment of Inertia Ip1 | 50152 kg·mm ² | 4.6347e+007 kg·mm ² | 1.5274e+005 kg·mm ² | 2.919e+005 kg·mm ² | 3267.4 kg·mm ² |
| Moment of Inertia Ip2 | 1.9922e+007 kg·mm ² | 6.1048e+005 kg·mm ² | 173.72 kg·mm ² | 215.61 kg·mm ² | 48.061 kg·mm ² |
| Moment of Inertia Ip3 | 1.9879e+007 kg·mm ² | 4.5748e+007 kg·mm ² | 1.5274e+005 kg·mm ² | 2.919e+005 kg·mm ² | 3267.5 kg·mm ² |
| Statistics | | | | | |
| Nodes | 850 | 7520 | 0 | | |
| Elements | 2222 | 30167 | 0 | | |

TABLE 6
Analysis 4.2 > Geometry > Parts

| Object Name | <i>rod2</i> | <i>rod3</i> | <i>rod6</i> | <i>hexcel</i> | <i>mylar</i> |
|----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| State | Suppressed | | | Meshed | Suppressed |
| Graphics Properties | | | | | |
| Visible | No | | | Yes | No |
| Transparency | | | | 1 | |
| Definition | | | | | |
| Suppressed | Yes | | | No | Yes |
| Material | Carbon Fiber | | | Hexcel sheet | Structural Steel |
| Stiffness Behavior | Flexible | | | | |
| Nonlinear Material Effects | Yes | | | | |
| Bounding Box | | | | | |
| Length X | 50.8 mm | | | 3831.1 mm | 3549.1 mm |
| Length Y | 1338.8 mm | 1948.4 mm | 3777.2 mm | 4559.1 mm | 4202.6 mm |
| Length Z | 50.8 mm | | | 2084.1 mm | 1916.6 mm |
| Properties | | | | | |
| Volume | 2.5873e+005 mm ³ | 3.7918e+005 mm ³ | 7.4054e+005 mm ³ | 4.0121e+008 mm ³ | 2.2063e+005 mm ³ |

| | | | | | |
|-----------------------|---------------------------|---------------------------|-------------------------------|--------------------------------|--------------------------------|
| Mass | 0.15006 kg | 0.21993 kg | 0.42951 kg | 11.568 kg | 1.7319 kg |
| Centroid X | 1122.8 mm | 1650.6 mm | 3234.3 mm | 2514.6 mm | 2415.9 mm |
| Centroid Y | -4.3959e-010 mm | -2.412e-009 mm | 1.355e-008 mm | -0.90675 mm | 8.2964e-009 mm |
| Centroid Z | -556.12 mm | -841.22 mm | -1696.5 mm | -776.52 mm | -1225.1 mm |
| Moment of Inertia Ip1 | 21253 kg·mm ² | 66800 kg·mm ² | 4.971e+005 kg·mm ² | 1.0036e+007 kg·mm ² | 1.2718e+006 kg·mm ² |
| Moment of Inertia Ip2 | 89.952 kg·mm ² | 131.84 kg·mm ² | 257.48 kg·mm ² | 1.2923e+007 kg·mm ² | 1.6364e+006 kg·mm ² |
| Moment of Inertia Ip3 | 21253 kg·mm ² | 66800 kg·mm ² | 4.971e+005 kg·mm ² | 2.2956e+007 kg·mm ² | 2.9081e+006 kg·mm ² |
| Statistics | | | | | |
| Nodes | 0 | | | 22570 | 0 |
| Elements | 0 | | | 77604 | 0 |

TABLE 7
Analysis 4.2 > Geometry > Parts

| | | | |
|----------------------------|--------------------------------|------------------------|----------------------------|
| Object Name | <i>top hinge area1</i> | <i>top hinge area2</i> | <i>ball joint</i> |
| State | Meshed | | |
| Graphics Properties | | | |
| Visible | Yes | | |
| Transparency | 1 | | |
| Definition | | | |
| Suppressed | No | | |
| Material | Polyurethane | | |
| Stiffness Behavior | Flexible | | |
| Nonlinear Material Effects | Yes | | |
| Bounding Box | | | |
| Length X | 562.43 mm | | 25. mm |
| Length Y | 300. mm | | 39.658 mm |
| Length Z | 624.05 mm | | 39.658 mm |
| Properties | | | |
| Volume | 6.1378e+007 mm ³ | | 11971 mm ³ |
| Mass | 14.731 kg | | 2.8731e-003 kg |
| Centroid X | 3935.1 mm | | -7.2354 mm |
| Centroid Y | 1519.7 mm | -1517.9 mm | 1.7419e-015 mm |
| Centroid Z | -1781.8 mm | | 290.6 mm |
| Moment of Inertia Ip1 | 4.3163e+005 kg·mm ² | | 0.33261 kg·mm ² |
| Moment of Inertia Ip2 | 5.1756e+005 kg·mm ² | | 0.25283 kg·mm ² |
| Moment of Inertia Ip3 | 3.0689e+005 kg·mm ² | | 0.25283 kg·mm ² |
| Statistics | | | |
| Nodes | 163 | 162 | 112 |
| Elements | 626 | 619 | 12 |

Connections

TABLE 8
Analysis 4.2 > Connections

| | |
|-----------------------|--------------------|
| Object Name | <i>Connections</i> |
| State | Fully Defined |
| Auto Detection | |
| | |

| | |
|----------------------------|-------------|
| Generate Contact On Update | Yes |
| Tolerance Type | Slider |
| Tolerance Slider | 0. |
| Tolerance Value | 16.945 mm |
| Face/Face | Yes |
| Face/Edge | Yes |
| Edge/Edge | Yes |
| Priority | Include All |
| Same Body Grouping | Yes |
| Revolute Joints | Yes |
| Fixed Joints | Yes |
| Transparency | |
| Enabled | Yes |

TABLE 9
Analysis 4.2 > Connections > Contact Regions

| | | | | | |
|---------------------|--|-------------------------------------|---|--|--|
| Object Name | <i>Bonded - nose plate To ball joint</i> | <i>Bonded - nose plate (1) 1of3</i> | <i>Bonded - nose plate To endplate(2)1 of 2</i> | <i>Bonded - end plate (1) 1of3 To end plate 1 hole area target end 1</i> | <i>Bonded - end plate (1) 1of3 To endplate (1)3 of 3</i> |
| State | Fully Defined | | | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Contact | 1 Face | | | | |
| Target | 1 Face | | | | |
| Contact Bodies | nose plate | | | end plate (1) 1of3 | |
| Target Bodies | ball joint | end plate (1) 1of3 | endplate(2)1 of 2 | end plate 1 hole area target end 1 | endplate (1)3 of 3 |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | | | |
| Suppressed | No | | | | |
| Advanced | | | | | |
| Formulation | Pure Penalty | | | | |
| Normal Stiffness | Program Controlled | | | | |
| Update Stiffness | Never | | | | |
| Thermal Conductance | Program Controlled | | | | |
| Pinball Region | Program Controlled | | | | |

TABLE 10
Analysis 4.2 > Connections > Contact Regions

| | | | | | |
|--------------|--|--|---|--|--|
| Object Name | <i>Bonded - end plate (1) 1of3 To endplate(1) 2 of 3</i> | <i>Bonded - end plate (1) 1of3 To endplate(1) 2 of 3</i> | <i>Bonded - end plate 1 hole area target end 1 To end plate 1 hole area target end2</i> | <i>Bonded - endplate (1)3 of 3 To end plate 1 hole area non target end</i> | <i>Bonded - endplate (1) 2 of 3 To end plate 1 hole area target end2</i> |
| State | Fully Defined | | | | |
| Scope | | | | | |
| Scoping | | | | | |

| Method | Geometry Selection | | | | |
|---------------------|--------------------|--------|------------------------------------|--------------------------------------|-----------------------------------|
| Contact | 2 Faces | 1 Edge | 1 Face | | |
| Target | 2 Faces | 1 Edge | 1 Face | | |
| Contact Bodies | end plate (1) 1of3 | | end plate 1 hole area target end 1 | endplate (1)3 of 3 | endplate(1) 2 of 3 |
| Target Bodies | endplate(1) 2 of 3 | | end plate 1 hole area target end2 | end plate 1 hole area non target end | end plate 1 hole area target end2 |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | Symmetric | | |
| Suppressed | No | | | | |
| Advanced | | | | | |
| Formulation | Pure Penalty | | | | |
| Normal Stiffness | Program Controlled | | | | |
| Update Stiffness | Never | | | | |
| Thermal Conductance | Program Controlled | | | | |
| Pinball Region | Program Controlled | | | | |

