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|  | |  | | --- | | **Simulation of Lab3\_knuckle-joint\_assembly**  **Date: 03 February 2025 Designer: Solidworks**  **Study name: Static 2**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc189441869)  [Assumptions 2](#_Toc189441870)  [Model Information 3](#_Toc189441871)  [Study Properties 5](#_Toc189441872)  [Units 5](#_Toc189441873)  [Material Properties 6](#_Toc189441874)  [Loads and Fixtures 6](#_Toc189441875)  [Connector Definitions 7](#_Toc189441876)  [Interaction Information 7](#_Toc189441877)  [Mesh information 8](#_Toc189441878)  [Sensor Details 8](#_Toc189441879)  [Resultant Forces 9](#_Toc189441880)  [Beams 9](#_Toc189441881)  [Study Results 10](#_Toc189441882)  [Conclusion 12](#_Toc189441883) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** Lab3\_knuckle-joint\_assembly**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Cut-Extrude3** | **Solid Body** | ****Mass:0.82145 kg****  ****Volume:0.000105314 m^3****  ****Density:7,800 kg/m^3****  ****Weight:8.05021 N**** | ****C:\Users\pushk\Documents\DME-Lab\Lab3\_eye.SLDPRT****  **Feb 3 00:33:34 2025** | | **Boss-Extrude2** | **Solid Body** | ****Mass:1.0853 kg****  ****Volume:0.000139142 m^3****  ****Density:7,800 kg/m^3****  ****Weight:10.636 N**** | ****C:\Users\pushk\Documents\DME-Lab\Lab3\_fork.SLDPRT****  **Feb 2 23:38:13 2025** | | **Cut-Extrude1** | **Solid Body** | ****Mass:0.136248 kg****  ****Volume:1.74677e-05 m^3****  ****Density:7,800 kg/m^3****  ****Weight:1.33523 N**** | ****C:\Users\pushk\Documents\DME-Lab\Lab3\_pin.SLDPRT****  **Feb 3 00:08:43 2025** | | **Boss-Extrude1** | **Solid Body** | ****Mass:0.0027445 kg****  ****Volume:3.51858e-07 m^3****  ****Density:7,800 kg/m^3****  ****Weight:0.0268961 N**** | ****C:\Users\pushk\Documents\DME-Lab\Lab3\_split-pin.SLDPRT****  **Feb 3 00:10:39 2025** | |

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| Study Properties  |  |  | | --- | --- | | Study name | Static 2 | | 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\pushk\Documents\DME-Lab) | |

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

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| Material Properties  |  |  |  | | --- | --- | --- | | ****Model Reference**** | ****Properties**** | ****Components**** | |  | |  |  | | --- | --- | | ****Name:**** | **Plain Carbon Steel** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Max von Mises Stress** | | ****Yield strength:**** | **2.20594e+08 N/m^2** | | ****Tensile strength:**** | **3.99826e+08 N/m^2** | | ****Elastic modulus:**** | **2.1e+11 N/m^2** | | ****Poisson's ratio:**** | **0.28** | | ****Mass density:**** | **7,800 kg/m^3** | | ****Shear modulus:**** | **7.9e+10 N/m^2** | | ****Thermal expansion coefficient:**** | **1.3e-05 /Kelvin** | | **SolidBody 1(Cut-Extrude3)(Lab3\_eye-1),**  **SolidBody 1(Boss-Extrude2)(Lab3\_fork-1),**  **SolidBody 1(Cut-Extrude1)(Lab3\_pin-1),**  **SolidBody 1(Boss-Extrude1)(Lab3\_split-pin-1)** | | **Curve Data:N/A** | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **25,000** | **0.00012207** | **3.05176e-05** | **25,000** | | **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: | **-25,000 N** | | |

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| Connector Definitions No Data |

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| Interaction Information  | Interaction | Interaction Image | Interaction Properties | | --- | --- | --- | | Global Interaction |  | |  |  | | --- | --- | | Type: | **Bonded** | | Components: | **1 component(s)** | | Options: | **Independent mesh** | | |

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| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Blended curvature-based mesh | | Jacobian points for High quality mesh | 16 Points | | Maximum element size | 12.8057 mm | | Minimum element size | 1.53073 mm | | Mesh Quality | High | | Remesh failed parts independently | Off |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 8721 | | Total Elements | 4891 | | Maximum Aspect Ratio | 9.0261 | | % of elements with Aspect Ratio < 3 | 95.4 | | Percentage of elements with Aspect Ratio > 10 | 0 | | Percentage of distorted elements | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:03 | | Computer name: | PUSHKIN | |

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| Sensor Details No Data |

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| Resultant ForcesReaction forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | 25,000 | 0.00012207 | 3.05176e-05 | 25,000 |  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 | 0.00176215 | -9.52482e-05 | -0.000586361 | 0.00185959 |  Free body moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 1e-33 | |

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| Beams No Data |

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| Study Results  | Name | Type | Min | Max | | --- | --- | --- | --- | | Stress1 | VON: von Mises Stress | 2.407e+05N/m^2  Node: 7574 | 1.155e+08N/m^2  Node: 2846 | | **Lab3\_knuckle-joint\_assembly-Static 2-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 7 | 5.089e-02mm  Node: 3703 | | **Lab3\_knuckle-joint\_assembly-Static 2-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 4.611e-07  Element: 3728 | 4.445e-04  Element: 1928 | | **Lab3\_knuckle-joint\_assembly-Static 2-Strain-Strain1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Max Normal Stress | 3.051e+00  Node: 3185 | 2.792e+03  Node: 7952 | | **Lab3\_knuckle-joint\_assembly-Static 2-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |