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|  | |  | | --- | | **Simulation of Hip Part**  **Date: Saturday, April 12, 2025 Designer: Solidworks**  **Study name: Static at 660N**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc195358765)  [Assumptions 2](#_Toc195358766)  [Model Information 3](#_Toc195358767)  [Study Properties 4](#_Toc195358768)  [Units 4](#_Toc195358769)  [Material Properties 5](#_Toc195358770)  [Loads and Fixtures 5](#_Toc195358771)  [Connector Definitions 6](#_Toc195358772)  [Interaction Information 6](#_Toc195358773)  [Mesh information 7](#_Toc195358774)  [Sensor Details 8](#_Toc195358775)  [Resultant Forces 8](#_Toc195358776)  [Beams 9](#_Toc195358777)  [Study Results 10](#_Toc195358778)  [Conclusion 12](#_Toc195358779)  [Appendix 12](#_Toc195358780) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** Hip Part**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Revolve8** | **Solid Body** | ****Mass:0.424141 kg****  ****Volume:0.000157089 m^3****  ****Density:2,700 kg/m^3****  ****Weight:4.15659 N**** | ****C:\Users\allen\Documents\GitHub\CAPSTONE\_LowerLimbExoskeleton\3D Redesign\Exoskeleton-Recreated Methodology v2.0\SLDPRT\Extension for Hip Part.SLDPRT****  **Apr 12 13:36:24 2025** | | **Cut-Extrude9** | **Solid Body** | ****Mass:1.35813 kg****  ****Volume:0.00050301 m^3****  ****Density:2,700 kg/m^3****  ****Weight:13.3096 N**** | ****C:\Users\allen\Documents\GitHub\CAPSTONE\_LowerLimbExoskeleton\3D Redesign\Exoskeleton-Recreated Methodology v2.0\SLDPRT\Hip Part.SLDPRT****  **Apr 12 13:36:24 2025** | | **Cut-Extrude9** | **Solid Body** | ****Mass:1.35813 kg****  ****Volume:0.00050301 m^3****  ****Density:2,700 kg/m^3****  ****Weight:13.3096 N**** | ****C:\Users\allen\Documents\GitHub\CAPSTONE\_LowerLimbExoskeleton\3D Redesign\Exoskeleton-Recreated Methodology v2.0\SLDPRT\Hip Part.SLDPRT****  **Apr 12 13:36:24 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\Documents\GitHub\CAPSTONE\_LowerLimbExoskeleton\3D Redesign\Exoskeleton-Recreated Methodology v2.0\SLDPRT) | |

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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:**** | **Max von Mises Stress** | | ****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(Revolve8)(Extension for Hip Part-1),**  **SolidBody 1(Cut-Extrude9)(Hip Part-1),**  **SolidBody 1(Cut-Extrude9)(Hip Part-2)** | | **Curve Data:N/A** | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **16 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **0.0299854** | **-0.0656447** | **-5,152.02** | **5,152.02** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-1** |  | |  |  | | --- | --- | | Entities: | **11 face(s)** | | Type: | **Apply normal force** | | Value: | **660 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 | 21.8002 mm | | Minimum element size | 2.2961 mm | | Mesh Quality | High | | Remesh failed parts independently | Off | | Reuse mesh for identical parts in an assembly (Blended curvature-based mesher only) | Off |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 21876 | | Total Elements | 11344 | | Maximum Aspect Ratio | 9.6391 | | % of elements with Aspect Ratio < 3 | 94.2 | | 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 Part-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 | 0.0299854 | -0.0656447 | -5,152.02 | 5,152.02 |  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 | 0.0414273 | -0.0985064 | 0.0857365 | 0.137005 |  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 | 0.000N/m^2  Node: 6103 | 31,833,046.000N/m^2  Node: 4836 | | **Hip Part-Static at 660N-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 6091 | 7.067e-02mm  Node: 5023 | | **Hip Part-Static at 660N-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 0.000e+00  Element: 4356 | 3.731e-04  Element: 2609 | | **Hip Part-Static at 660N-Strain-Strain1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Max von Mises Stress | 1.732e+00  Node: 4836 | 1.000e+16  Node: 6103 | | **Hip Part-Static at 660N-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |

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| Appendix |