Project-2

UME412

PERFUME BOTTLE DESIGN AND ANALYSIS

Table of contents

Mechanical Engineering Department

Aim: Optimum design of a Perfume bottle

Software used: PTC Creo Parametric 7.0.0.0

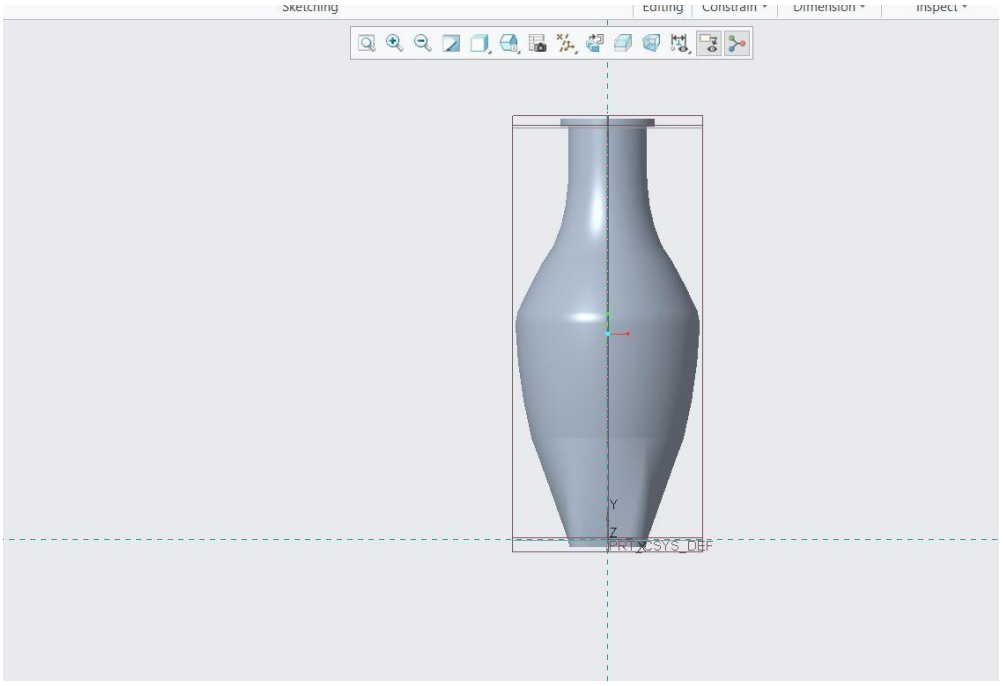
Introduction:

The aim is to design an optimum aesthetic design of a bottle with a height of 200 mm, with a volume of 550 ml. The base of the perfume is essentially a rectangular base bottle with curved edges of radius 5mm. A rectangular bottle is taken for reference. Firstly, a bottle body is designed, with all the required conditions and then the neck modelling of perfume bottle:

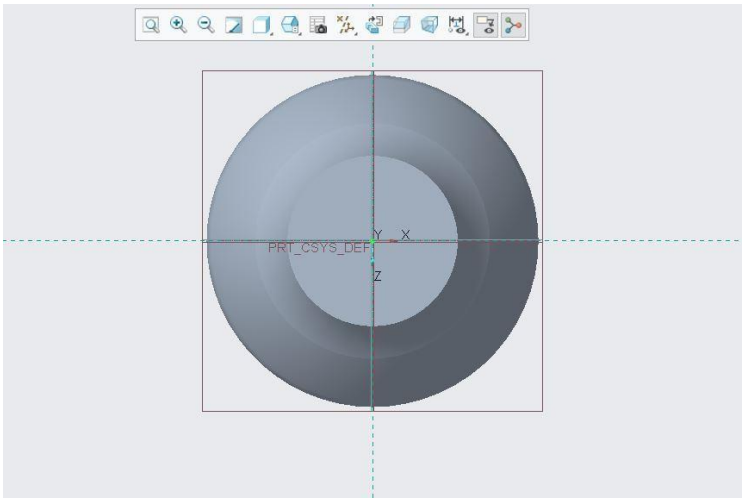
Modelling of the perfume bottle was done on PTC Creo 6.0.2.0. The process of the modelling was,fairly difficult as this was the first time me trying to model such a complicated part without anyguidance and help from anyone.

