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|  | |  | | --- | | **Simulation of Needle (1)**  **Date: Monday, March 17, 2025 Designer: Solidworks**  **Study name: Static 1**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc193138253)  [Assumptions 2](#_Toc193138254)  [Model Information 2](#_Toc193138255)  [Study Properties 3](#_Toc193138256)  [Units 3](#_Toc193138257)  [Material Properties 4](#_Toc193138258)  [Loads and Fixtures 4](#_Toc193138259)  [Connector Definitions 5](#_Toc193138260)  [Interaction Information 5](#_Toc193138261)  [Mesh information 5](#_Toc193138262)  [Sensor Details 6](#_Toc193138263)  [Resultant Forces 6](#_Toc193138264)  [Beams 6](#_Toc193138265)  [Study Results 7](#_Toc193138266)  [Conclusion 9](#_Toc193138267) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** Needle (1)**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Cut-Extrude3** | **Solid Body** | ****Mass:0.000190148 kg****  ****Volume:1.34857e-07 m^3****  ****Density:1,410 kg/m^3****  ****Weight:0.00186345 N**** | ****D:\New Life\Learning SOLIDWORKS\Vertanux1 Simulations\Lab 3\Needle (1).SLDPRT****  **Mar 17 21:09:42 2025** | |

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| Study Properties  |  |  | | --- | --- | | Study name | Static 1 | | 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 (D:\New Life\Learning SOLIDWORKS\Vertanux1 Simulations\Lab 3) | |

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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:**** | **Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **6.3e+07 N/m^2** | | ****Tensile strength:**** | **4.07e+07 N/m^2** | | ****Elastic modulus:**** | **2.9e+09 N/m^2** | | ****Poisson's ratio:**** | **0.3** | | ****Mass density:**** | **1,410 kg/m^3** | | **SolidBody 1(Cut-Extrude3)(Needle (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)** | **5.72605e-05** | **44.4855** | **-0.00140448** | **44.4855** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-2** |  | |  |  | | --- | --- | | Entities: | **1 face(s), 1 Solid Body (s)** | | Type: | **Apply normal force** | | Value: | **10 lbf** | | |

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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 | 0.0212229 in | | Minimum element size | 0.00707422 in | | Mesh Quality | High |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 12103 | | Total Elements | 7416 | | Maximum Aspect Ratio | 23.119 | | % of elements with Aspect Ratio < 3 | 99.5 | | Percentage of elements with Aspect Ratio > 10 | 0.027 | | Percentage of distorted elements | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:05 | | 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 | 5.72605e-05 | 44.4855 | -0.00140448 | 44.4855 |  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 | 0.194534 | -0.013104 | -0.0632459 | 0.204976 |  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 | 2.285e+05N/m^2  Node: 8425 | 4.653e+08N/m^2  Node: 7282 | | **Needle (1)-Static 1-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 1 | 7.847e-01mm  Node: 255 | | **Needle (1)-Static 1-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 6.432e-05  Element: 4358 | 9.637e-02  Element: 5375 | | **Needle (1)-Static 1-Strain-Strain1** | | | | |

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| Conclusion |