TABLE 11
Analysis 4.2 > Connections > Contact Regions

| Object Name | <i>Bonded - endplate (1) 2 of 3 To end plate 1 hole area target end2</i> | <i>Bonded - endplate (1) 2 of 3 To end plate 1 hole area non target end</i> | <i>Bonded - endplate (1) 2 of 3 To end plate 1 hole area non target end</i> | <i>Bonded - endplate(1) 2 of 3 To back plate</i> | <i>Bonded - endplate(1) 2 of 3 To back plate</i> |
|---------------------|--|---|---|--|--|
| State | Fully Defined | | | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Contact | 1 Face | | | | 1 Edge |
| Target | 1 Face | | | | 1 Edge |
| Contact Bodies | endplate(1) 2 of 3 | | | | |
| Target Bodies | end plate 1 hole area target end2 | end plate 1 hole area non target end | | back plate | |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | | | |
| Suppressed | No | | | | |
| Advanced | | | | | |
| Formulation | Pure Penalty | | | | |
| Normal Stiffness | Program Controlled | | | | |
| Update Stiffness | Never | | | | |
| Thermal Conductance | Program Controlled | | | | |
| Pinball Region | Program Controlled | | | Radius | |

| | |
|----------------|--------|
| Pinball Radius | 40. mm |
|----------------|--------|

TABLE 12
Analysis 4.2 > Connections > Contact Regions

| | | | | | |
|---------------------|--|--|--|--|--|
| Object Name | <i>Bonded - endplate (1) 2 of 3 To rod4-rod5-rod1-rod2-rod3-rod6</i> | <i>Bonded - end plate 1 hole area target end2 To rod4-rod5-rod1-rod2-rod3-rod6</i> | <i>Bonded - endplate(2)1 of 2 To endplate (2) 2 of 2</i> | <i>Bonded - endplate(2)1 of 2 To endplate (2) 2 of 2</i> | <i>Bonded - endplate (2) 2 of 2 To endplate 2 hole area non target end</i> |
| State | Suppressed | | Fully Defined | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Contact | 1 Face | | | 1 Edge | 1 Face |
| Target | No Selection | | 3 Faces | 1 Edge | 1 Face |
| Contact Bodies | endplate(1) 2 of 3 | end plate 1 hole area target end2 | endplate(2)1 of 2 | | endplate(2) 2 of 2 |
| Target Bodies | rod4-rod5-rod1-rod2-rod3-rod6 | | endplate(2) 2 of 2 | | endplate 2 hole area non target end |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | | | Symmetric |
| Suppressed | No | | | | |
| Advanced | | | | | |
| Formulation | Pure Penalty | | | | |
| Normal Stiffness | Program Controlled | | | | |
| Update Stiffness | Never | | | | |
| Thermal Conductance | Program Controlled | | | | |
| Pinball Region | Program Controlled | | | | |

TABLE 13
Analysis 4.2 > Connections > Contact Regions

| | | | | | |
|-------------------|--|---|---|--|--|
| Object Name | <i>Bonded - endplate (2) 2 of 2 To endplate 2 hole area non target end</i> | <i>Bonded - endplate (2) 2 of 2 To end plate 2 hole area target end</i> | <i>Bonded - endplate (2) 2 of 2 To end plate 2 hole area target end</i> | <i>Bonded - endplate(2) 2 of 2 To back plate</i> | <i>Bonded - endplate(2) 2 of 2 To back plate</i> |
| State | Fully Defined | | | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Contact | 1 Face | | | | 1 Edge |
| Target | 1 Face | | | | 1 Edge |
| Contact Bodies | endplate(2) 2 of 2 | | | | |
| Target Bodies | endplate 2 hole area non target end | end plate 2 hole area target end | | back plate | |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | | | |

| | | |
|---------------------|--------------------|--------|
| Suppressed | No | |
| Advanced | | |
| Formulation | Pure Penalty | |
| Normal Stiffness | Program Controlled | |
| Update Stiffness | Never | |
| Thermal Conductance | Program Controlled | |
| Pinball Region | Program Controlled | Radius |
| Pinball Radius | | 50. mm |

TABLE 14
Analysis 4.2 > Connections > Contact Regions

| | | | | | |
|---------------------|---|---|--------------------------------------|--------------------------------------|--|
| Object Name | <i>Bonded - endplate(2) 2 of 2 To rod4-rod5-rod1-rod2-rod3-rod6</i> | <i>Bonded - end plate 2 hole area target end To rod4-rod5-rod1-rod2-rod3-rod6</i> | <i>Bonded - hexcel To nose plate</i> | <i>Bonded - hexcel To back plate</i> | <i>Bonded - hexcel To endplate(2) 2 of 2</i> |
| State | Suppressed | | Fully Defined | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Contact | 1 Face | | | 1 Edge | |
| Target | No Selection | | 1 Face | 1 Edge | |
| Contact Bodies | endplate(2) 2 of 2 | end plate 2 hole area target end | hexcel | | |
| Target Bodies | rod4-rod5-rod1-rod2-rod3-rod6 | | nose plate | back plate | endplate(2) 2 of 2 |
| Definition | | | | | |
| Type | Bonded | | | | |
| Scope Mode | Manual | | | | |
| Behavior | Symmetric | | | | |
| Suppressed | No | | | | |
| Advanced | | | | | |
| Formulation | Pure Penalty | | | | |
| Normal Stiffness | Program Controlled | | | | |
| Update Stiffness | Never | | | | |
| Thermal Conductance | Program Controlled | | | | |
| Pinball Region | Program Controlled | | Radius | | |
| Pinball Radius | | | 30. mm | | |

TABLE 15
Analysis 4.2 > Connections > Contact Regions

| | | | | |
|----------------|--|--------------------------------------|---|---|
| Object Name | <i>Bonded - hexcel To endplate(1) 2 of 3</i> | <i>Bonded - hexcel To back plate</i> | <i>Bonded - back plate To top hinge area1</i> | <i>Bonded - back plate To top hinge area2</i> |
| State | Fully Defined | | | |
| Scope | | | | |
| Scoping Method | Geometry Selection | | | |
| Contact | 1 Edge | | 1 Face | |
| Target | 1 Edge | | 1 Face | |

| | | | | |
|---------------------|--------------------|------------|--------------------|-----------------|
| Contact Bodies | hexcel | | back plate | |
| Target Bodies | endplate(1) 2 of 3 | back plate | top hinge area1 | top hinge area2 |
| Definition | | | | |
| Type | Bonded | | | |
| Scope Mode | Manual | | | |
| Suppressed | No | | | |
| Behavior | Symmetric | | | |
| Advanced | | | | |
| Formulation | Pure Penalty | | | |
| Normal Stiffness | Program Controlled | | | |
| Update Stiffness | Never | | | |
| Thermal Conductance | Program Controlled | | | |
| Pinball Region | Radius | | Program Controlled | |
| Pinball Radius | 30. mm | | | |

Mesh

TABLE 16
Analysis 4.2 > Mesh

| | |
|-----------------------------|---------------------|
| Object Name | <i>Mesh</i> |
| State | Solved |
| Defaults | |
| Physics Preference | Mechanical |
| Relevance | 0 |
| Advanced | |
| Relevance Center | Coarse |
| Element Size | Default |
| Shape Checking | Standard Mechanical |
| Solid Element Midside Nodes | Program Controlled |
| Straight Sided Elements | No |
| Initial Size Seed | Active Assembly |
| Smoothing | Low |
| Transition | Fast |
| Statistics | |
| Nodes | 46742 |
| Elements | 156153 |

TABLE 17
Analysis 4.2 > Mesh > Mesh Controls

| | |
|-----------------------|--------------------------|
| Object Name | <i>Patch Independent</i> |
| State | Fully Defined |
| Scope | |
| Scoping Method | Geometry Selection |
| Geometry | 14 Bodies |
| Definition | |
| Suppressed | No |
| Method | Tetrahedrons |
| Algorithm | Patch Independent |
| Element Midside Nodes | Dropped |
| Defined By | Max Element Size |

| | |
|------------------------------------|----------------|
| Max Element Size | Default |
| Define Defeaturing Tolerance | Yes |
| Defeaturing Tolerance | 1. mm |
| Curvature and Proximity Refinement | Yes |
| Min Size Limit | 5. mm |
| Num Cells Across Gap | Default |
| Span Angle | Coarse |
| Minimum Edge Length | 7.7856e-003 mm |

Named Selections

TABLE 18
Analysis 4.2 > Named Selections > Named Selections

| | | |
|-------------------|-----------------------------|-------------------------------|
| Object Name | <i>Problematic Geometry</i> | <i>Problematic Geometry 2</i> |
| State | Fully Defined | |
| Scope | | |
| Geometry | 1 Edge | |
| Statistics | | |
| Type | Manual | |
| Total Selection | 1 Edge | |
| Suppressed | 0 | |
| Hidden | 0 | |

Static Structural

TABLE 19
Analysis 4.2 > Analysis

| | |
|-------------------|--------------------------|
| Object Name | <i>Static Structural</i> |
| State | Fully Defined |
| Definition | |
| Physics Type | Structural |
| Analysis Type | Static Structural |
| Options | |
| Reference Temp | 22. °C |

TABLE 20
Analysis 4.2 > Static Structural > Analysis Settings

| | |
|---------------------------|--------------------------|
| Object Name | <i>Analysis Settings</i> |
| 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 | Program Controlled |
| Large Deflection | Off |
| Inertia Relief | Off |
| Nonlinear Controls | |

| | |
|---------------------------------|---|
| Force Convergence | Program Controlled |
| Moment Convergence | Program Controlled |
| Displacement Convergence | Program Controlled |
| Rotation Convergence | Program Controlled |
| Line Search | Program Controlled |
| Output Controls | |
| Calculate Stress | Yes |
| Calculate Strain | Yes |
| Calculate Results At | All Time Points |
| Analysis Data Management | |
| Solver Files Directory | C:\Documents and Settings\Jinnuri\Desktop\website\allaxis Simulation Files\Static Structural\ |
| Future Analysis | None |
| Save ANSYS db | No |
| Delete Unneeded Files | Yes |
| Nonlinear Solution | No |

FIGURE 1
Analysis 4.2 > Static Structural > Figure

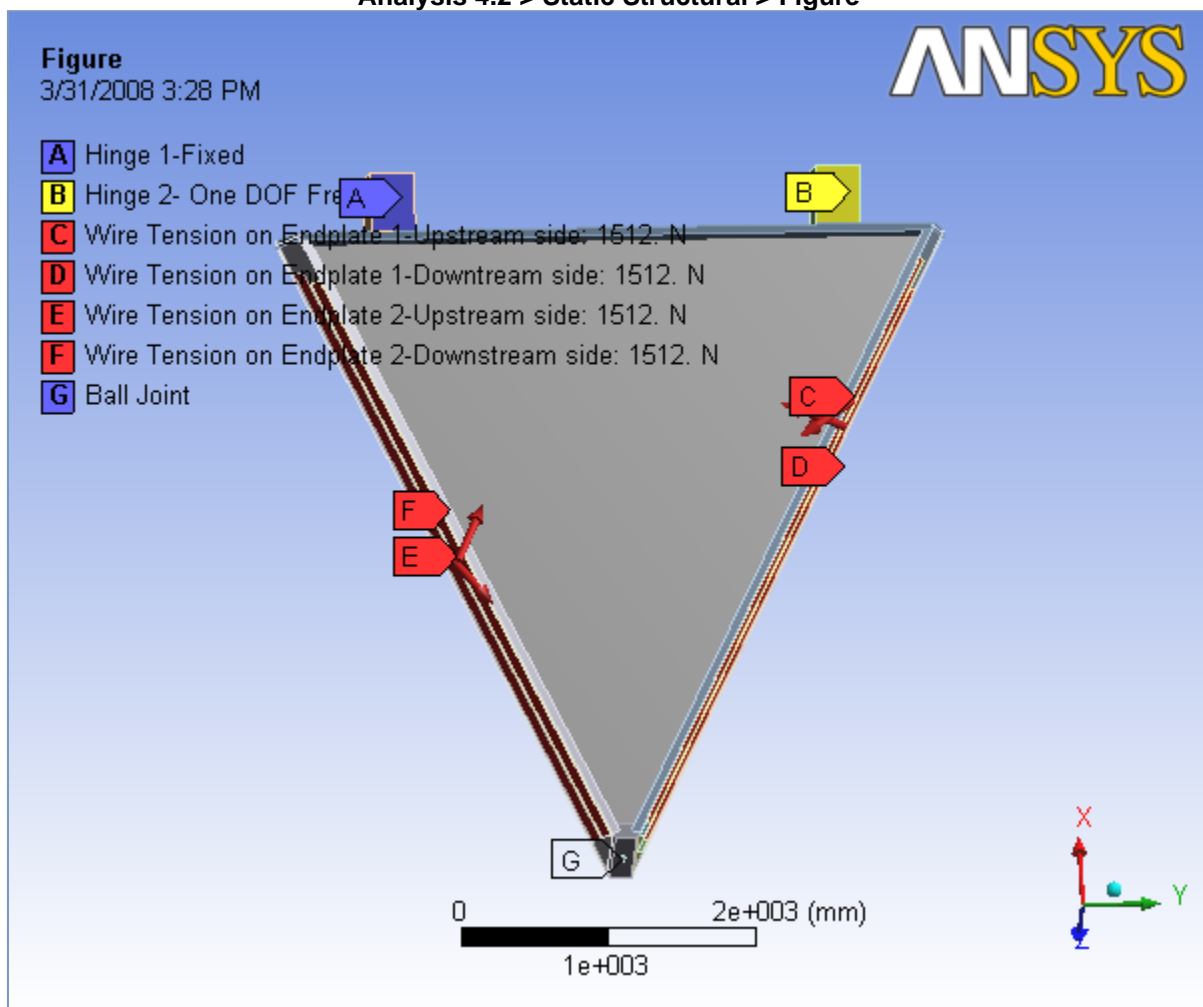


TABLE 21
Analysis 4.2 > Static Structural > Accelerations

| | |
|-------------------|----------------------------------|
| Object Name | <i>Acceleration</i> |
| State | Suppressed |
| Scope | |
| Geometry | All Bodies |
| Definition | |
| Define By | Components |
| X Component | 9810. mm/s ² (ramped) |
| Y Component | 0. mm/s ² (ramped) |
| Z Component | 0. mm/s ² (ramped) |
| Suppressed | Yes |

FIGURE 2
Analysis 4.2 > Static Structural > Acceleration

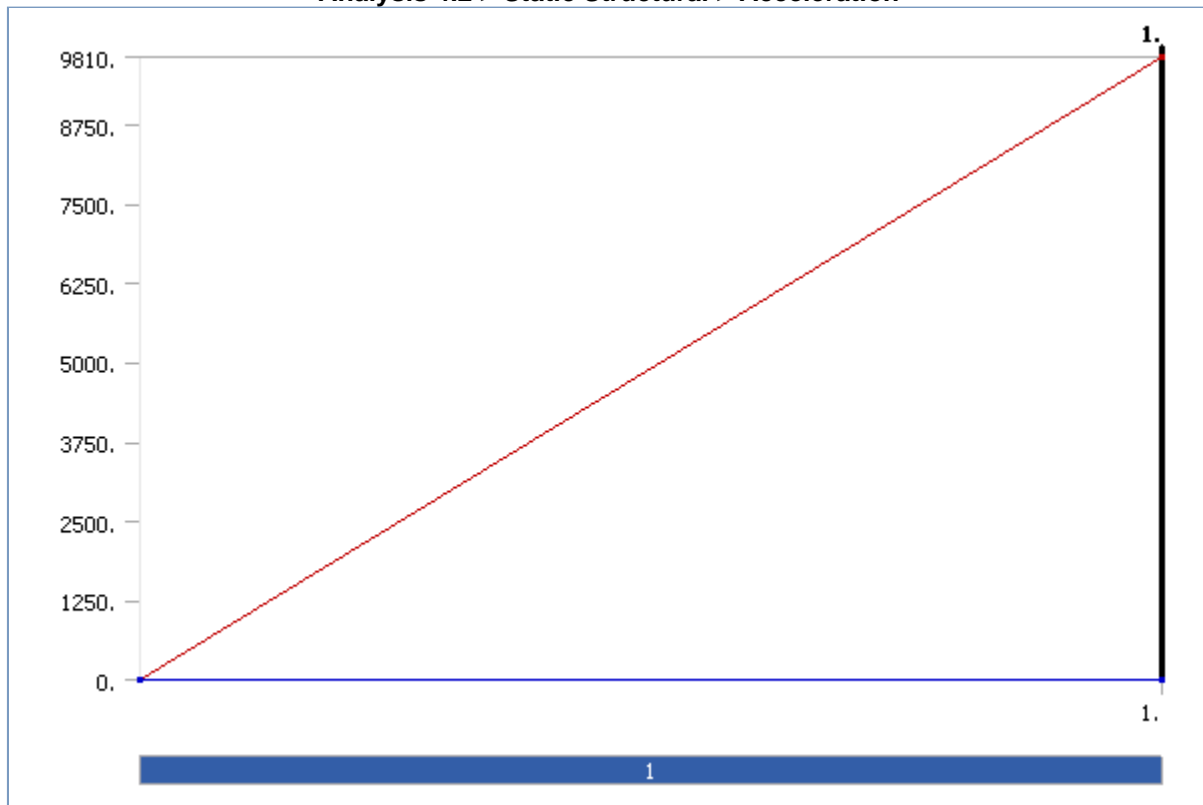


TABLE 22
Analysis 4.2 > Static Structural > Loads

| Object Name | <i>Hinge 1- Fixed</i> | <i>Hinge 2- One DOF Free</i> | <i>Wire Tension on Endplate 1- Upstream side</i> | <i>Wire Tension on Endplate 1- Downstream side</i> | <i>Wire Tension on Endplate 2- Upstream side</i> |
|-------------------|-----------------------|------------------------------|--|--|--|
| State | Fully Defined | | | | |
| Scope | | | | | |
| Scoping Method | Geometry Selection | | | | |
| Geometry | 1 Face | | | | |
| Definition | | | | | |
| Type | Fixed Support | Displacement | Force | | |
| Suppressed | No | | | | |
| Define By | Components | | | | |

| | | | | |
|----------------|----------------|--------------------|--------------------|-------------------|
| X Component | 0. mm (ramped) | -888.73 N (ramped) | 614.98 N (ramped) | 1381.3 N (ramped) |
| Y Component | Free | -1223.2 N (ramped) | -1381.3 N (ramped) | 614.98 N (ramped) |
| Z Component | 0. mm (ramped) | 0. N (ramped) | | |

