Mahri [redacted]

BE 4312

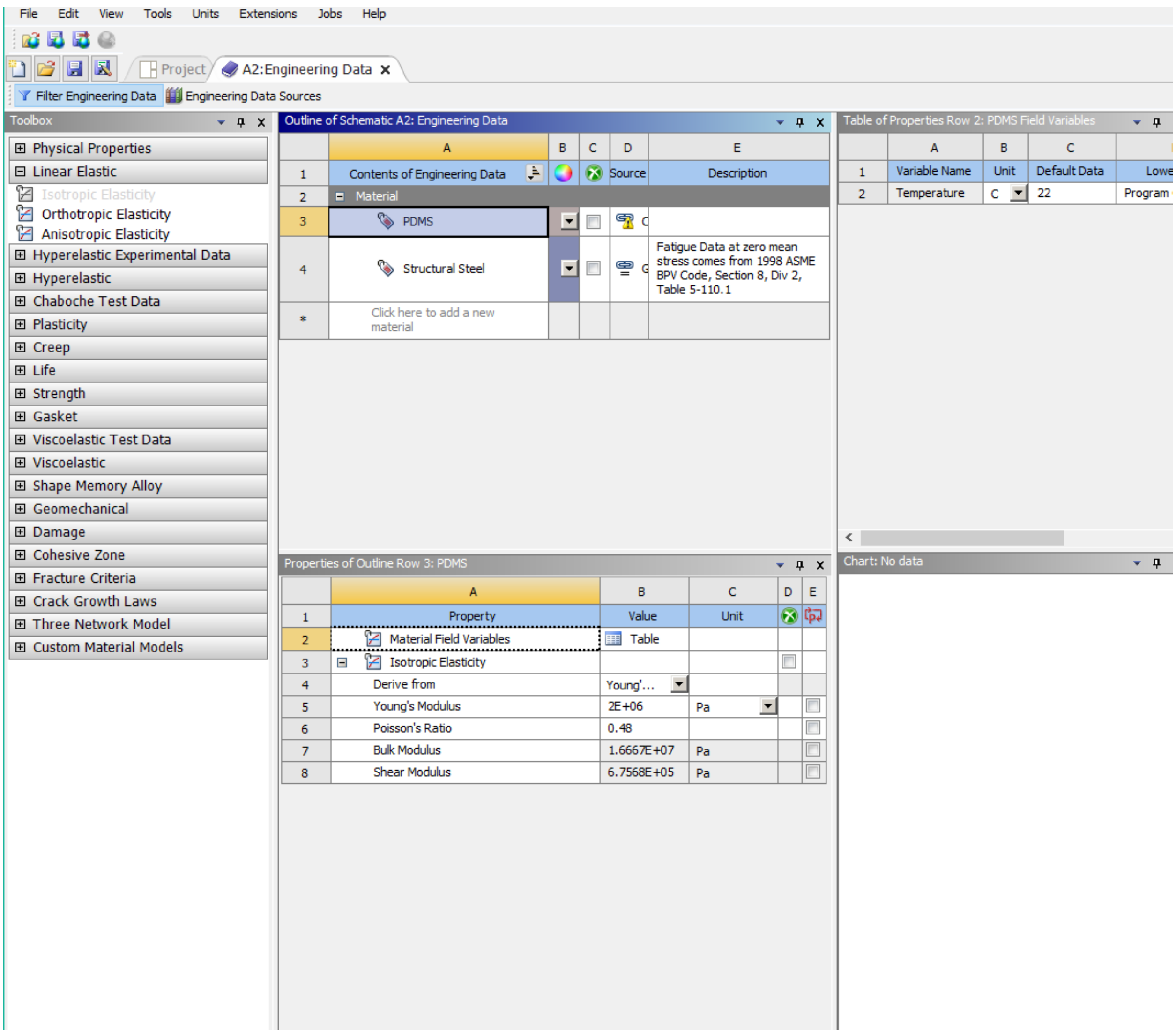
Project 2 Ansys

Dr. Jun Liao

Part I

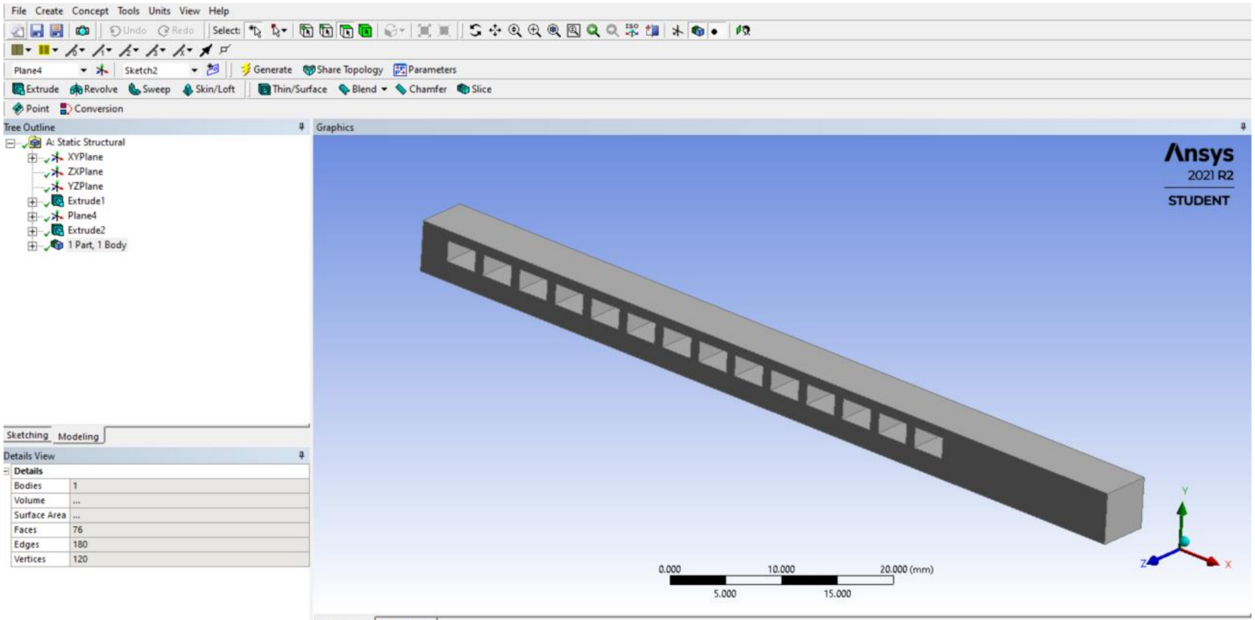
The structure used was static structural analysis system.

