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|  | |  | | --- | | **Simulation of FEA\_Assembly**  **Date: Friday, March 26, 2021 Designer: Solidworks**  **Study name: Static 2**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc67652201)  [Assumptions 2](#_Toc67652202)  [Model Information 2](#_Toc67652203)  [Study Properties 3](#_Toc67652204)  [Units 3](#_Toc67652205)  [Material Properties 4](#_Toc67652206)  [Loads and Fixtures 5](#_Toc67652207)  [Connector Definitions 5](#_Toc67652208)  [Contact Information 6](#_Toc67652209)  [Mesh information 7](#_Toc67652210)  [Sensor Details 8](#_Toc67652211)  [Resultant Forces 8](#_Toc67652212)  [Beams 8](#_Toc67652213)  [Study Results 9](#_Toc67652214)  [Conclusion 12](#_Toc67652215) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** FEA\_Assembly**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Split Line2** | **Solid Body** | ****Mass:0.590725 kg****  ****Volume:0.000234415 m^3****  ****Density:2,520 kg/m^3****  ****Weight:5.7891 N**** | ****C:\Users\luisa\Documents\GrabCAD\Lunar Dust Challenge\Current\Mechanical\v3\_tiz\FEA\FEAbplate\_v3.2.SLDPRT****  **Mar 26 11:41:15 2021** | | **Split Line2** | **Solid Body** | ****Mass:0.194624 kg****  ****Volume:9.375e-05 m^3****  ****Density:2,075.99 kg/m^3****  ****Weight:1.90732 N**** | ****C:\Users\luisa\Documents\GrabCAD\Lunar Dust Challenge\Current\Mechanical\v3\_tiz\FEA\FEAtplate\_v3.2.SLDPRT****  **Mar 26 11:41:15 2021** | |

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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 | 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\luisa\Documents\GrabCAD\Lunar Dust Challenge\Current\Mechanical\v3\_tiz\FEA) | |

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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:**** | **Macor** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Mohr-Coulomb Stress** | | ****Yield strength:**** | **9.4e+07 N/m^2** | | ****Tensile strength:**** | **3.5e+07 N/m^2** | | ****Compressive strength:**** | **3.45e+08 N/m^2** | | ****Elastic modulus:**** | **6.68791e+10 N/m^2** | | ****Poisson's ratio:**** | **0.29** | | ****Mass density:**** | **2,520 kg/m^3** | | ****Shear modulus:**** | **2.55106e+10 N/m^2** | | **SolidBody 1(Split Line2)(FEAbplate\_v3.2-1)** | | | | **Curve Data:N/A** | | | | | |  | |  |  | | --- | --- | | ****Name:**** | **99.5% Aluminum Oxide** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Mohr-Coulomb Stress** | | ****Yield strength:**** | **2.17185e+07 N/m^2** | | ****Tensile strength:**** | **2.17185e+07 N/m^2** | | ****Compressive strength:**** | **2.99922e+07 N/m^2** | | ****Elastic modulus:**** | **3e+11 N/m^2** | | ****Poisson's ratio:**** | **0.22** | | ****Mass density:**** | **2,075.99 kg/m^3** | | ****Thermal expansion coefficient:**** | **8e-06 /Kelvin** | | **SolidBody 1(Split Line2)(FEAtplate\_v3.2-1)** | | | | **Curve Data:N/A** | | | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **10 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **0.000211529** | **480.002** | **-0.000109691** | **480.002** | | **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: | **480 N** | | |

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| Connector Definitions  | ****Connector Name**** | ****Connector Details**** | ****Connector Image**** | | --- | --- | --- | | **Spring Connector-1** | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Spring(Flat parallel faces)(Compression & Extension)** | | Normal stiffness value: | **5e+09 (N/m)/m^2** | | Tangential Stiffness: | **0 (N/m)/m^2** | | |  | | --- | |  | | **Spring Connector-1** | | |

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| Contact Information  | Contact | Contact Image | Contact Properties | | --- | --- | --- | | Contact Set-1 |  | |  |  | | --- | --- | | Type: | **Bonded contact pair** | | Entities: | **9 face(s)** | | | Global Contact |  | |  |  | | --- | --- | | Type: | **Bonded** | | Components: | **1 component(s)** | | Options: | **Compatible mesh** | | |

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| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Standard mesh | | Automatic Transition: | Off | | Include Mesh Auto Loops: | Off | | Jacobian points | 4 Points | | Element Size | 0.1 in | | Tolerance | 0.005 in | | Mesh Quality Plot | High | | Remesh failed parts with incompatible mesh | Off |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 314215 | | Total Elements | 174513 | | Maximum Aspect Ratio | 10.25 | | % of elements with Aspect Ratio < 3 | 98.5 | | % of elements with Aspect Ratio > 10 | 0.00115 | | % of distorted elements(Jacobian) | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:37 | | Computer name: |  | |  | | |

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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 | 0.000211529 | 480.002 | -0.000109691 | 480.002 |  Reaction Moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 0 | |
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| Study Results  | Name | Type | Min | Max | | --- | --- | --- | --- | | Stress1 | VON: von Mises Stress | 3.474e-02 N/m^2  Node: 193676 | 5.475e+06 N/m^2  Node: 300377 | | **FEA\_Assembly-Static 2-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00 mm  Node: 97 | 2.122e-02 mm  Node: 215246 | | **FEA\_Assembly-Static 2-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 6.721e-13  Element: 38628 | 1.184e-05  Element: 140295 | | **FEA\_Assembly-Static 2-Strain-Strain1** | | | |  | Name | Type | | --- | --- | | Displacement1{1} | Deformed shape | | **FEA\_Assembly-Static 2-Displacement-Displacement1{1}** | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Mohr-Coulomb Stress | 3.870e+00  Node: 230151 | 3.050e+09  Node: 136376 | | **FEA\_Assembly-Static 2-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |