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|  | |  | | --- | | **Simulation of Hip Joint**  **Date: Saturday, March 15, 2025 Designer: Solidworks**  **Study name: Static at 660N**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc192971477)  [Assumptions 2](#_Toc192971478)  [Model Information 2](#_Toc192971479)  [Study Properties 3](#_Toc192971480)  [Units 3](#_Toc192971481)  [Material Properties 4](#_Toc192971482)  [Loads and Fixtures 4](#_Toc192971483)  [Connector Definitions 5](#_Toc192971484)  [Interaction Information 5](#_Toc192971485)  [Mesh information 6](#_Toc192971486)  [Sensor Details 7](#_Toc192971487)  [Resultant Forces 7](#_Toc192971488)  [Beams 7](#_Toc192971489)  [Study Results 8](#_Toc192971490)  [Conclusion 10](#_Toc192971491) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** Hip Joint**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **CSK for M6 Countersunk Flat Head Screw1** | **Solid Body** | ****Mass:0.28663 kg****  ****Volume:0.000106159 m^3****  ****Density:2,700 kg/m^3****  ****Weight:2.80897 N**** | ****C:\Users\allen\Downloads\CAPSTONE\_LowerLimbExoskeleton-main\CAPSTONE\_LowerLimbExoskeleton-main\3D Redesign\Exoskeleton\Using Aluminum 6061\Hip Joint.SLDPRT****  **Mar 15 09:49:36 2025** | |

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| Study Properties  |  |  | | --- | --- | | Study name | Static at 660N | | 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\allen\Downloads\CAPSTONE\_LowerLimbExoskeleton-main\CAPSTONE\_LowerLimbExoskeleton-main\3D Redesign\Exoskeleton\Using Aluminum 6061) | |

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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:**** | **6061 Alloy** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **5.51485e+07 N/m^2** | | ****Tensile strength:**** | **1.24084e+08 N/m^2** | | ****Elastic modulus:**** | **6.9e+10 N/m^2** | | ****Poisson's ratio:**** | **0.33** | | ****Mass density:**** | **2,700 kg/m^3** | | ****Shear modulus:**** | **2.6e+10 N/m^2** | | ****Thermal expansion coefficient:**** | **2.4e-05 /Kelvin** | | **SolidBody 1(CSK for M6 Countersunk Flat Head Screw1)(Hip Joint)** | | **Curve Data:N/A** | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **12 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **660.001** | **-0.000192523** | **0.00113624** | **660.001** | | **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: | **660 N** | | |

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| Connector Definitions No Data |

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| Interaction Information No Data |

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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 | 4.73643 mm | | Minimum element size | 1.5788 mm | | Mesh Quality | High |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 18393 | | Total Elements | 10858 | | Maximum Aspect Ratio | 7.5923 | | % of elements with Aspect Ratio < 3 | 99.3 | | 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: | ENGRLEANDZ |  Mesh Quality Plots  | Name | Type | Min | Max | | --- | --- | --- | --- | | Quality1 | Mesh | - | - | | **Hip Joint-Static at 660N-Quality-Quality1** | | | | |

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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 | 660.001 | -0.000192523 | 0.00113624 | 660.001 |  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 | 0.000485837 | 0.0024581 | 0.00139342 | 0.00286703 |  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 | 0.005N/m^2  Node: 56 | 1,649,803.250N/m^2  Node: 17588 | | **Hip Joint-Static at 660N-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 1 | 2.061e-04mm  Node: 14168 | | **Hip Joint-Static at 660N-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 2.195e-07  Element: 1624 | 1.098e-05  Element: 7942 | | **Hip Joint-Static at 660N-Strain-Strain1** | | | |  | Name | Type | | --- | --- | | Displacement1{1} | Deformed shape | | **Hip Joint-Static at 660N-Displacement-Displacement1{1}** | | |

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| Conclusion |