|  |  |  |  |
| --- | --- | --- | --- |
|  | |  | | --- | | **Simulation of BoneWrench**  **Date: Thursday, September 3, 2020 Designer: Solidworks**  **Study name: wrench analysis**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc50029272)  [Assumptions 2](#_Toc50029273)  [Model Information 2](#_Toc50029274)  [Study Properties 3](#_Toc50029275)  [Units 3](#_Toc50029276)  [Material Properties 4](#_Toc50029277)  [Loads and Fixtures 4](#_Toc50029278)  [Connector Definitions 5](#_Toc50029279)  [Contact Information 5](#_Toc50029280)  [Mesh information 5](#_Toc50029281)  [Sensor Details 6](#_Toc50029282)  [Resultant Forces 6](#_Toc50029283)  [Beams 6](#_Toc50029284)  [Study Results 7](#_Toc50029285)  [Conclusion 9](#_Toc50029286) | |
| Description No Data |

|  |
| --- |
| Assumptions |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** BoneWrench**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Fillet4** | **Solid Body** | ****Mass:0.104839 kg****  ****Volume:1.36162e-05 m^3****  ****Density:7,699.58 kg/m^3****  ****Weight:1.02743 N**** | ****C:\Users\nlr1\Desktop\SW Simulation 2021\Training Files\SOLIDWORKS Simulation - With Results\Lesson02\Exercises\Bone Wrench\BoneWrench.SLDPRT****  **Sep 3 12:04:28 2020** | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study Properties  |  |  | | --- | --- | | Study name | wrench analysis | | 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 | Automatic | | 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\nlr1\Desktop\SW Simulation 2021\Training Files\SOLIDWORKS Simulation - With Results\Lesson02\Exercises\Bone Wrench\Results) | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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:**** | **Alloy Steel** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Max von Mises Stress** | | ****Yield strength:**** | **620.422 N/mm^2** | | ****Tensile strength:**** | **723.826 N/mm^2** | | ****Elastic modulus:**** | **210,000 N/mm^2** | | ****Poisson's ratio:**** | **0.28** | | ****Mass density:**** | **7.7 g/cm^3** | | ****Shear modulus:**** | **79,000 N/mm^2** | | ****Thermal expansion coefficient:**** | **1.3e-05 /Kelvin** | | **SolidBody 1(Fillet4)(BoneWrench)** | | **Curve Data:N/A** | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **8 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **-0.000209808** | **-4.76837e-06** | **-150** | **150** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-1** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Type: | **Apply normal force** | | Value: | **150 N** | | |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Curvature-based mesh | | Jacobian points for High quality mesh | 16 Points | | Maximum element size | 4.77751 mm | | Minimum element size | 0.955503 mm | | Mesh Quality | High |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 30582 | | Total Elements | 18176 | | Maximum Aspect Ratio | 16.711 | | % of elements with Aspect Ratio < 3 | 90.9 | | Percentage of elements with Aspect Ratio > 10 | 0.088 | | Percentage of distorted elements | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:02 | | Computer name: | LP5-NLR1\_DSA | |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Resultant ForcesReaction forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | -0.000209808 | -4.76837e-06 | -150 | 150 |  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 | -0.000220384 | -3.72256e-06 | -4.68068e-05 | 0.000225331 |  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 | 8.619009e-03N/mm^2 (MPa)  Node: 10409 | 2.443004e+02N/mm^2 (MPa)  Node: 522 | | **BoneWrench-wrench analysis-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000000e+00mm  Node: 123 | 3.115175e-01mm  Node: 1344 | | **BoneWrench-wrench analysis-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 4.310924e-08  Element: 15726 | 9.235157e-04  Element: 7432 | | **BoneWrench-wrench analysis-Strain-Strain1** | | | | |

|  |
| --- |
| Conclusion |