Then engineering data was entered for the PDMS finger:

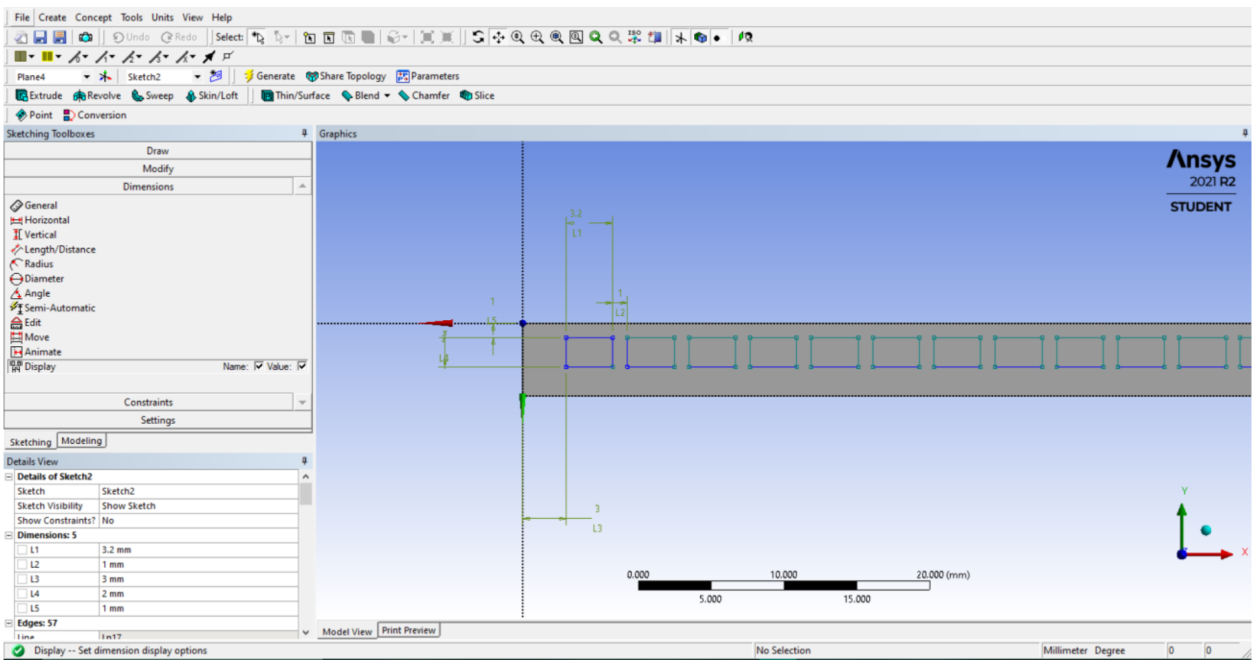


In here the main input was the characteristics of the isotropic linear elasticity that included young's modulus and Poisson's ratio. The values were obtained from the literature as well.

Then the next step was to create geometry using DesignModeler:



Here the dimensions and the exact numbers were used using the video found online.



As can be seen from the above snapshot, the measurements were obtained from the author's literature.

Also, during the procedure replication tool, reversed extrusion, cut inward extrusion were used to create accurate chambers.

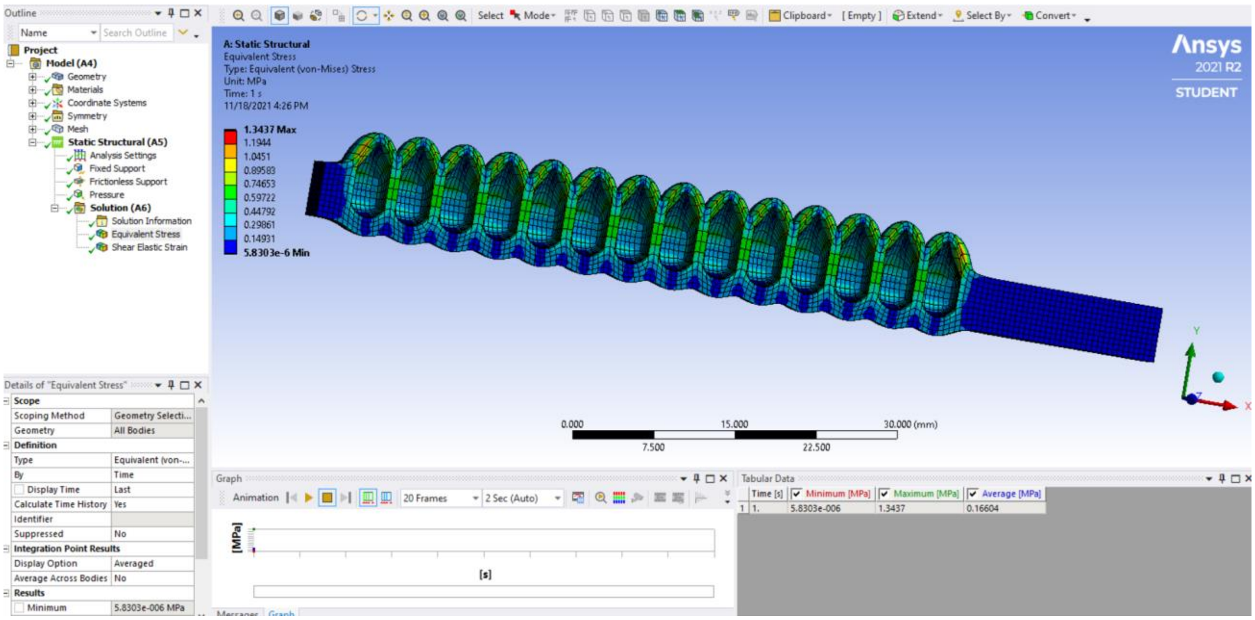
The next step was to work on the model and obtain solution results using mechanical :

