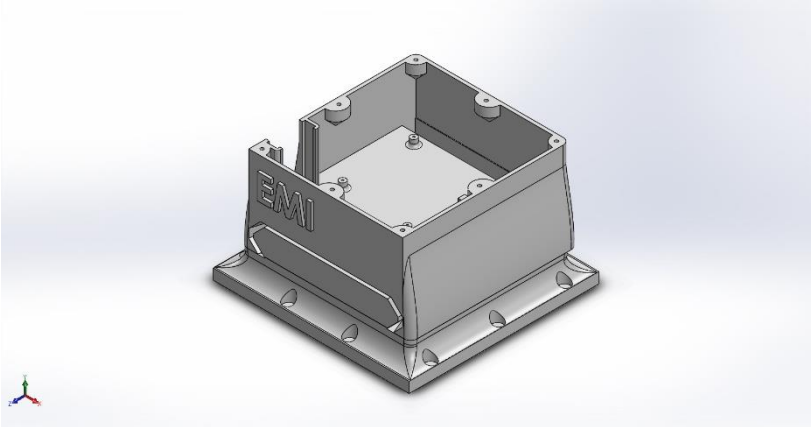


Simulation of 000001 Main Assembly

Date: donderdag 21 november 2019
Designer: J.H.T. Koster
Study name: Static 1
Analysis type: Static

Table of Contents

Description

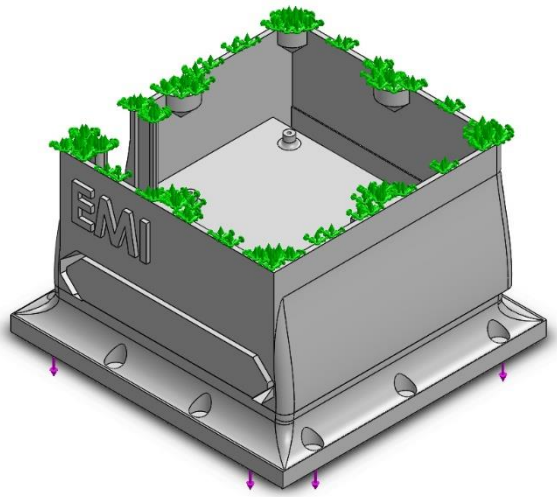
Strength test of the mechanical component connections in the EMI.

Assumptions

This simulation is started to test the strain of the material. By choosing the right material we noticed the differences between the material and the final 3D print. The 3D print is a material build in layers. In this simulation is the material a solid mass. The main difference is the strain of the connection between the printed layers. In this simulation we ignore this layer strength and look deeper in to the solid mass. This to predict the final test with a 3D printed model.

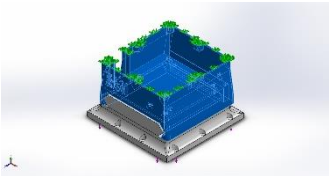
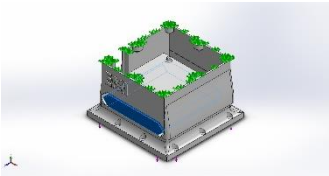
In this simulation is the model tested by a force on his bottom. This is the place where the final load will be placed. The assumptive load will be 50N, this is approximately equal to the abandoned 5kg. We aspect that the modulated design will hold the load. We also aspect that we don't see much of displacement.

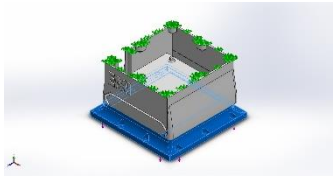
Model Information



Model name: 000001 Main Assembly
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Chamfer9 	Solid Body	**Mass:0,213408 kg Volume:0,000209223 m^3 Density:1.020 kg/m^3 Weight:2,0914 N**	**C:\Users\Gebruiker\Desktop\Saxion\Project Mechatronisch ontwerpen en realiseren(2019-2020)\Technisch ontwerp\02 Female interface\020002.2 Bak.SLDPRT** Nov 21 11:05:16 2019
Boss-Extrude1 	Solid Body	**Mass:0,218005 kg Volume:0,00021373 m^3 Density:1.020 kg/m^3 Weight:2,13645 N**	**C:\Users\Gebruiker\Desktop\Saxion\Project Mechatronisch ontwerpen en realiseren(2019-2020)\Technisch ontwerp\03 Male interface\03001 Base.SLDPRT** Nov 21 10:51:46 2019

Cut-Extrude2 	Solid Body	**Mass:0,420454 kg** **Volume:0,000412216 m^3** **Density:1.019,99 kg/m^3** **Weight:4,12045 N**	**C:\Users\Gebruiker\Desktop\Saxion\Project Mechatronisch ontwerpen en realiseren(2019-2020)\Technisch ontwerp\03 Male interface\03001 Base.SLDPRT** Nov 21 10:51:46 2019

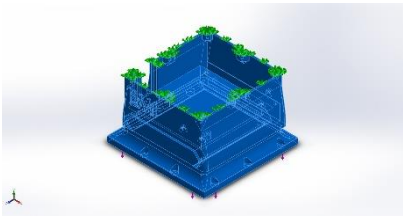
Study Properties

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	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\Gebruiker\Desktop\Saxion\Project Mechatronisch ontwerpen en realiseren(2019-2020)\Technisch ontwerp)

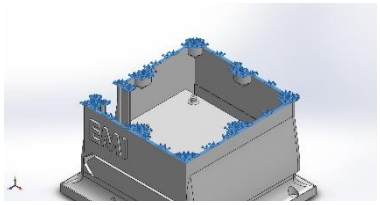
Units

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

Material Properties

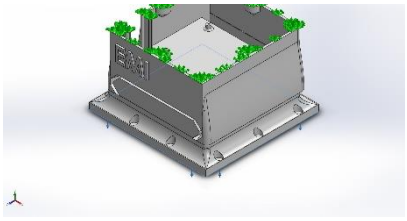
Model Reference	Properties	Components
	**Name:** ABS **Model type:** Linear Elastic Isotropic **Default failure criterion:** Unknown **Tensile strength:** 3e+07 N/m^2 **Elastic modulus:** 2e+09 N/m^2 **Poisson's ratio:** 0,394 **Mass density:** 1.020 kg/m^3 **Shear modulus:** 3,189e+08 N/m^2	SolidBody 1(Chamfer9)(020002.2 Bak-1), SolidBody 1(Boss-Extrude1)(03001 Base-1), SolidBody 2(Cut-Extrude2)(03001 Base-1)
Curve Data:N/A		

Loads and Fixtures

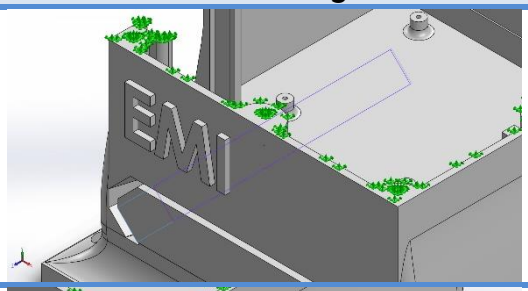
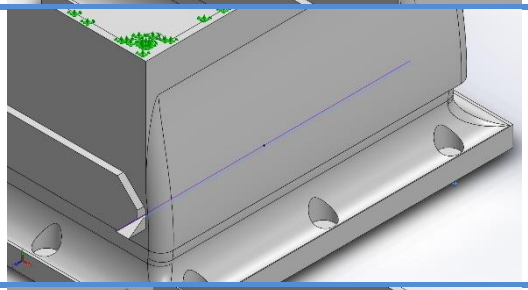
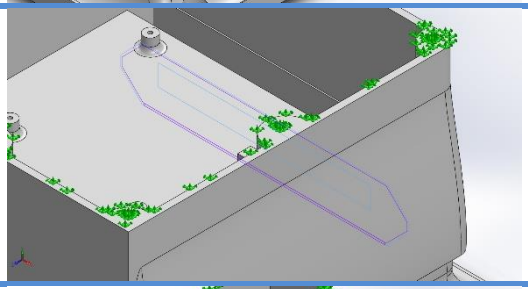
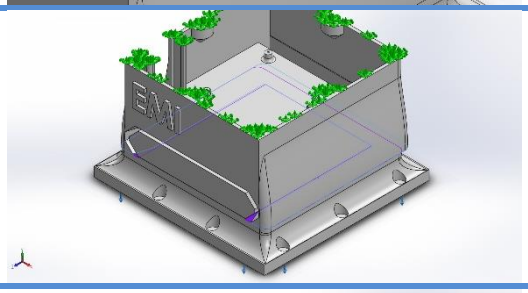
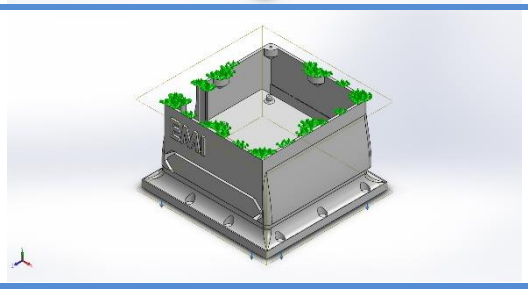
Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 1 face(s) **Type:** Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	-2,59131e-05	5.000	1,50651e-05	5.000
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:** -5.000 N

Contact Information

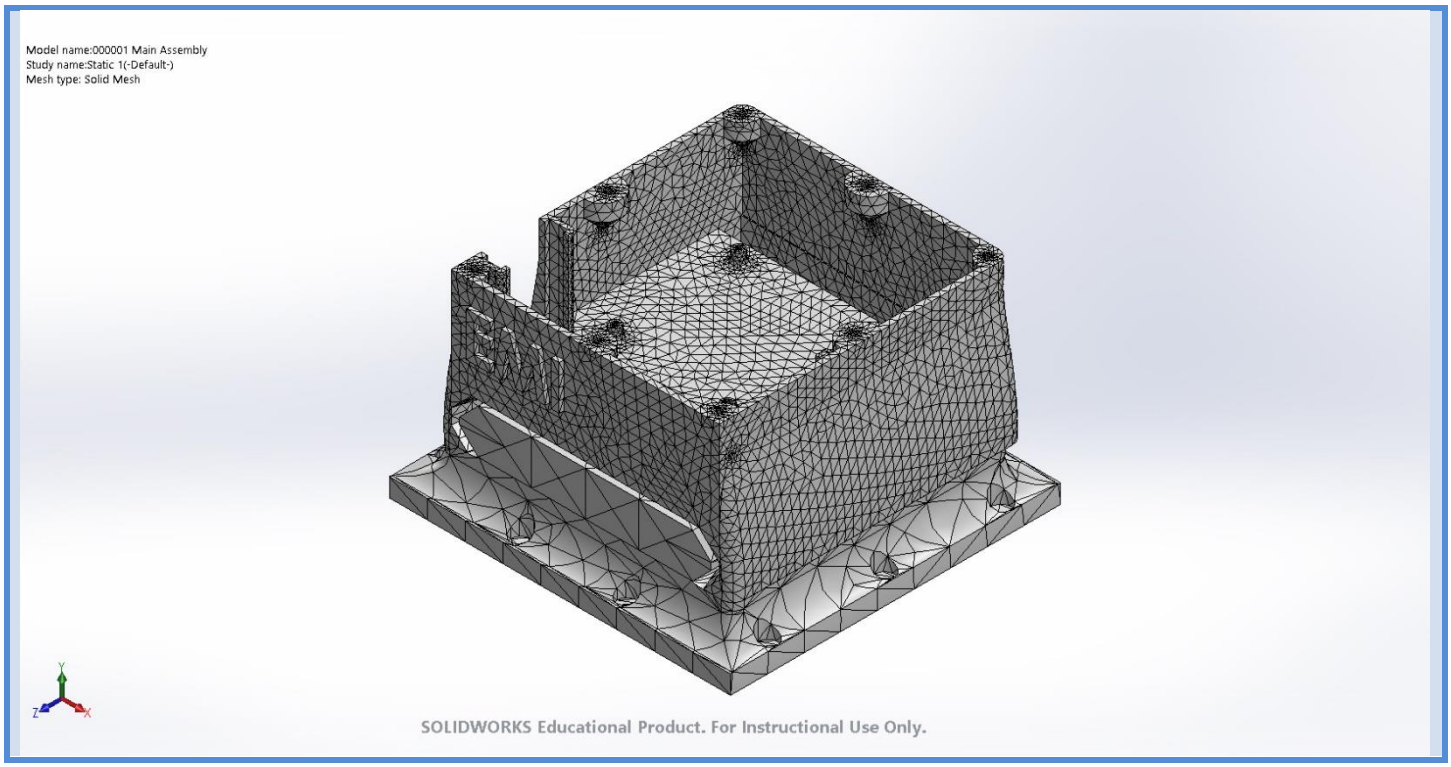
Contact	Contact Image	Contact Properties
Contact Set-2		**Type:** No Penetration contact pair **Entities:** 2 face(s) **Advanced:** Node to surface
Contact Set-4		**Type:** No Penetration contact pair **Entities:** 2 face(s) **Advanced:** Node to surface
Contact Set-5		**Type:** Bonded contact pair **Entities:** 3 face(s)
Contact Set-6		**Type:** Bonded contact pair **Entities:** 2 face(s)
Global Contact		**Type:** Bonded **Components:** 1 component(s) **Options:** Compatible mesh

Mesh information

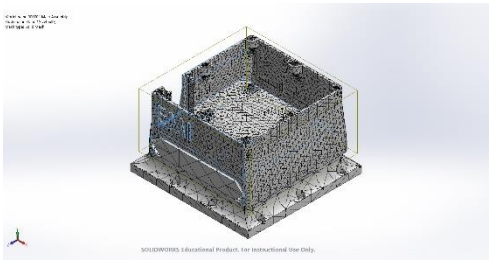
Mesh type	Solid Mesh
Mesher Used:	Curvature-based mesh
Jacobian points	4 Points
Maximum element size	17,4265 mm
Minimum element size	0,871323 mm
Mesh Quality Plot	High
Remesh failed parts with incompatible mesh	On

Mesh information - Details

Total Nodes	84914
Total Elements	49250
Maximum Aspect Ratio	45,829
% of elements with Aspect Ratio < 3	93,6
% of elements with Aspect Ratio > 10	0,638
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:04
Computer name:	



Mesh Control Information:

Mesh Control Name	Mesh Control Image	Mesh Control Details
Control-1		**Entities:** 6 face(s), 1 component(s) **Units:** mm **Size:** 4,70975 **Ratio:** 4,70975

Resultant Forces

Reaction forces

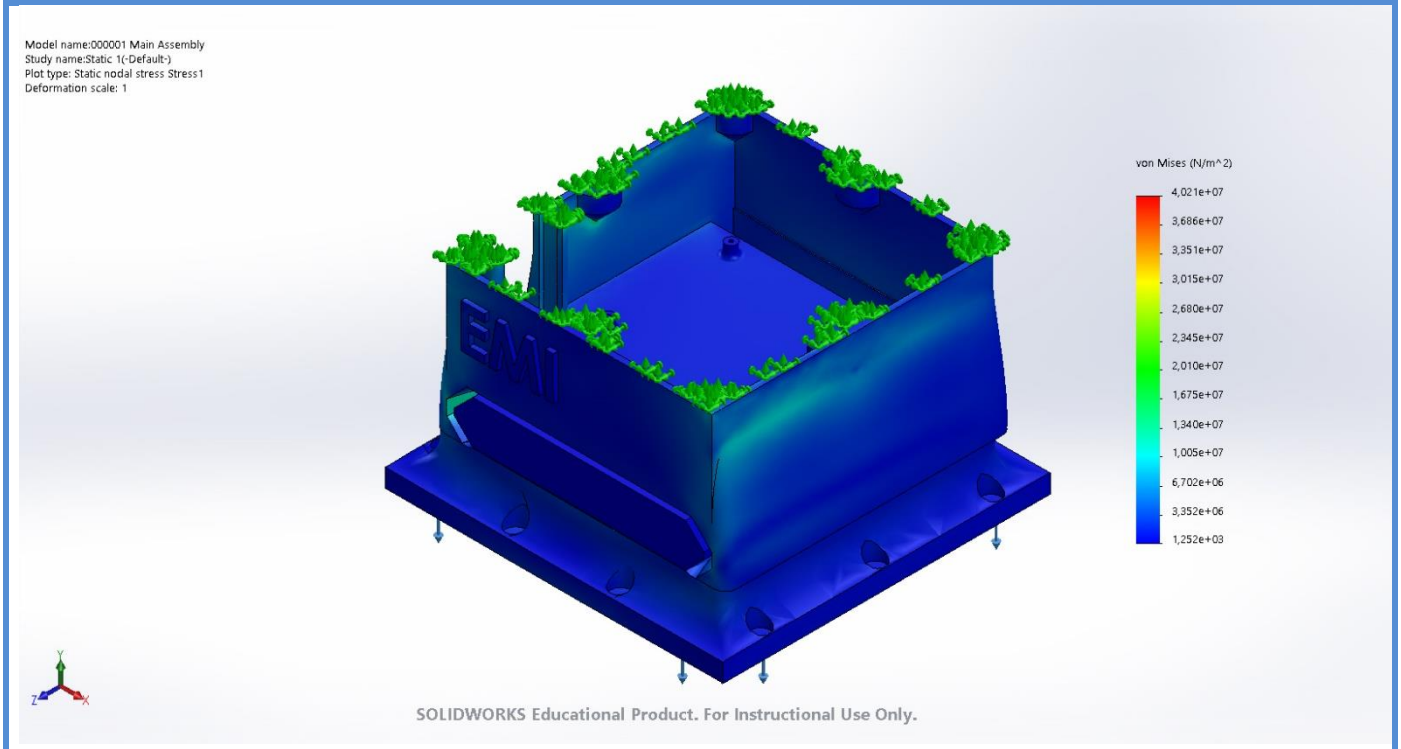
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	-2,59131e-05	5.000	1,50651e-05	5.000