FIGURE 3
Analysis 4.2 > Static Structural > Hinge 2- One DOF Free

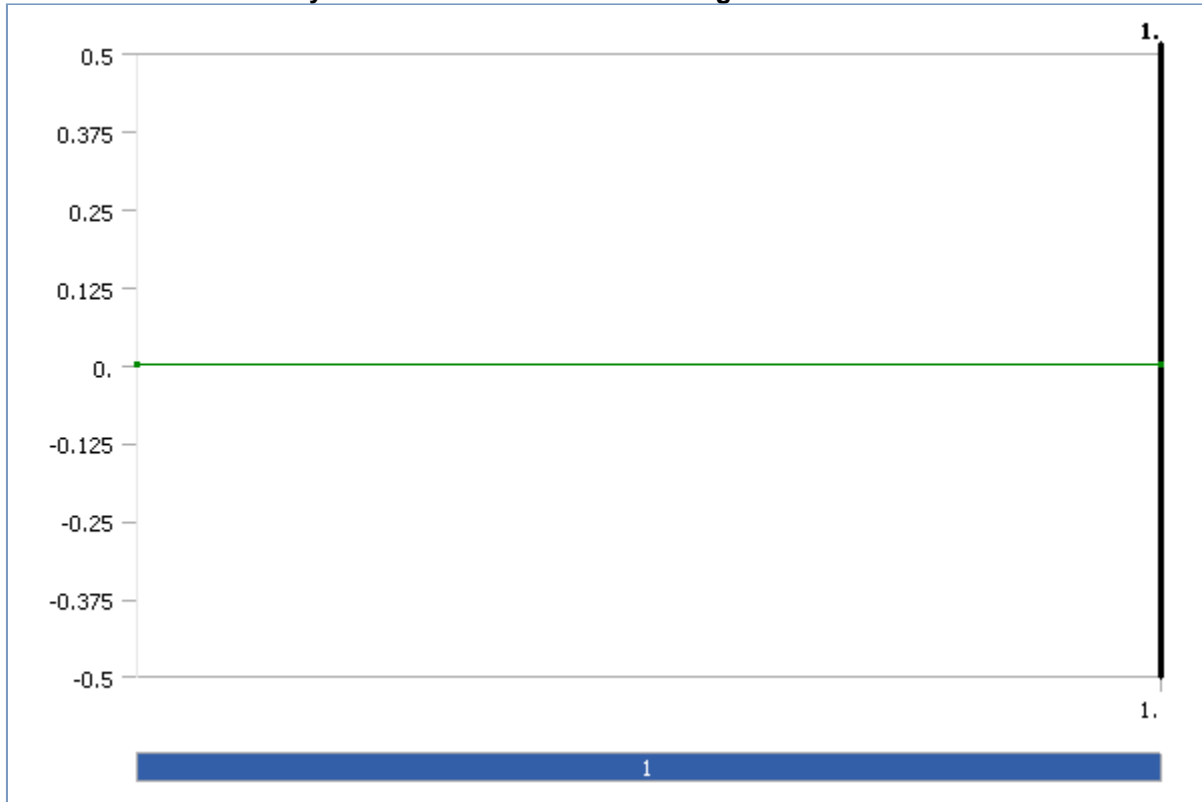


FIGURE 4
Analysis 4.2 > Static Structural > Wire Tension on Endplate 1-Upstream side

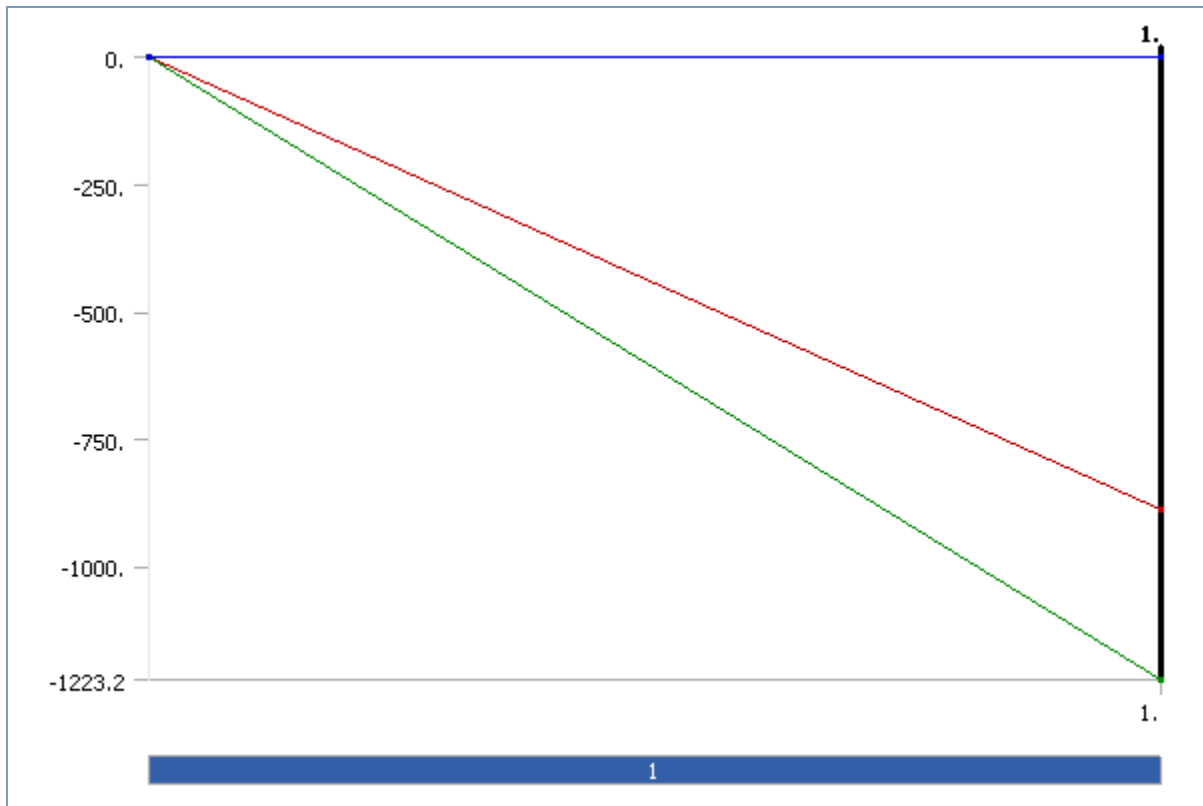


FIGURE 5
Analysis 4.2 > Static Structural > Wire Tension on Endplate 1-Downstream side

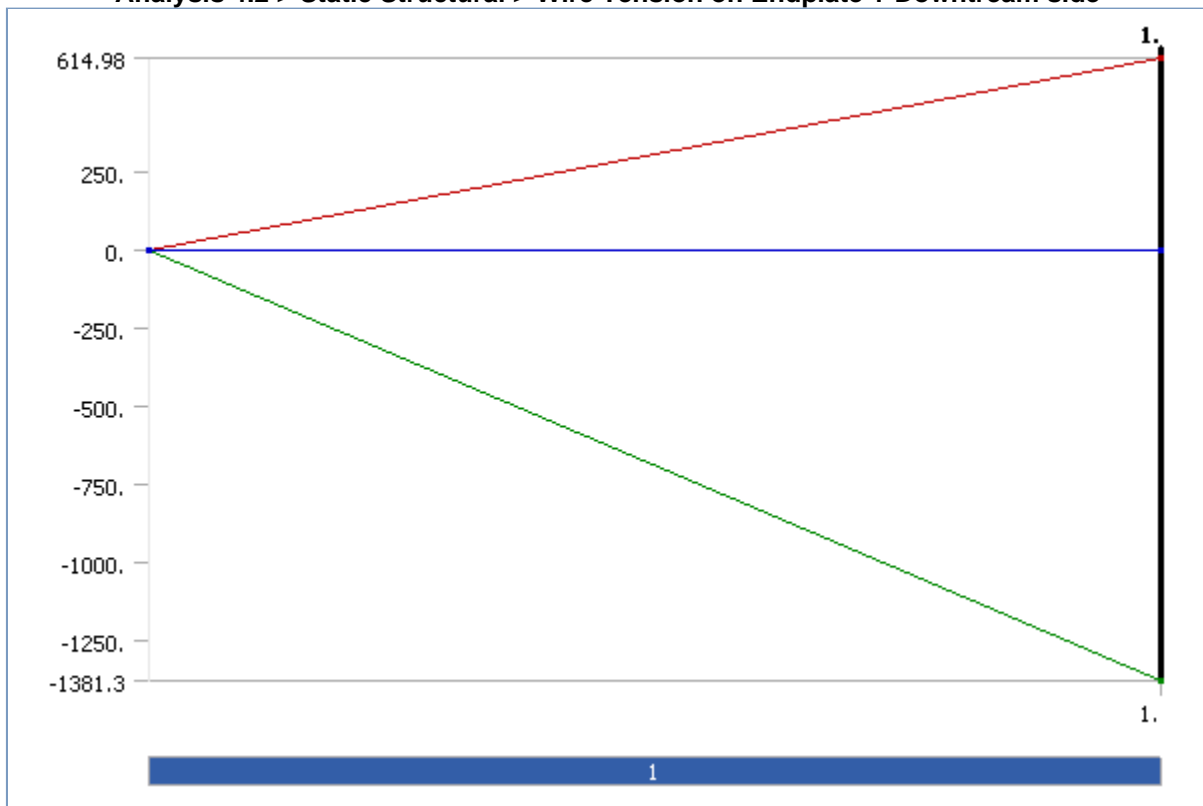


FIGURE 6
Analysis 4.2 > Static Structural > Wire Tension on Endplate 2-Upstream side

