Thermal deformation, 4 ladders

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1. Introduction

Thermal deformation, shear loads on 4 ladder locations

Note:

Do not base your design decisions solely on the data presented in this report. Use this information in conjunction with experimental data and practical experience. Field testing is mandatory to validate your final design. COSMOSWorks helps you reduce your time-to-market by reducing but not eliminating field tests.

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2. Description

20 Deg thermal distortion
2D sandwich values for stress loads
All 4 ladder positions loaded

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3. File Information

Model name:	beam
Model location:	C:\Documents and Settings\Howard Wieman\My Documents\aps project\mechanical\ladder thermal thin 3\beam.SLDPRT
Results location:	C:\Program Files\SolidWorks\COSMOS\work
Study name:	2D values 4 surfaces (-Default-)

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4. Materials

No.	Shell Name	Material	Thickness
1	Shell-1	[SW]ladder carbon corrected	0.2 mm

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5. Load & Restraint Information

Restraint	
Restraint-1 <beam>	on **16 Edge(s)** fixed.
Description:	

Load	
Pressure-1 <beam>	on **1 Face(s)** with Pressure **0.335 psi** normal to reference plane **Edge< 1 >** using equation **0 + 1x + 0y + 0xy + 0x^2 + 0y^2** with respect to coord. system **F2**
Description:	
Pressure-2 <beam>	on **1 Face(s)** with Pressure **-0.361 psi** normal to reference plane **Front Plane** using equation **0 + 1x + 0y + 0xy + 0x^2 + 0y^2** with respect to coord. system **F1**
Description:	
Pressure-3 <beam>	on **1 Face(s)** with Pressure **-0.361 psi** normal to reference plane **Front Plane** using equation **0 + 1x + 0y + 0xy + 0x^2 + 0y^2** with respect to coord. system **F3**
Description:	
Pressure-4 <beam>	on **1 Face(s)** with Pressure **-0.338 psi** normal to reference plane **Front Plane** using equation **0 + 1x + 0y + 0xy + 0x^2 + 0y^2** with respect to coord. system **F4**
Description:	

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6. Study Property

Mesh Information	
Mesh Type:	Shell mesh using surfaces
Mesher Used:	Standard
Automatic Transition:	Off
Smooth Surface:	On
Jacobian Check:	4 Points
Element Size:	2.718 mm

Tolerance:	0.1359 mm
Quality:	High
Number of elements:	14648
Number of nodes:	29450
Time to complete mesh(hh;mm;ss):	00:00:06
Computer name:	WIEMAN-M90

Solver Information	
Quality:	High
Solver Type:	FFEPlus
Option:	Include Thermal Effects
Thermal Option:	Input Temperature
Thermal Option:	Reference Temperature at zero strain: 298 Kelvin