Before the solution was obtained, the mesh was created where the element size was set to be 0.5 mm. After the mesh was generated, the hex dominant method mesh was applied one more time to the whole structure.

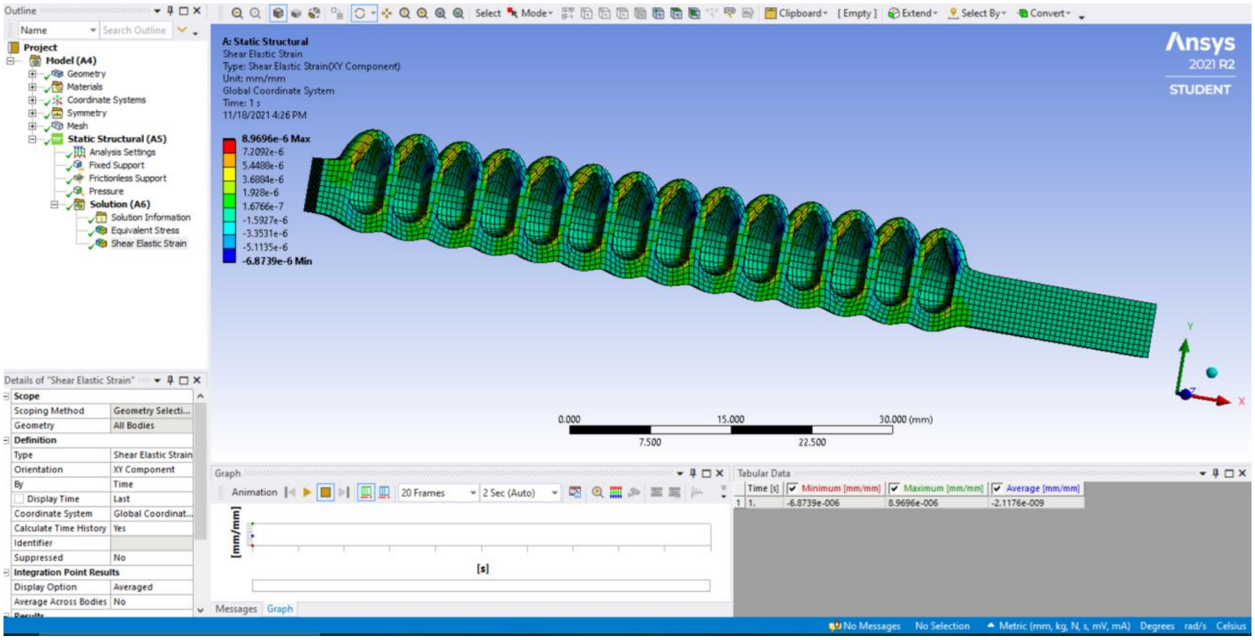
Then fixed support, frictionless support and pressure to the chambers were set.

Various parameters were tested after generating solution and the three parameters were included below.

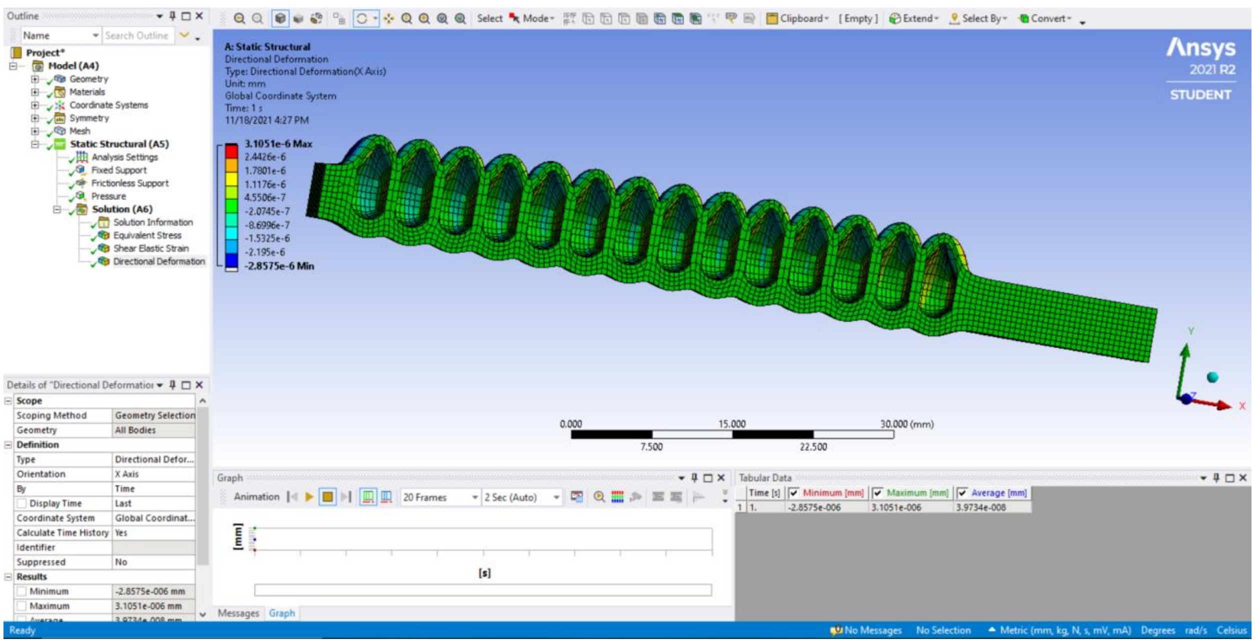
This experiment included equivalent von misses stress simulation :



This experiment included shear elastic strain simulation:



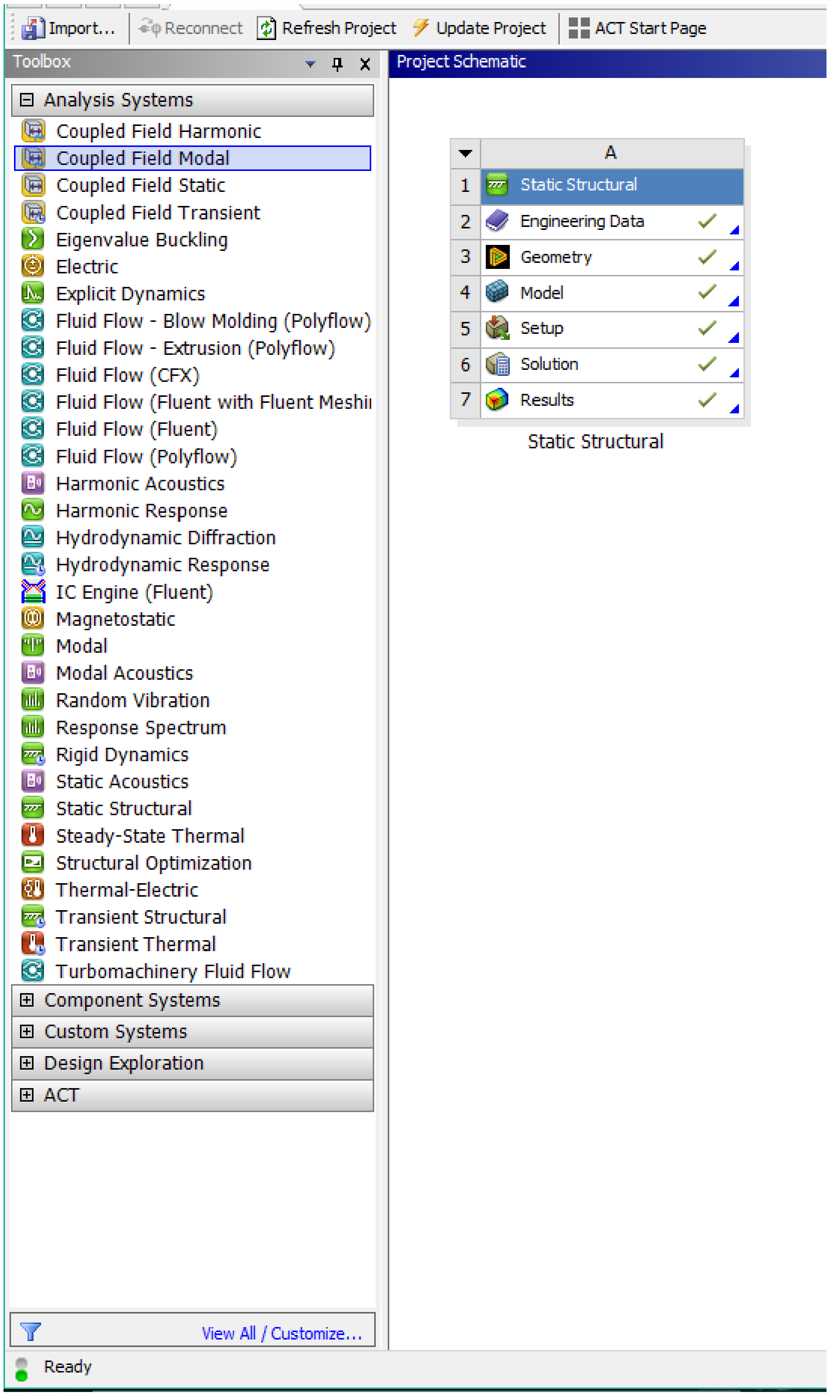
This experiment includes directional deformation simulation:



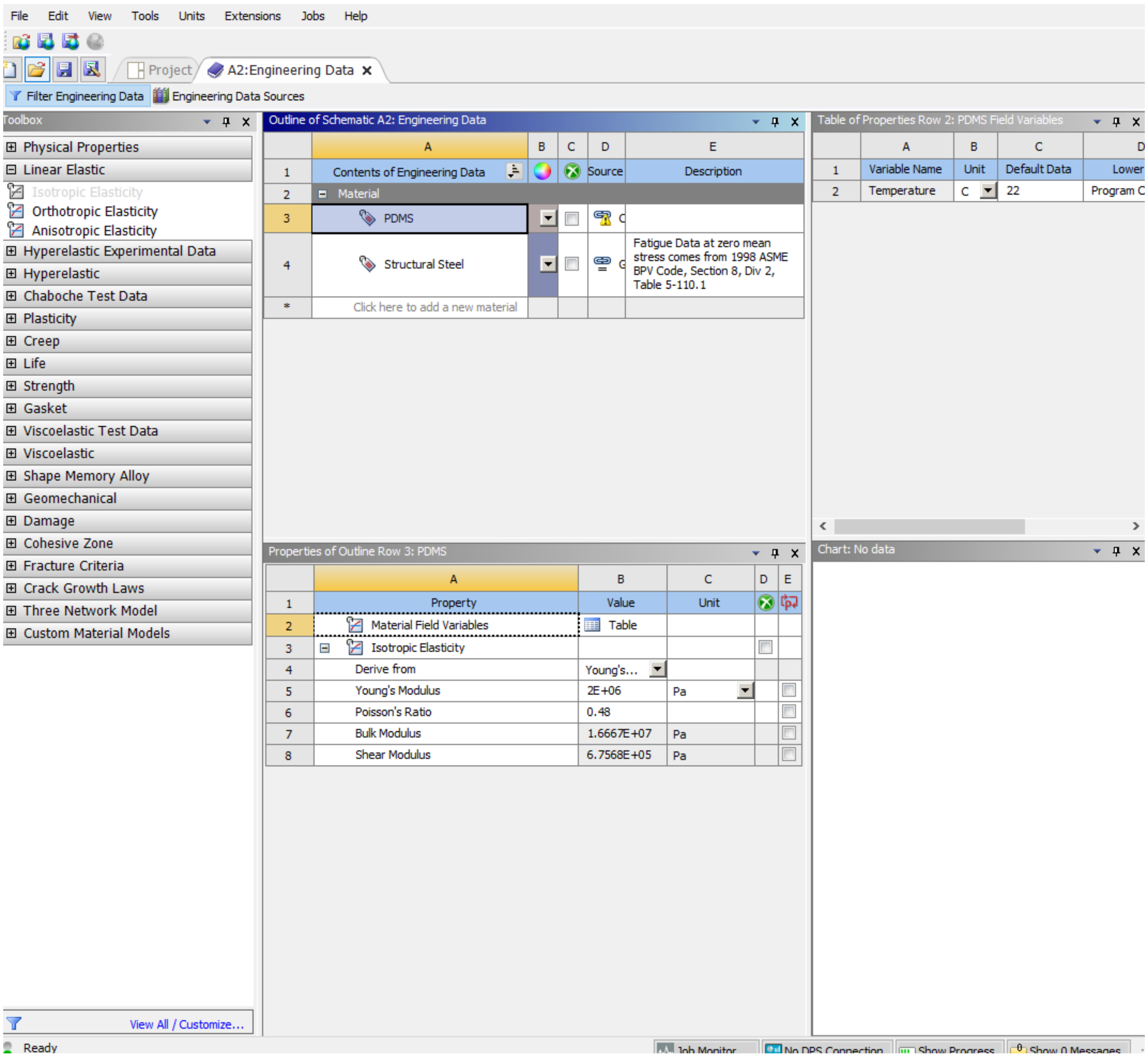
Part II

This experiment includes creating PDMS finger with two chamber.

The system used was static structural analysis systems:

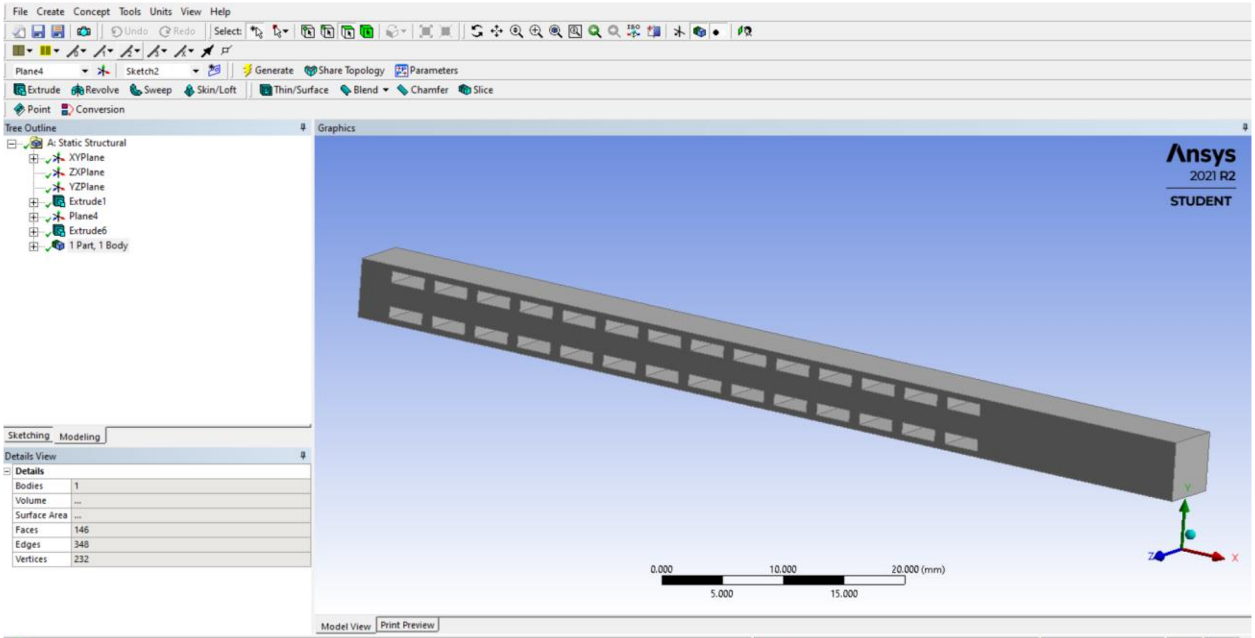


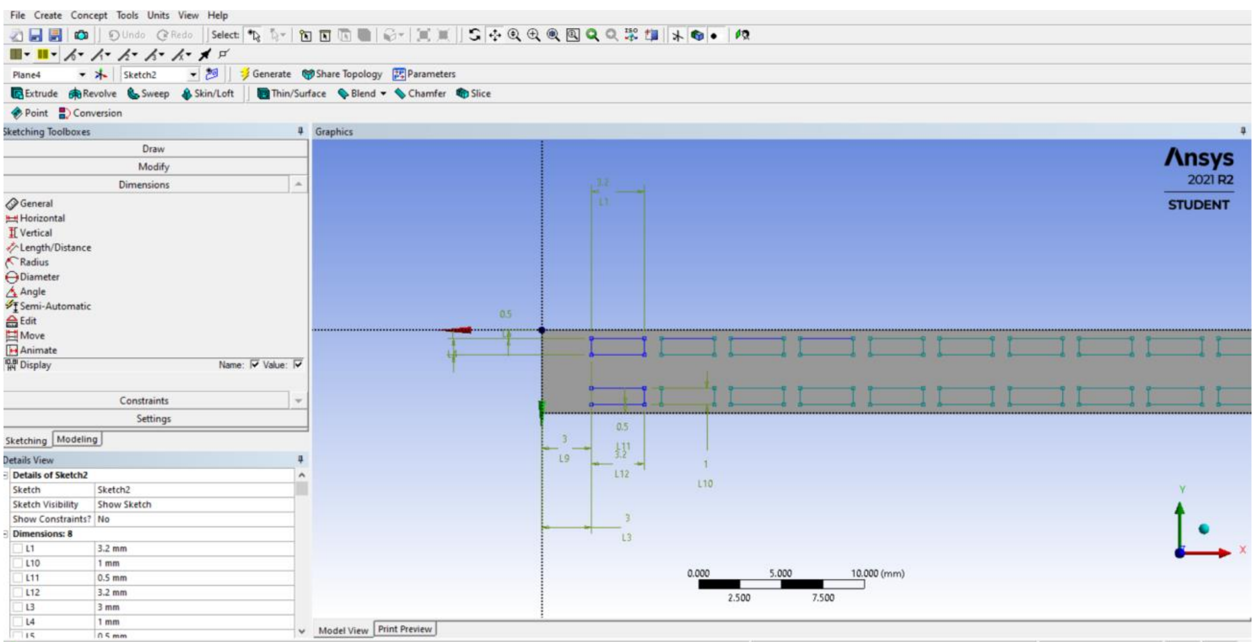
Here the engineering data has been obtained from literature and input into the engineering data:



The same as above parameters were set for the engineering data section.

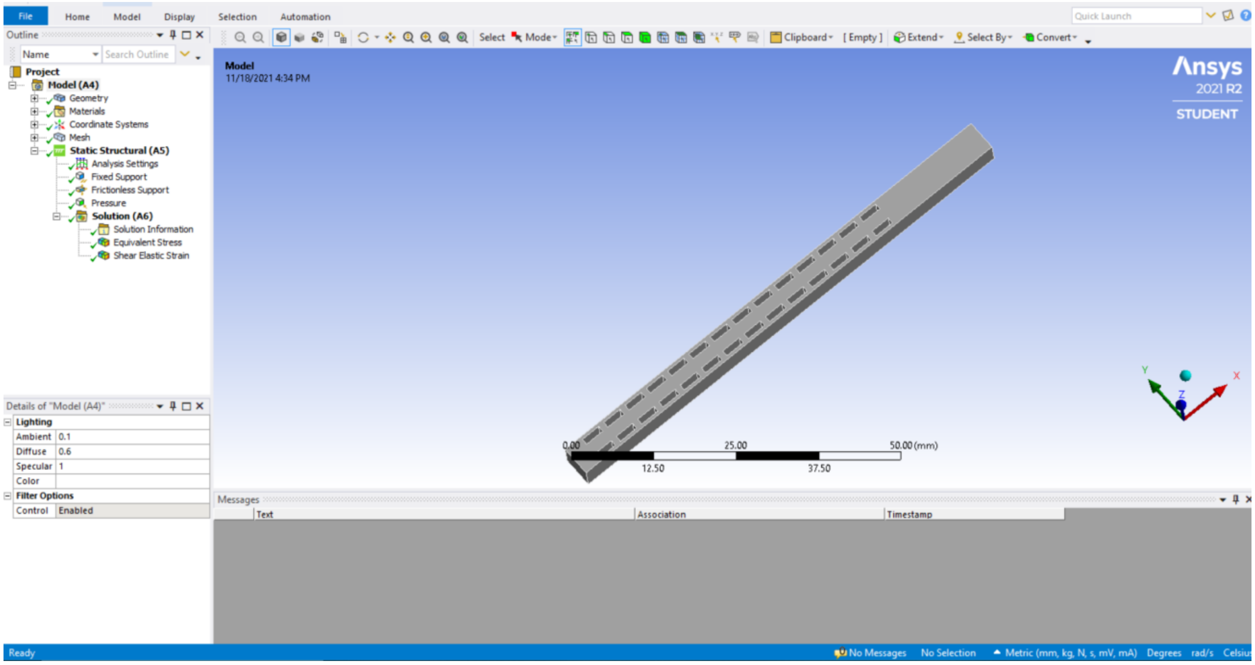
The next step included creating the model using DesignModeler:





The procedures such as replication and extrusion has been used. The process was very similar to the part I part but only included adding extra row of 14 chambers and calculations. As can be seen from the picture, careful dimensional analysis has been done to be able to create symmetry between two rows of chambers and the structure itself.

The next step included performing simulation analysis using mechanical model:

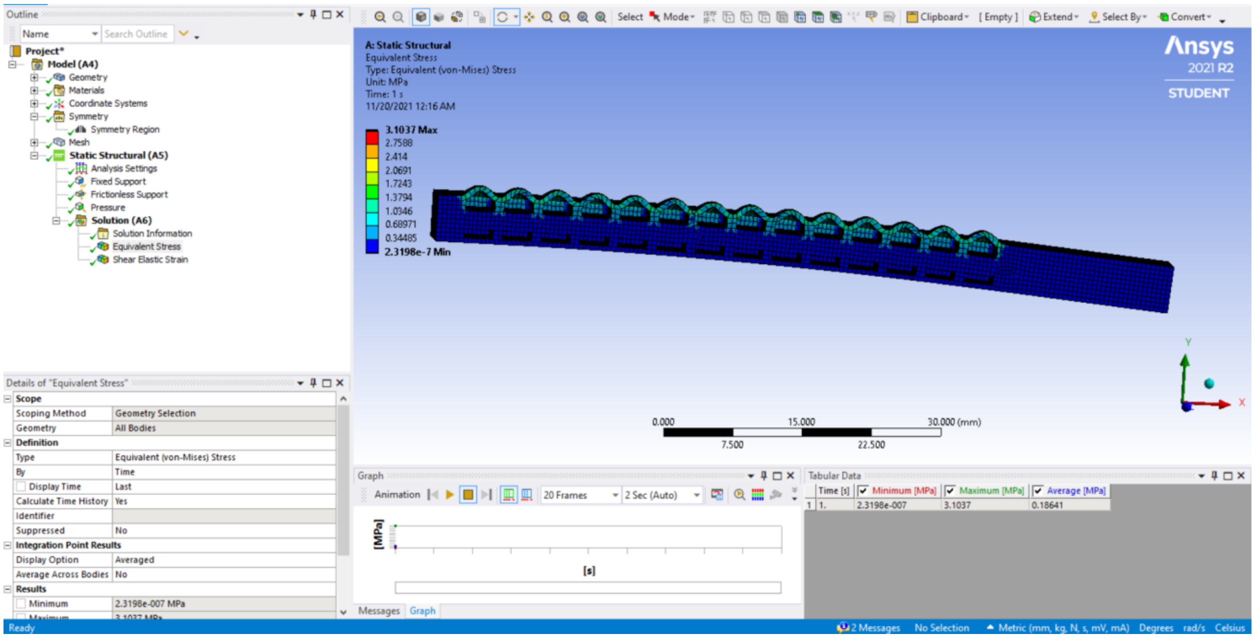


The procedure was the same as above where the mesh was created with element size of 0.5 mm, hex dominant method mesh was generated, fixed support, frictionless support, pressure was generated.

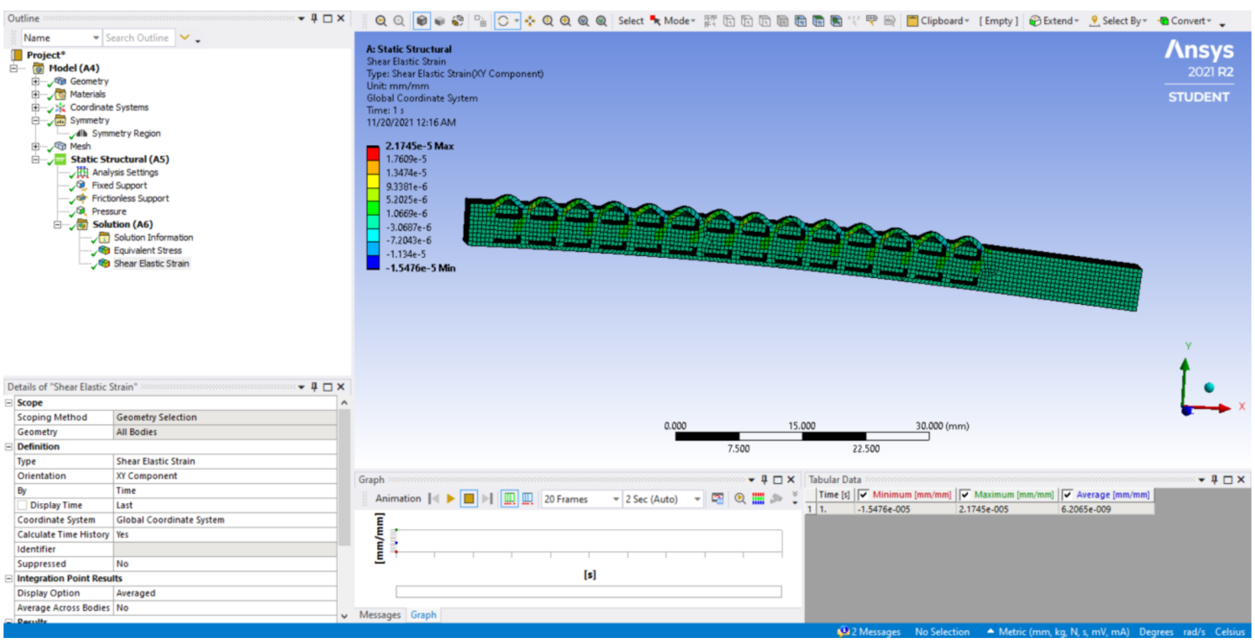
The only difference was that the pressure was applied to top row for experiment 1 and to bottom row for experiment 2 which will be seen in below pictures.

Here we can see the application of the equivalent stress application on the top row chambers:

This is where the pressure was applied to the top row chambers. The symmetry along z axis was also applied.

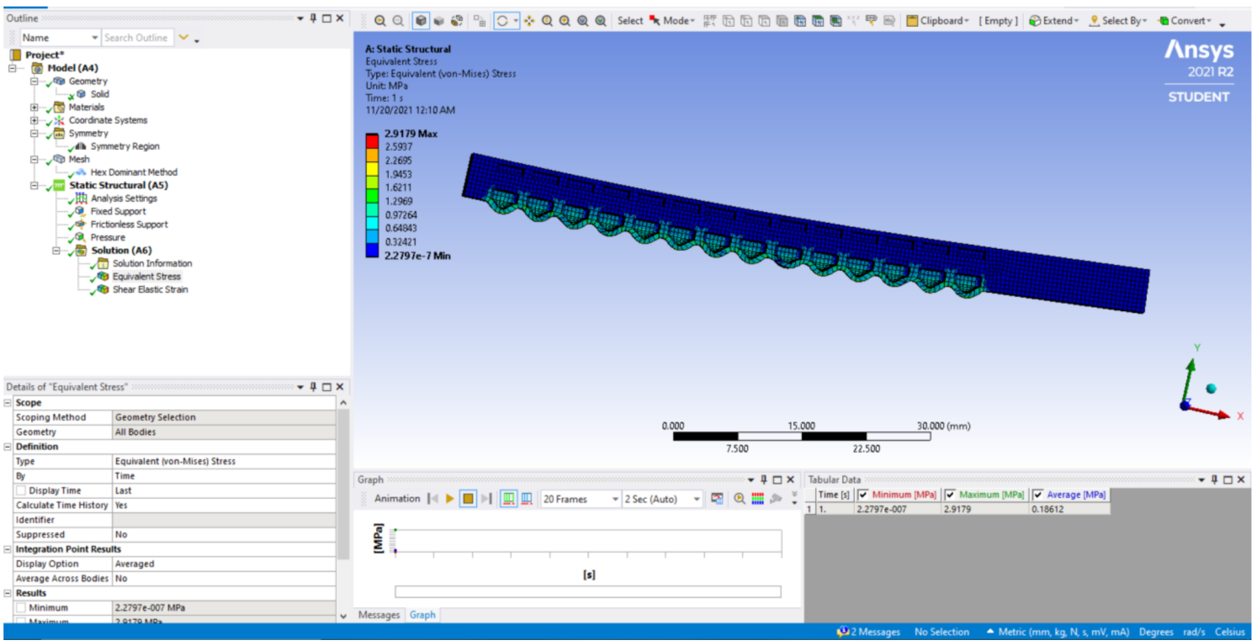


Here we can see the application of the shear elastic strain application on the top row chambers:

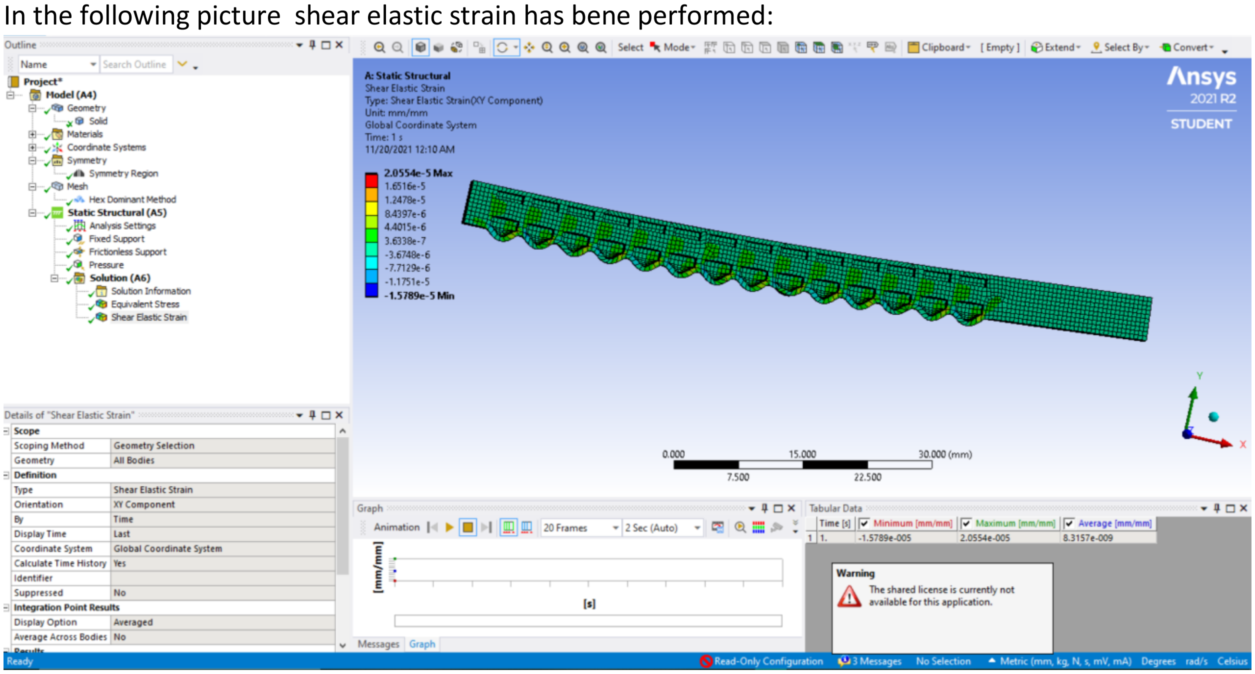


The second part of the part II includes simulating the bottom row chambers. This is where the pressure was applied to the bottom chambers and the analysis has been performed. The symmetry along z axis was also applied.

In the bottom picture equivalent von misses stress has been performed on the structure:



In the following picture shear elastic strain has bene performed:



As can be seen from the above pictures, the two row chambered finger prototypes bend upwards and downwards when the pressure either falls on the top row chambers or bottom row chambers. When the upper pneumatical chambers were pressurized, the robot finger bended downwards and when the lower pneumatical chambers were pressurized the robot finger bended upwards.