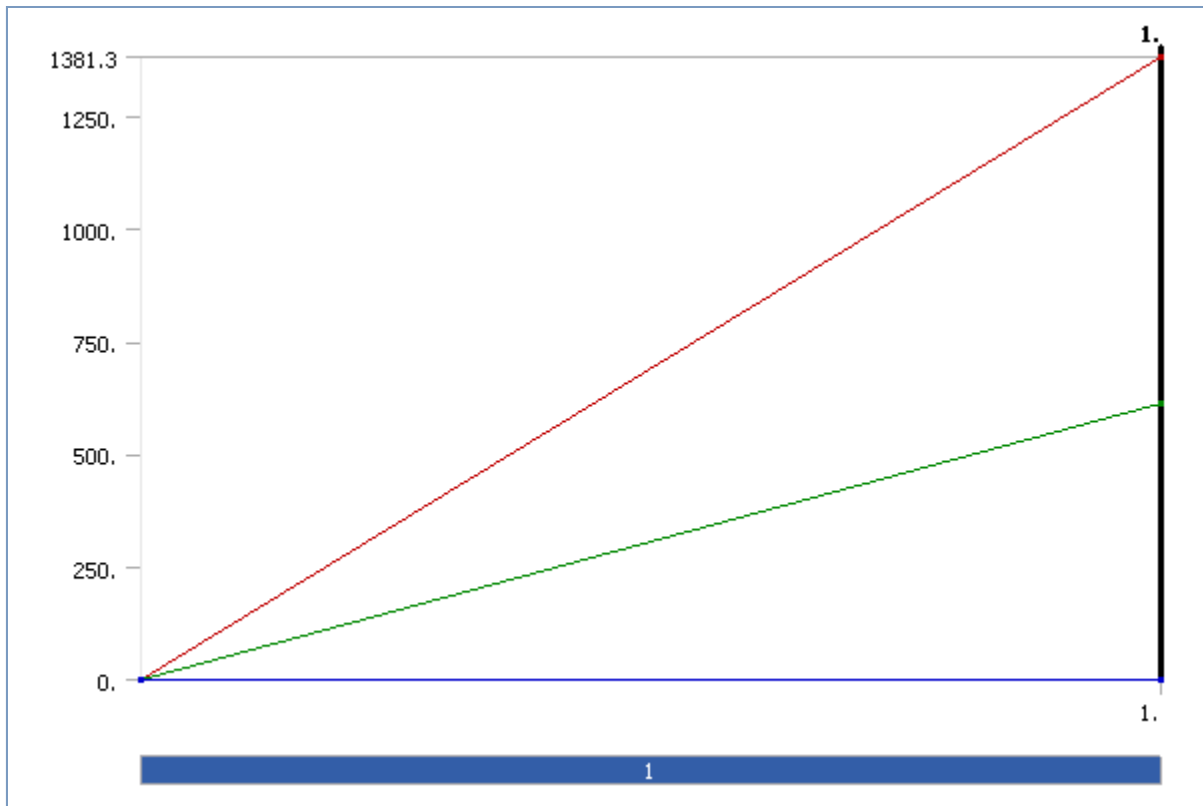
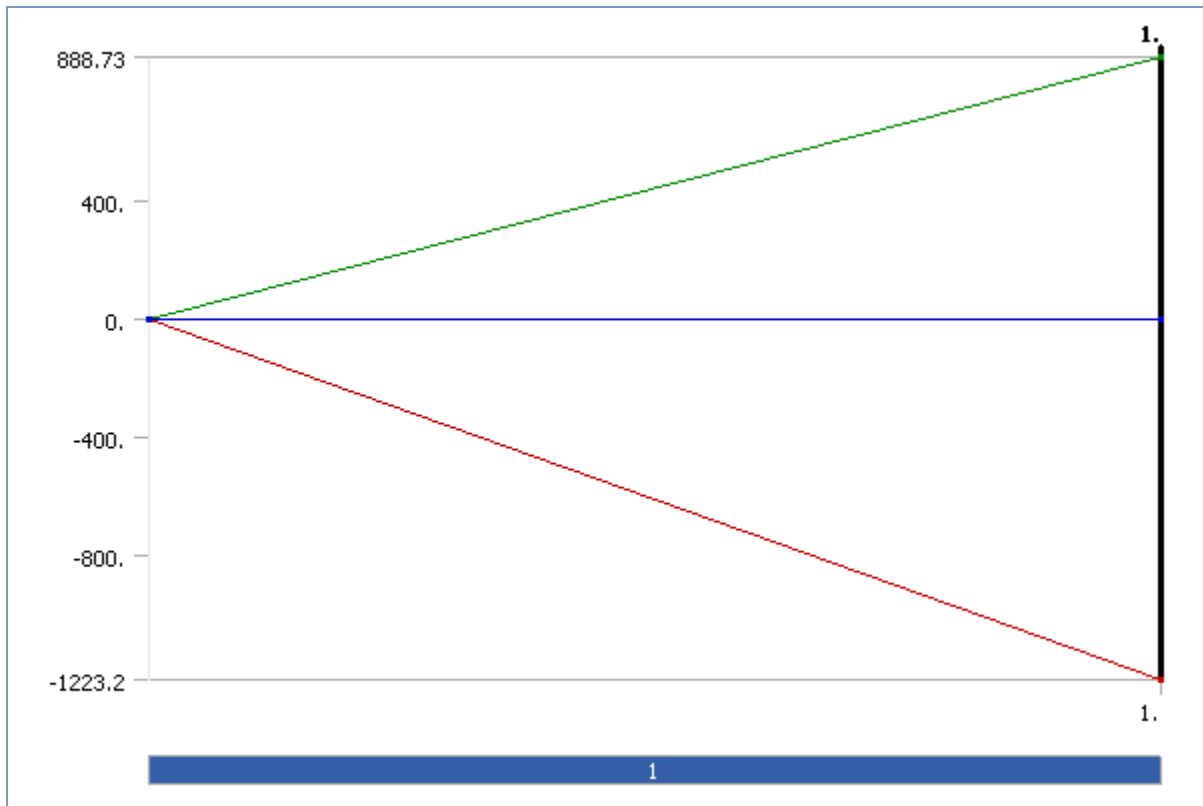


TABLE 23
Analysis 4.2 > Static Structural > Loads

| | | |
|-------------------|---|-------------------|
| Object Name | <i>Wire Tension on Endplate 2-Downstream side</i> | <i>Ball Joint</i> |
| State | Fully Defined | |
| Scope | | |
| Scoping Method | Geometry Selection | |
| Geometry | 1 Face | |
| Definition | | |
| Define By | Components | |
| Type | Force | Fixed Support |
| X Component | -1223.2 N (ramped) | |
| Y Component | 888.73 N (ramped) | |
| Z Component | 0. N (ramped) | |
| Suppressed | No | |

FIGURE 7
Analysis 4.2 > Static Structural > Wire Tension on Endplate 2-Downstream side



Solution

TABLE 24
Analysis 4.2 > Static Structural > Solution

| | |
|---------------------------------|-----------------|
| Object Name | <i>Solution</i> |
| State | Solved |
| Adaptive Mesh Refinement | |
| Max Refinement Loops | 1. |
| Refinement Depth | 2. |

TABLE 25
Analysis 4.2 > Static Structural > Solution > Solution Information

| | |
|-----------------------------|-----------------------------|
| Object Name | <i>Solution Information</i> |
| State | Solved |
| Solution Information | |
| Solution Output | Solver Output |
| Newton-Raphson Residuals | 0 |
| Update Interval | 2.5 s |
| Display Points | All |

TABLE 26
Analysis 4.2 > Static Structural > Solution > Results

| Object Name | <i>Total Deformation</i> | <i>x Directional Deformation</i> | <i>y Directional Deformation</i> | <i>z Directional Deformation</i> |
|-------------------|--------------------------|----------------------------------|----------------------------------|----------------------------------|
| State | Solved | | | |
| Scope | | | | |
| Geometry | All Bodies | | | |
| Definition | | | | |

| Type | Total Deformation | Directional Deformation | | |
|--------------------|--------------------|-------------------------|-------------|-----------------|
| Display Time | 0.40293 s | End Time | | |
| Orientation | | X Axis | Y Axis | Z Axis |
| Results | | | | |
| Minimum | 0. mm | -1.0543e-002 mm | -0.25508 mm | -1.5971e-002 mm |
| Maximum | 0.28919 mm | 0.15386 mm | 0.25105 mm | 1.6609e-002 mm |
| Minimum Occurs On | top hinge area2 | endplate(1) 2 of 3 | | |
| Maximum Occurs On | endplate(2) 2 of 2 | | | |
| Information | | | | |
| Time | 1. s | | | |
| Load Step | 1 | | | |
| Substep | 1 | | | |
| Iteration Number | 1 | | | |

FIGURE 8
Analysis 4.2 > Static Structural > Solution > Total Deformation > Figure

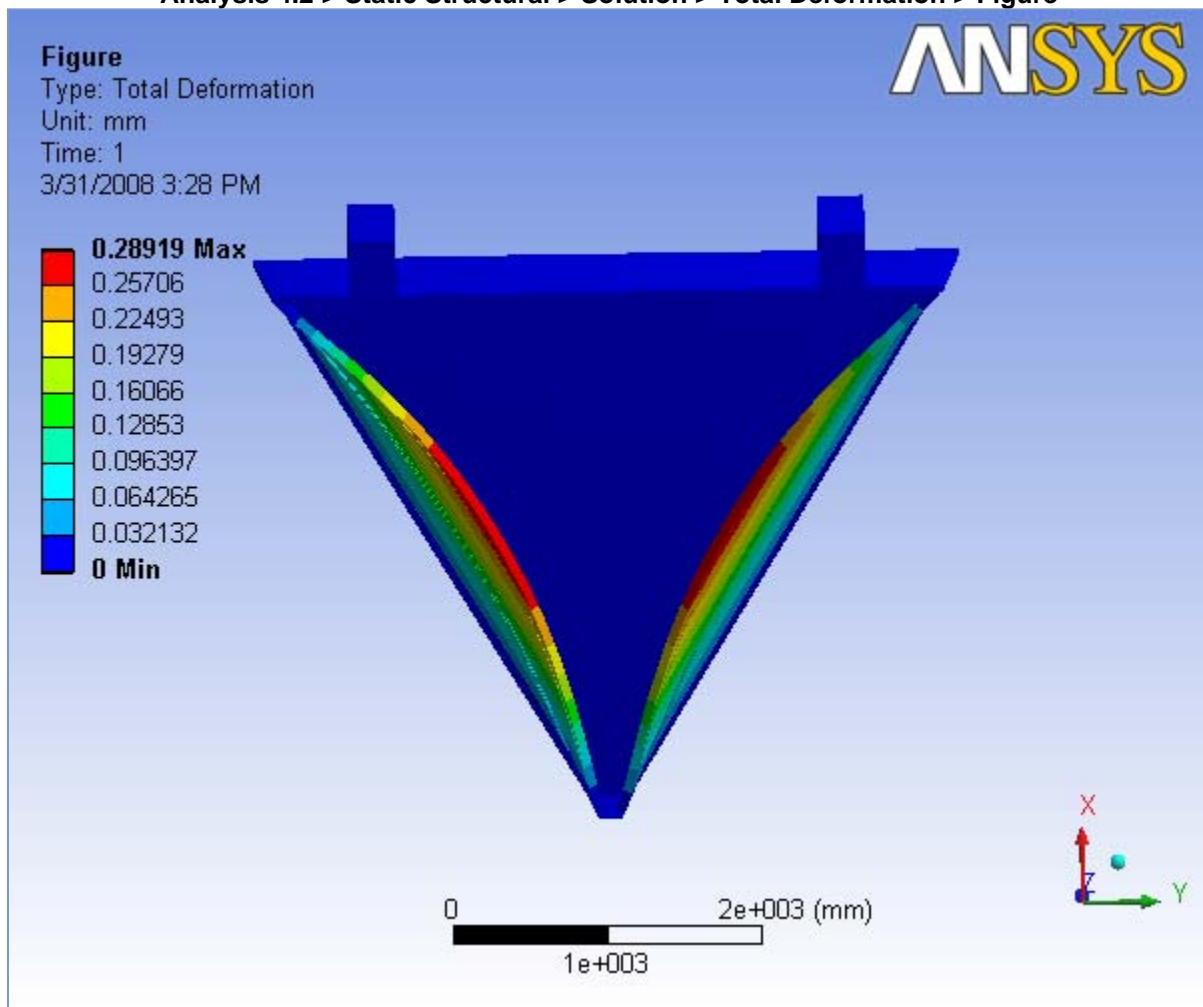


FIGURE 9
Analysis 4.2 > Static Structural > Solution > x Directional Deformation > Figure

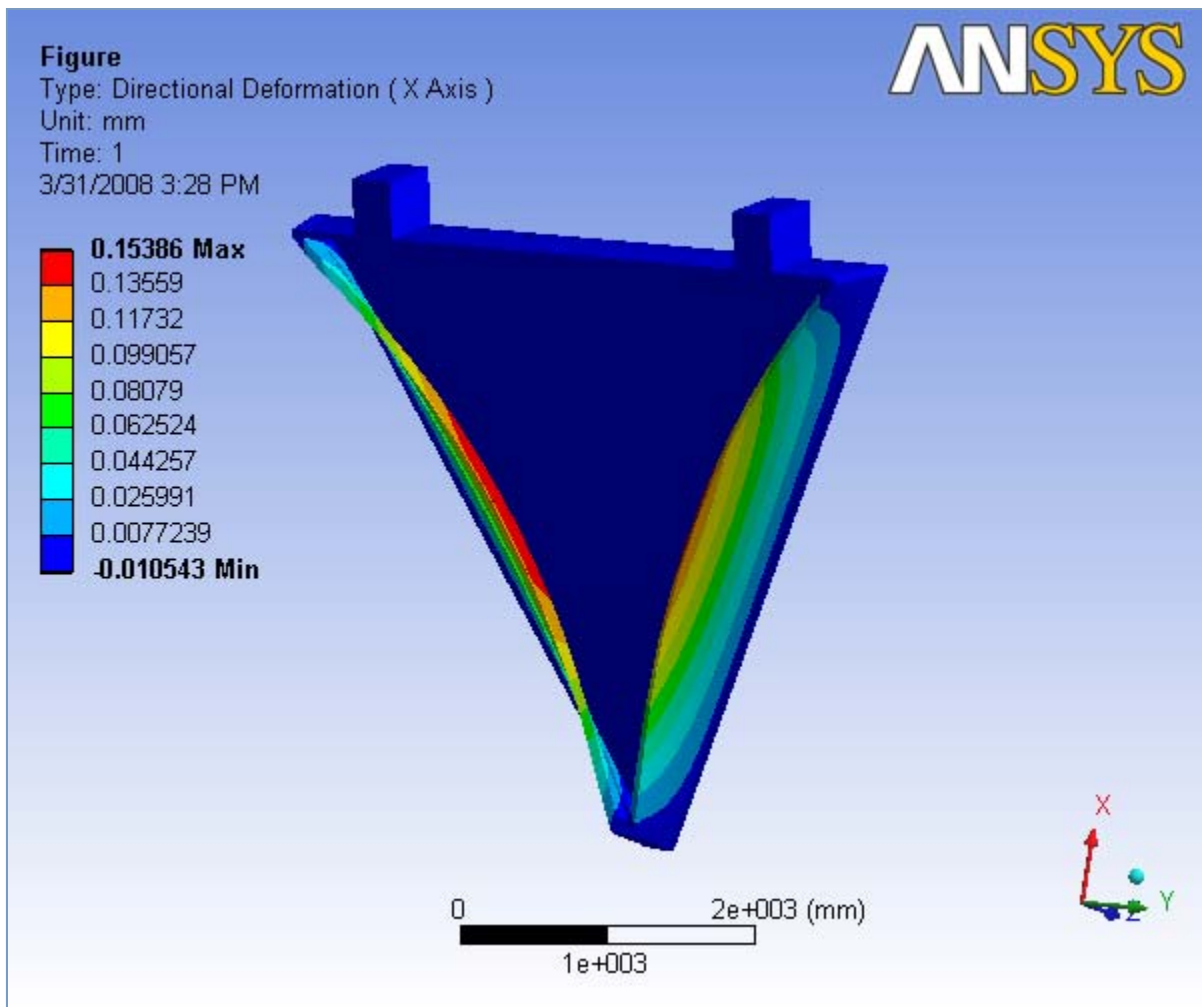


FIGURE 10
Analysis 4.2 > Static Structural > Solution > y Directional Deformation > Figure

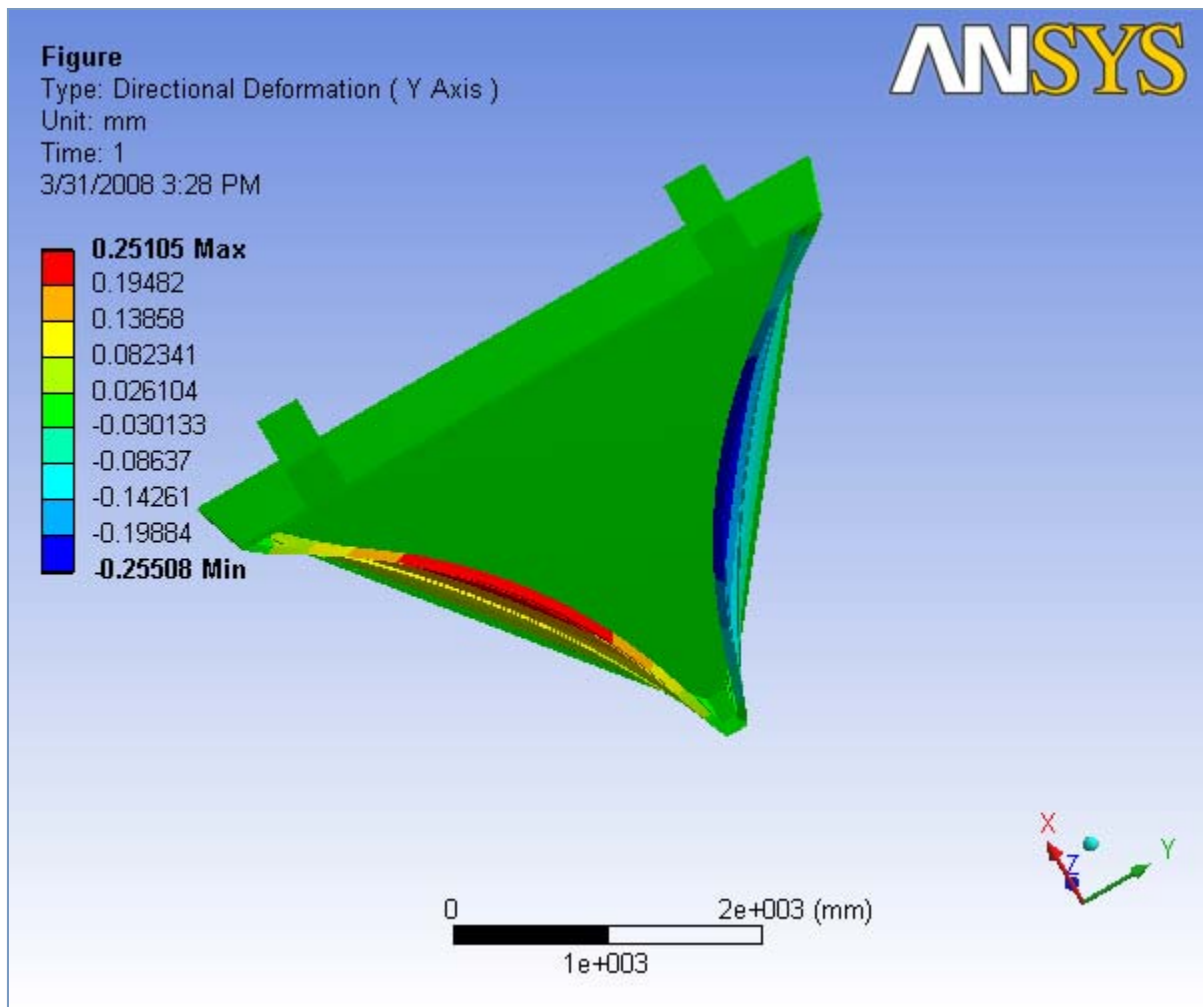
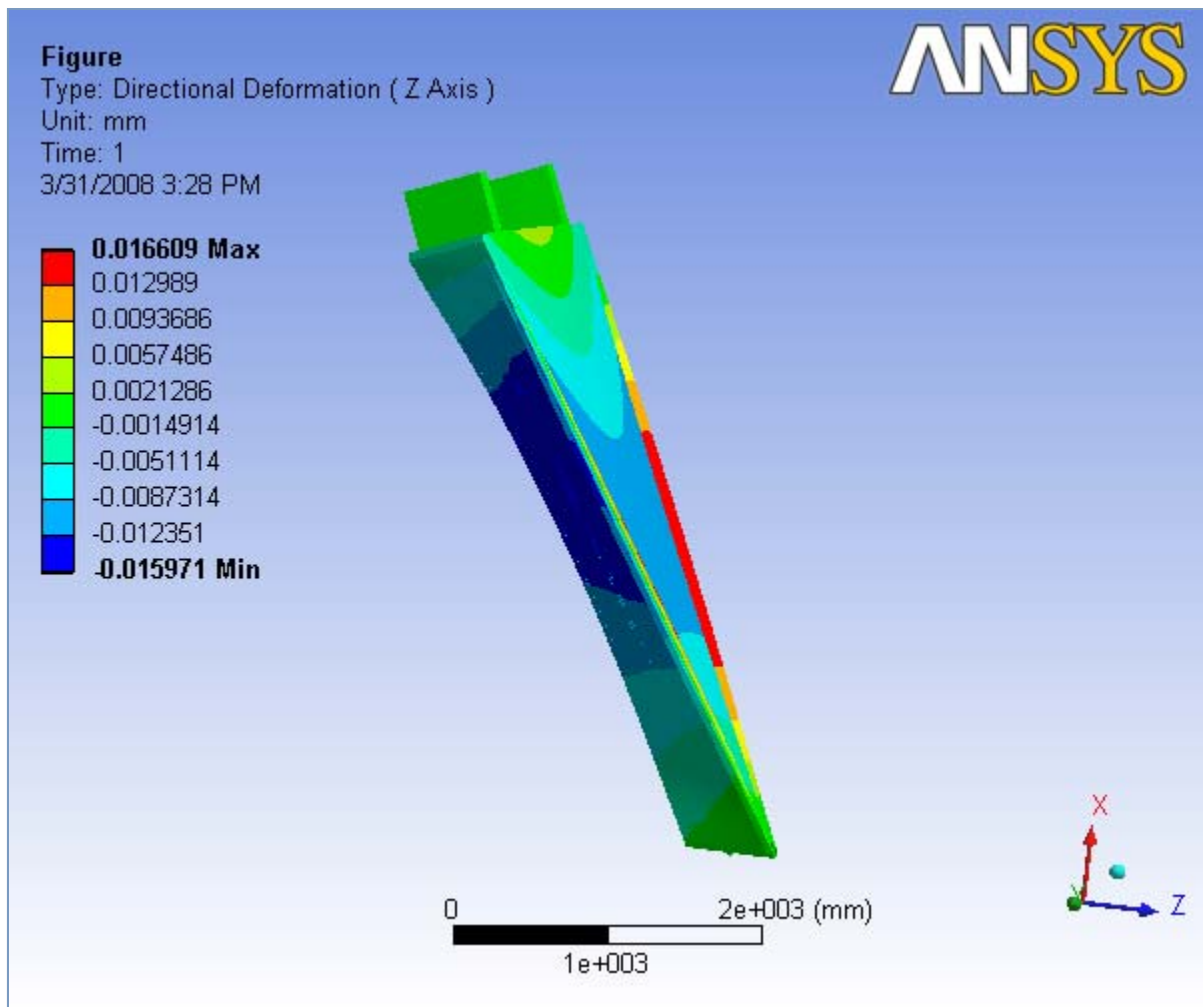


FIGURE 11
Analysis 4.2 > Static Structural > Solution > z Directional Deformation > Figure



Material Data

Polyurethane

TABLE 27
Polyurethane > Constants

| Structural | |
|-------------------------|-----------------------------|
| Young's Modulus | 9751.9 MPa |
| Poisson's Ratio | 0. |
| Density | 2.4e-007 kg/mm ³ |
| Thermal Expansion | 0. 1/°C |
| Thermal | |
| Thermal Conductivity | 0. W/mm·°C |
| Specific Heat | 0. J/kg·°C |
| Electromagnetics | |
| Relative Permeability | 0. |
| Resistivity | 0. Ohm-mm |

Carbon Fiber

TABLE 28

Carbon Fiber > Constants

| Structural | |
|-------------------------|-----------------------------|
| Young's Modulus | 1.5e+005 MPa |
| Poisson's Ratio | 0. |
| Density | 5.8e-007 kg/mm ³ |
| Thermal Expansion | 0. 1/°C |
| Thermal | |
| Thermal Conductivity | 0. W/mm·°C |
| Specific Heat | 0. J/kg·°C |
| Electromagnetics | |
| Relative Permeability | 0. |
| Resistivity | 0. Ohm·mm |

Hexcel sheet

TABLE 29
Hexcel sheet > Constants

| Structural | |
|-------------------------|--------------------------------|
| Young's Modulus | 1.4805e+005 MPa |
| Poisson's Ratio | 0. |
| Density | 2.8833e-008 kg/mm ³ |
| Thermal Expansion | 0. 1/°C |
| Thermal | |
| Thermal Conductivity | 0. W/mm·°C |
| Specific Heat | 0. J/kg·°C |
| Electromagnetics | |
| Relative Permeability | 0. |
| Resistivity | 0. Ohm·mm |

Structural Steel

TABLE 30
Structural Steel > Constants

| Structural | |
|-------------------------------|------------------------------|
| Young's Modulus | 2.e+005 MPa |
| Poisson's Ratio | 0.3 |
| Density | 7.85e-006 kg/mm ³ |
| Thermal Expansion | 1.2e-005 1/°C |
| Tensile Yield Strength | 250. MPa |
| Compressive Yield Strength | 250. MPa |
| Tensile Ultimate Strength | 460. MPa |
| Compressive Ultimate Strength | 0. MPa |
| Thermal | |
| Thermal Conductivity | 6.05e-002 W/mm·°C |
| Specific Heat | 434. J/kg·°C |
| Electromagnetics | |
| Relative Permeability | 10000 |
| Resistivity | 1.7e-004 Ohm·mm |

FIGURE 12
Structural Steel > Alternating Stress

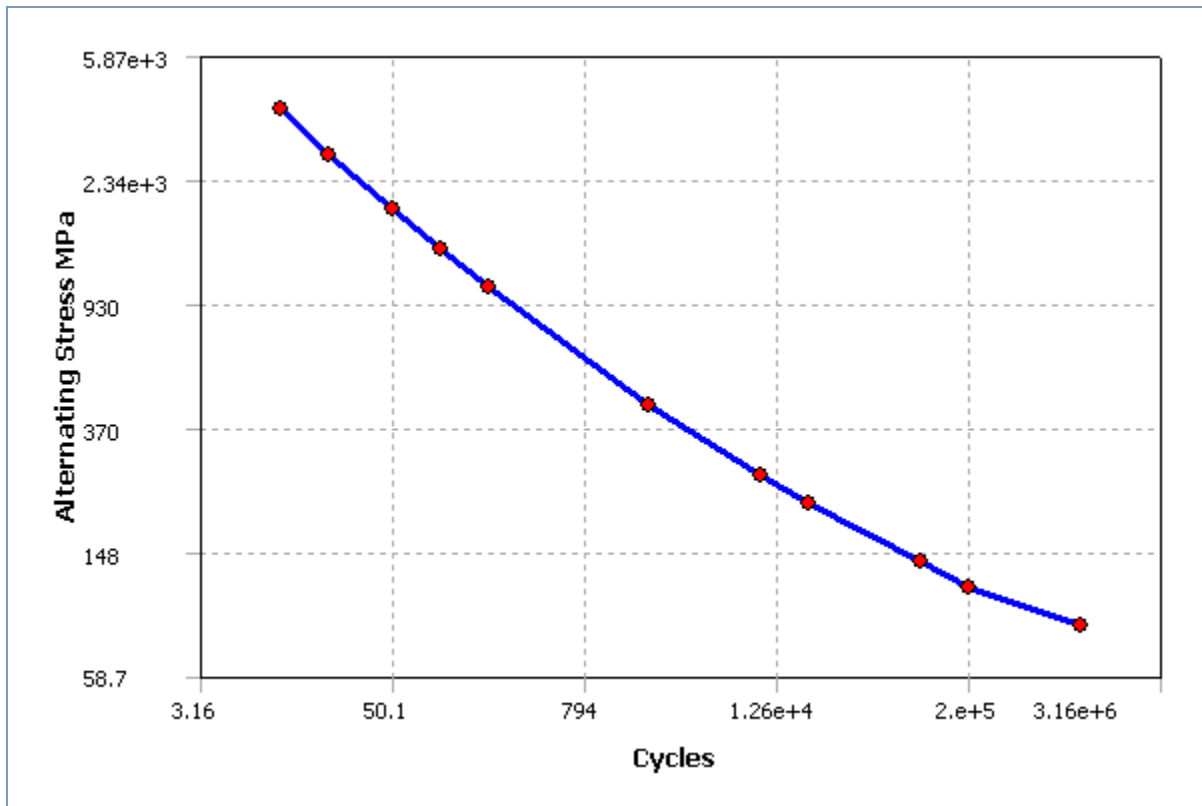


TABLE 31
Structural Steel > Alternating Stress > Property Attributes

| | |
|-----------------|-------------|
| Interpolation | Log-Log |
| Mean Curve Type | Mean Stress |

TABLE 32
Structural Steel > Alternating Stress > Alternating Stress Curve Data

| |
|----------------|
| Mean Value MPa |
| 0. |

TABLE 33
Structural Steel > Alternating Stress > Alternating Stress vs. Cycles

| Cycles | Alternating Stress MPa |
|---------|------------------------|
| 10. | 3999. |
| 20. | 2827. |
| 50. | 1896. |
| 100. | 1413. |
| 200. | 1069. |
| 2000. | 441. |
| 10000 | 262. |
| 20000 | 214. |
| 1.e+005 | 138. |
| 2.e+005 | 114. |
| 1.e+006 | 86.2 |

FIGURE 13
Structural Steel > Strain-Life Parameters

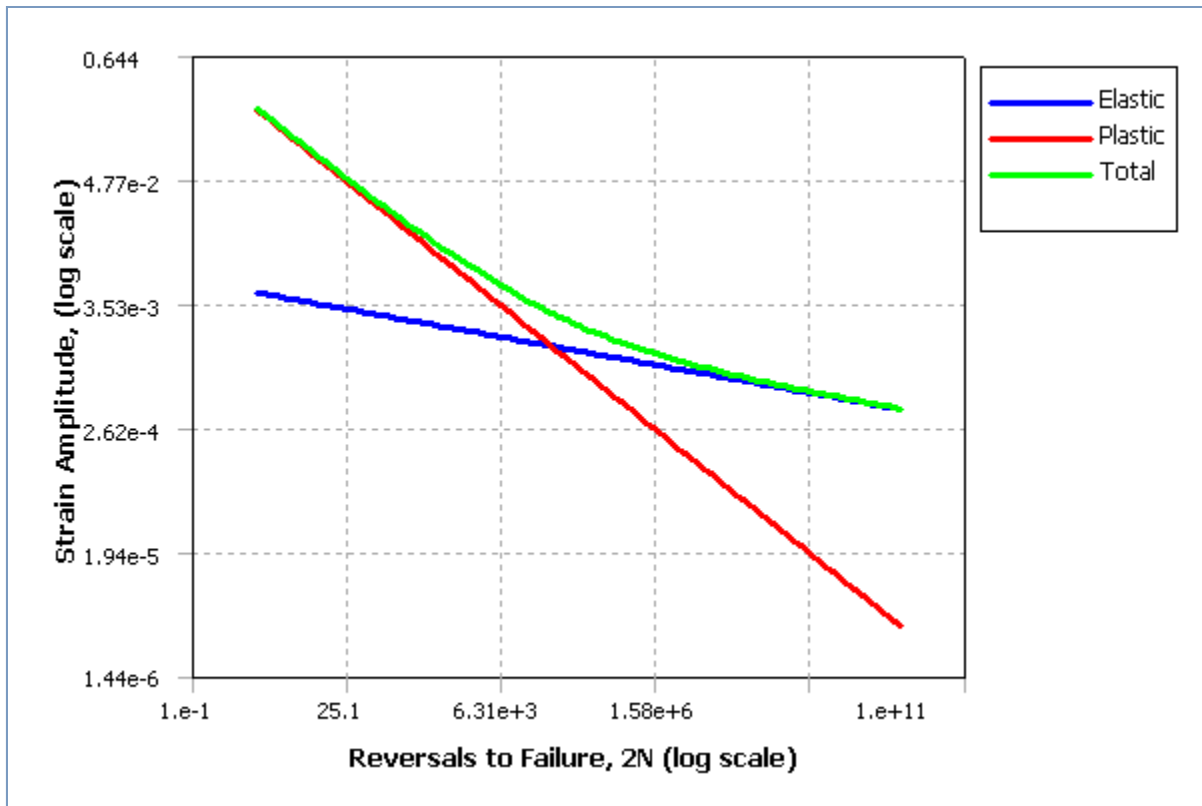


TABLE 34
Structural Steel > Strain-Life Parameters > Property Attributes
 Display Curve Type Strain-Life

TABLE 35
Structural Steel > Strain-Life Parameters > Strain-Life Parameters

| | |
|----------------------------------|--------|
| Strength Coefficient MPa | 920. |
| Strength Exponent | -0.106 |
| Ductility Coefficient | 0.213 |
| Ductility Exponent | -0.47 |
| Cyclic Strength Coefficient MPa | 1000. |
| Cyclic Strain Hardening Exponent | 0.2 |