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7. Contact

Contact state: Touching faces - Bonded

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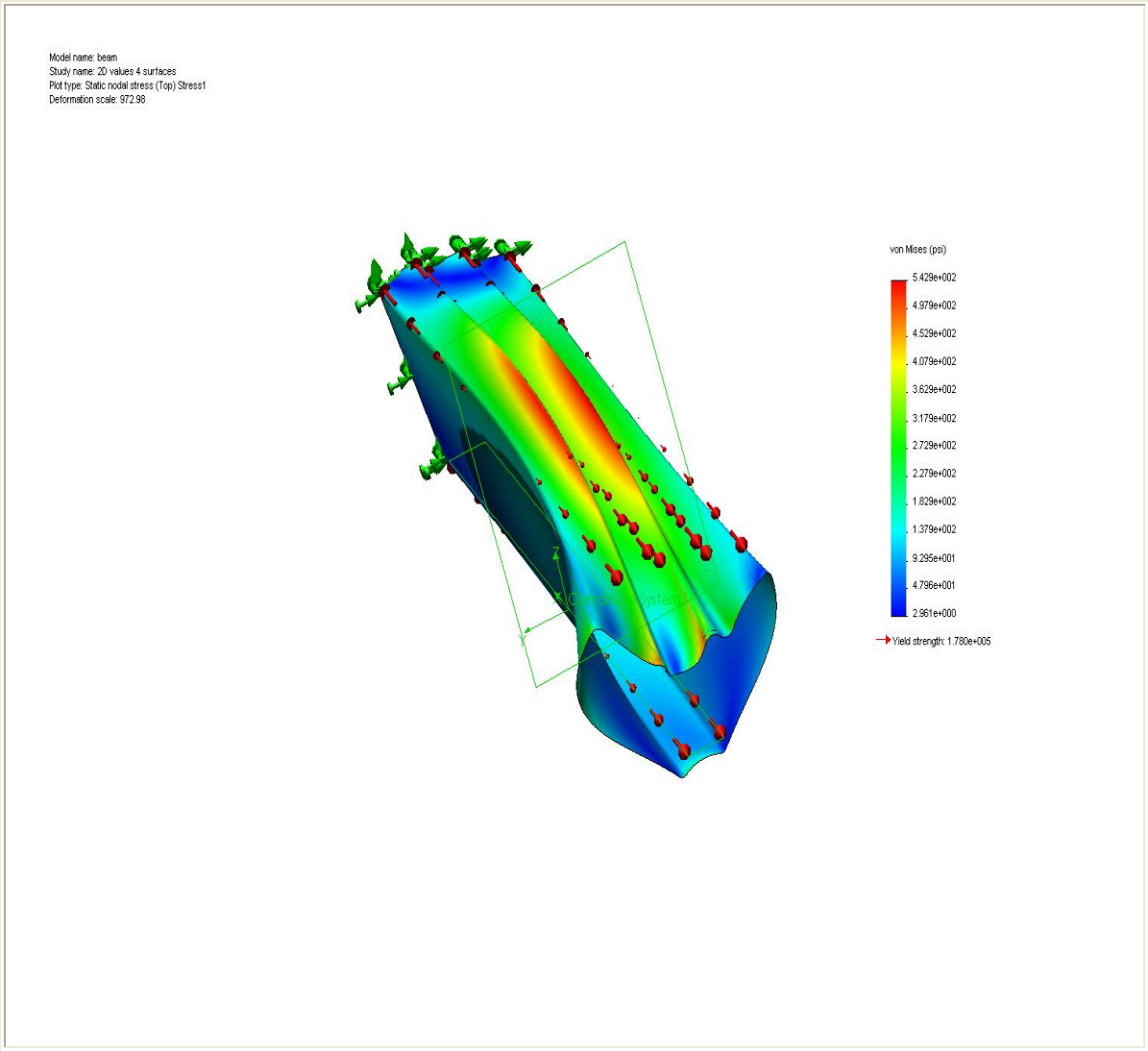
8. Results

8a. Default Results

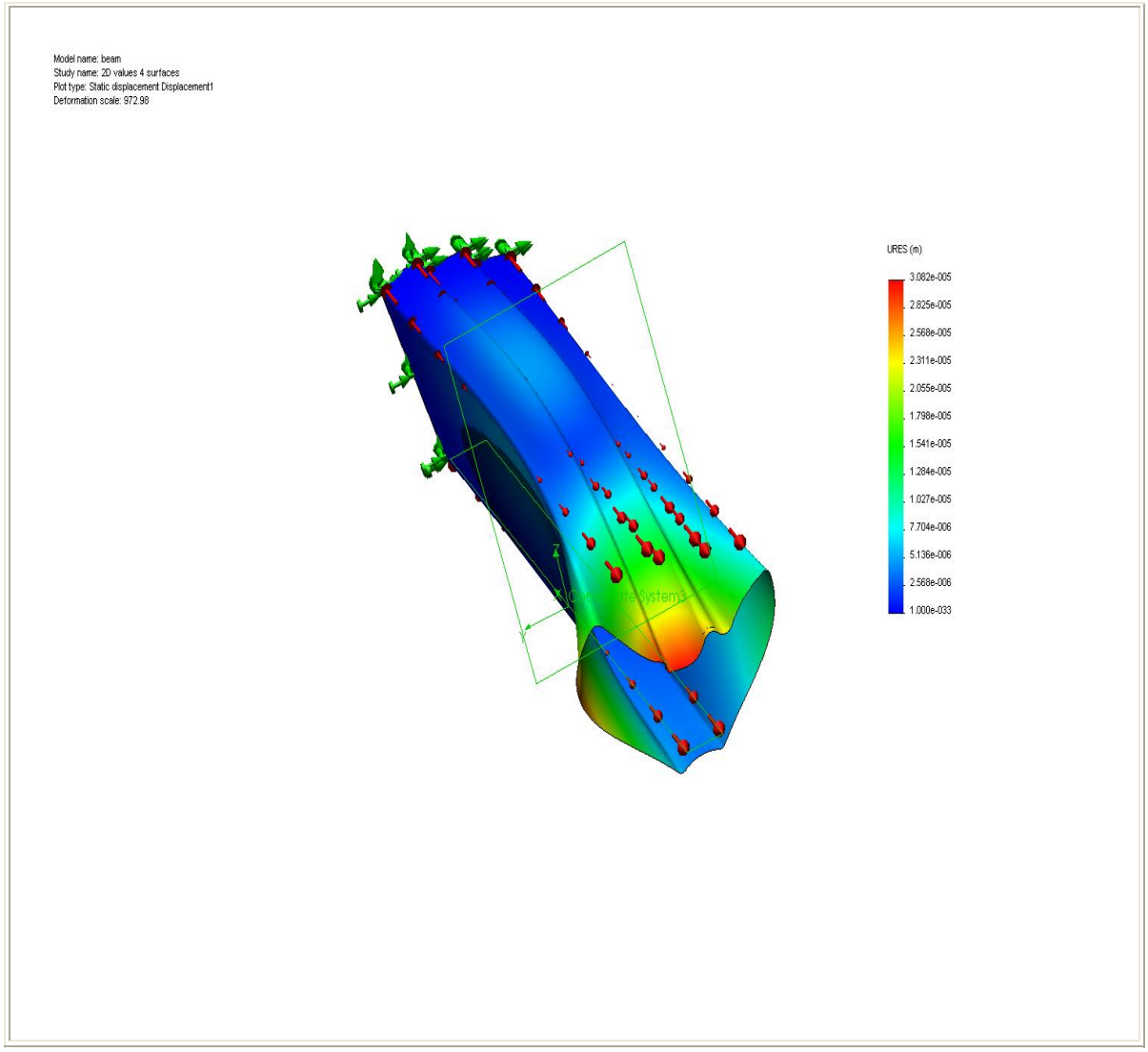
Name	Type	Min	Location	Max	Location
Stress1	VON: von Mises stress	2.96075 psi Node: 7570	(22.4175 mm, 77.5761 mm, -86.9957 mm)	542.895 psi Node: 6598	(29.2185 mm, 77.3228 mm, 46.0347 mm)
Displacement1	URES: Resultant displacement	0 m Node: 1	(12.4299 mm, 81.6951 mm, -106 mm)	3.08177e-005 m Node: 6866	(21.0573 mm, 77.6267 mm, 181.78 mm)

beam-2D values 4 surfaces-Stress-Stress1
JPEG



beam-2D values 4 surfaces-Displacement-Displacement1

JPEG



9. Conclusion

30 micron displacement
Does not include strength of carbon substrate on the ladder and the load is applied over the full ladder length. The real system will have a shorter shear accumulating length since the ladders do not go the full length.

10. Appendix

Material name: [SW]ladder carbon corrected

Description:

Material Source: Used SolidWorks material

Material Library Name: carbon composite tube

Material Model Type: Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	1.3996e+011	N/m^2	Constant
Poisson's ratio	0.33	NA	Constant
Shear modulus	7.0396e+010	N/m^2	Constant
Mass density	1550.1	kg/m^3	Constant
Tensile strength	1.8961e+009	N/m^2	Constant
Yield strength	1.2273e+009	N/m^2	Constant
Thermal expansion coefficient	1e-006	/Kelvin	Constant
Thermal conductivity	46	W/(m.K)	Constant
Specific heat	920	J/(kg.K)	Constant