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N.m	0	0	0	0

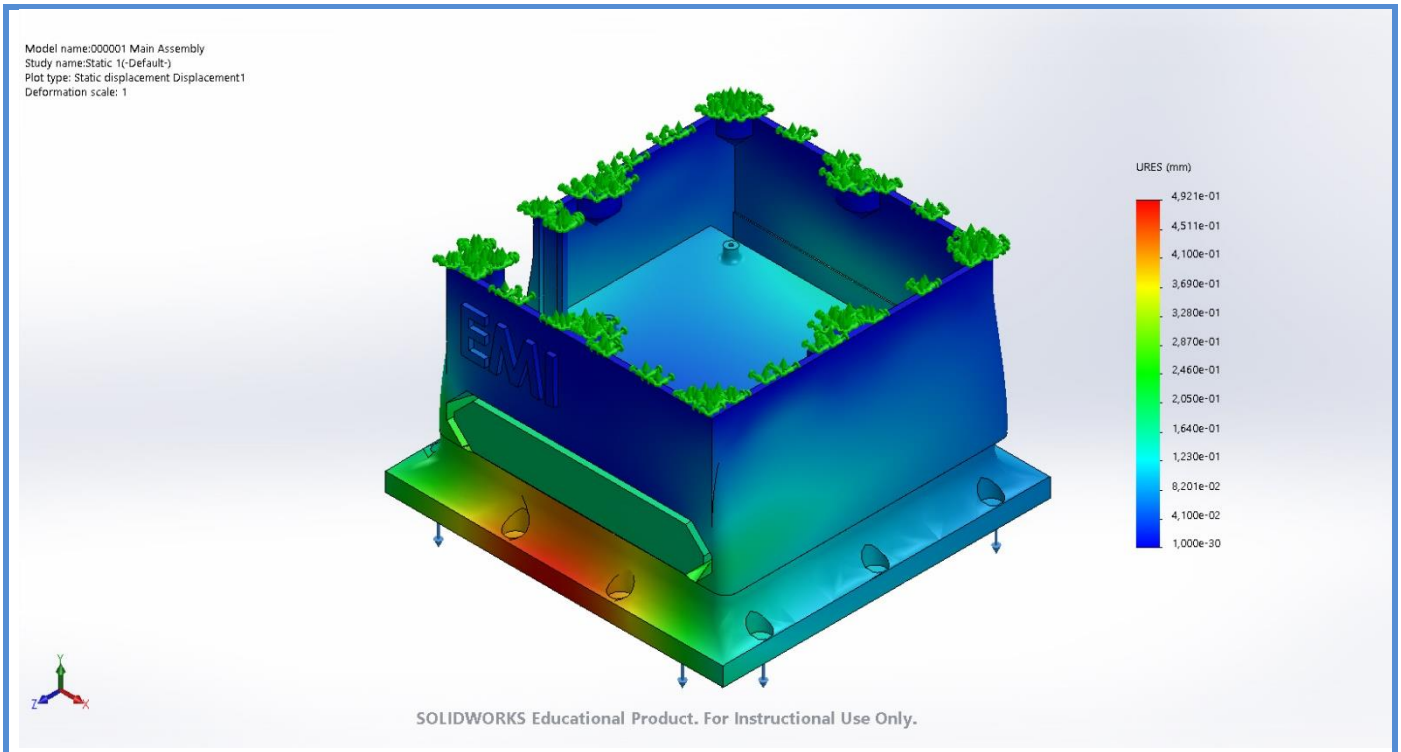
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	1,252e+03 N/m^2 Node: 83371	4,021e+07 N/m^2 Node: 19225



