|  |  |  |  |
| --- | --- | --- | --- |
|  | |  | | --- | | **Simulation of AutoRecover Of ShelledModel1**  **Date: March 30, 2023 Designer: Solidworks**  **Study name: Static 5**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc131071899)  [Assumptions 2](#_Toc131071900)  [Model Information 2](#_Toc131071901)  [Study Properties 3](#_Toc131071902)  [Units 3](#_Toc131071903)  [Material Properties 4](#_Toc131071904)  [Loads and Fixtures 5](#_Toc131071905)  [Connector Definitions 6](#_Toc131071906)  [Contact Information 6](#_Toc131071907)  [Mesh information 7](#_Toc131071908)  [Sensor Details 8](#_Toc131071909)  [Resultant Forces 8](#_Toc131071910)  [Beams 8](#_Toc131071911)  [Study Results 9](#_Toc131071912)  [Conclusion 11](#_Toc131071913) | |
| Description Torsional Forces Analysis. Torsional Forces were applied along all 4 columns to simulate the forces the subframe would typically experience |

|  |
| --- |
| Assumptions |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** AutoRecover Of ShelledModel1**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Mirror4** | **Solid Body** | ****Mass:3.3 kg****  ****Volume:0.00111137 m^3****  ****Density:7,847.94 kg/m^3****  ****Weight:32.24 N**** | ****C:\Users\westy\OneDrive\Documents\SubFrame Documents\Frame\_Documents\ShelledModel1.SLDPRT****  **Mar 30 11:46:53 2023** | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study Properties  |  |  | | --- | --- | | Study name | Static 5 | | Analysis type | Static | | Mesh type | Solid Mesh | | Thermal Effect: | On | | Thermal option | Include temperature loads | | Zero strain temperature | 298 Kelvin | | Include fluid pressure effects from SOLIDWORKS Flow Simulation | Off | | Solver type | FFEPlus | | Inplane Effect: | Off | | Soft Spring: | Off | | Inertial Relief: | Off | | Incompatible bonding options | Automatic | | Large displacement | Off | | Compute free body forces | On | | Friction | Off | | Use Adaptive Method: | Off | | Result folder | SOLIDWORKS document (C:\Users\westy\OneDrive\Documents\SubFrame Documents\Frame\_Documents) | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Units  |  |  | | --- | --- | | Unit system: | SI (MKS) | | Length/Displacement | mm | | Temperature | Kelvin | | Angular velocity | Rad/sec | | Pressure/Stress | N/mm^2 (MPa) | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material Properties  |  |  |  | | --- | --- | --- | | ****Model Reference**** | ****Properties**** | ****Components**** | |  | |  |  | | --- | --- | | ****Name:**** | **AISI 4130 Steel, normalized at 870C** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **460 N/mm^2** | | ****Tensile strength:**** | **731 N/mm^2** | | ****Elastic modulus:**** | **205,000 N/mm^2** | | ****Poisson's ratio:**** | **0.285** | | ****Mass density:**** | **7.85 g/cm^3** | | ****Shear modulus:**** | **80,000 N/mm^2** | | **SolidBody 1(Mirror4)(AutoRecover Of ShelledModel1)** | | **Curve Data:N/A** | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **4 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **-0.20706** | **0.00578785** | **-14.8168** | **14.8183** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Torque-1** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Reference: | **Face< 1 >** | | Type: | **Apply torque** | | Value: | **1 N.m** | | | **Torque-2** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Reference: | **Face< 1 >** | | Type: | **Apply torque** | | Value: | **1 N.m** | | | **Torque-3** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Reference: | **Face< 1 >** | | Type: | **Apply torque** | | Value: | **1 N.m** | | | **Torque-4** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Reference: | **Face< 1 >** | | Type: | **Apply torque** | | Value: | **1 N.m** | | |

|  |
| --- |
| Connector Definitions No Data |

|  |
| --- |
| Contact Information No Data |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Standard mesh | | Automatic Transition: | Off | | Include Mesh Auto Loops: | Off | | Jacobian points for High quality mesh | 16 Points | | Element Size | 10.361 mm | | Tolerance | 0.518051 mm | | Mesh Quality | High |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 21826 | | Total Elements | 11009 | | Maximum Aspect Ratio | 19.259 | | % of elements with Aspect Ratio < 3 | 92.8 | | Percentage of elements with Aspect Ratio > 10 | 0.109 | | Percentage of distorted elements | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:04 | | Computer name: | JOSH-G15 | |  | | |

|  |
| --- |
| Sensor Details No Data |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Resultant ForcesReaction forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | -0.20706 | 0.00578785 | -14.8168 | 14.8183 |  Reaction Moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 0 | |
| Free body forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | 0.0245838 | 0.0809659 | 0.0185621 | 0.0866279 |  Free body moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 1e-33 | |

|  |
| --- |
| Beams No Data |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study Results  | Name | Type | Min | Max | | --- | --- | --- | --- | | Stress1 | VON: von Mises Stress | 4.024e-03N/mm^2 (MPa)  Node: 9597 | 4.298e+00N/mm^2 (MPa)  Node: 18244 | | **AutoRecover Of ShelledModel1-Static 5-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 259 | 5.889e-02mm  Node: 18935 | | **AutoRecover Of ShelledModel1-Static 5-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 8.030e-08  Element: 9586 | 1.216e-05  Element: 2861 | | **AutoRecover Of ShelledModel1-Static 5-Strain-Strain1** | | | |  | Name | Type | | --- | --- | | Displacement1{1} | Deformed shape | | **AutoRecover Of ShelledModel1-Static 5-Displacement-Displacement1{1}** | | |

|  |
| --- |
| Conclusion |