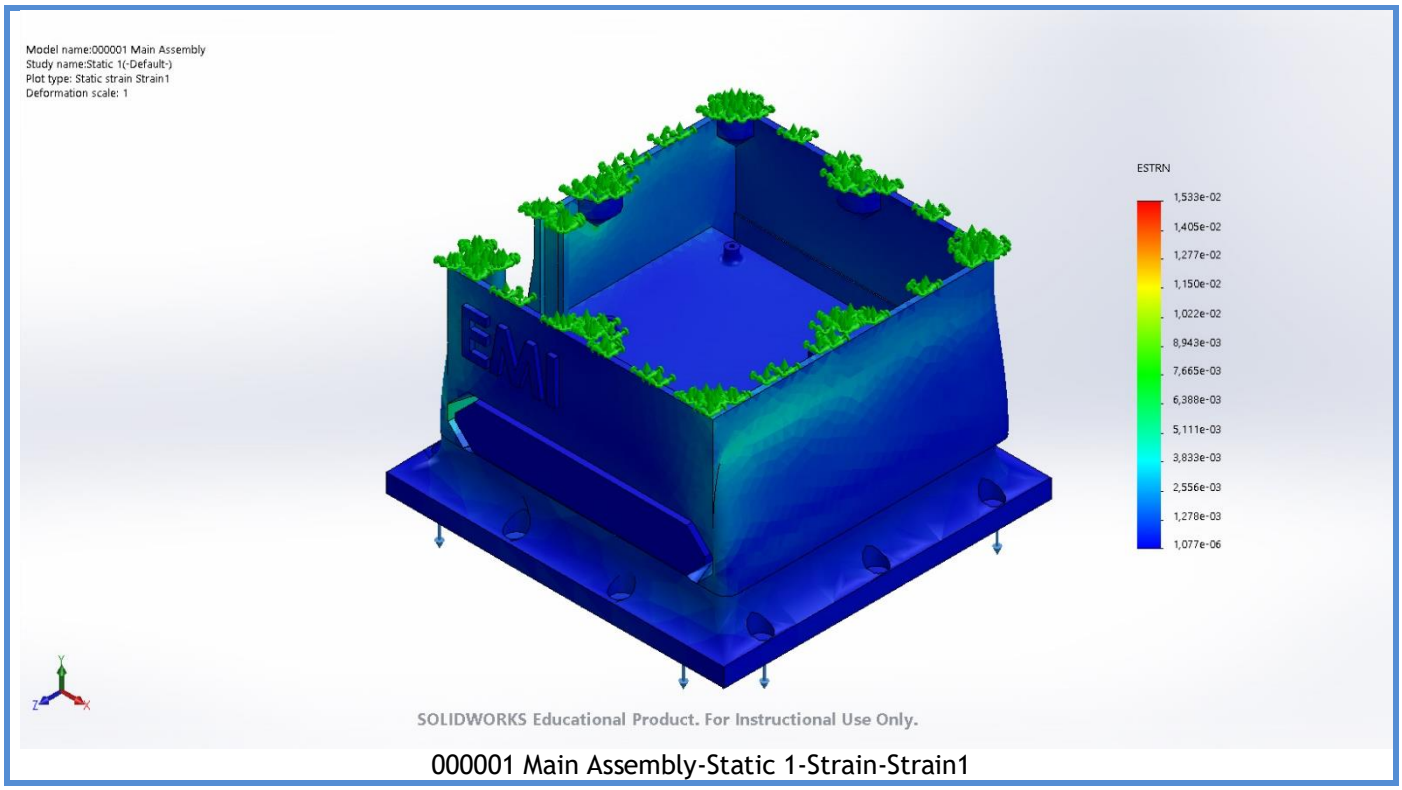
000001 Main Assembly-Static 1-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0,000e+00 mm Node: 7147	4,921e-01 mm Node: 3543



000001 Main Assembly-Static 1-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	1,077e-06 Element: 47528	1,533e-02 Element: 17543



000001 Main Assembly-Static 1-Strain-Strain1

Conclusion

Looking to the simulation results above. We see that the conclusions match our expectations. The model is well modulated and the material is well chosen.

We recommend to 3D print this model and test the model by strength in a draw bench. To see the actual behavior of the model paired with the material.