Some of the views are as shown below:

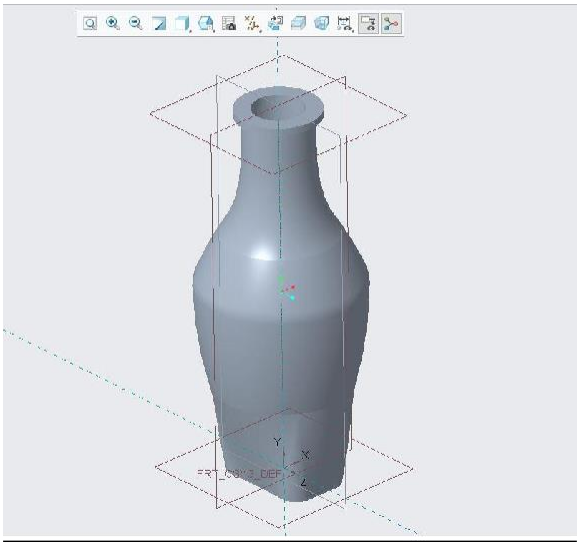
1. FRONT VIEW



2. TOP VIEW



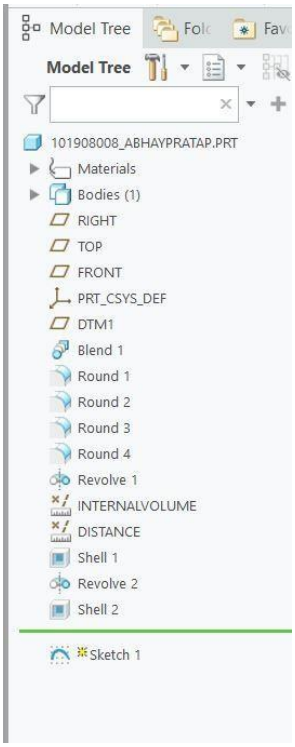
3. RIGHT VIEW

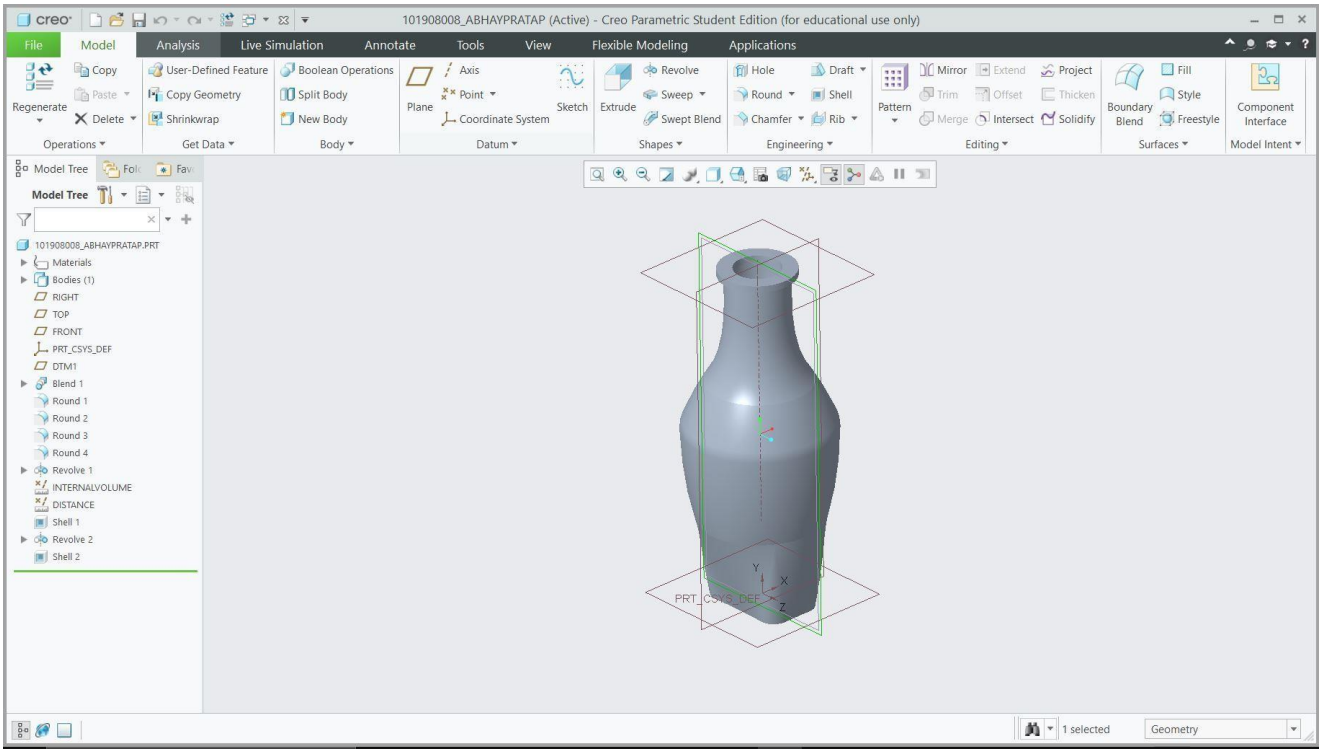


Procedure of modelling:

The major different steps used for modelling the PERFUME BOTTLE are shown below in the form ofsnips of different sketches used to make different parts.

MODEL TREE AND FINAL MODEL





Material assigned:

To Add and Assign a Material to a Part

1. Click File > Prepare > Model Properties. The **Model Properties** dialog box opens.

2. Click **change** in the **Material** line. The **Materials** dialog box opens. The preview of the material is available on the right that is selected by default.

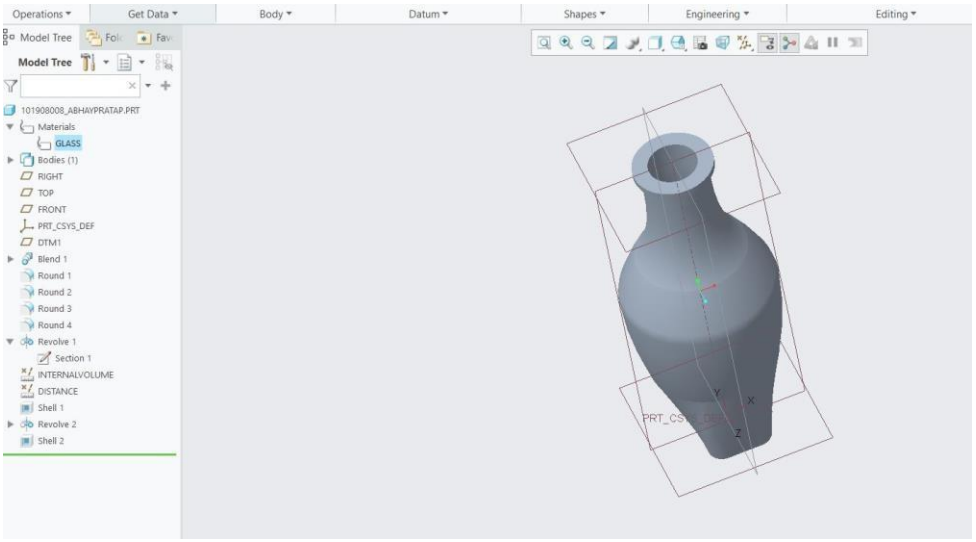
.◦ The Materials in Library list displays the contents of the directory in the look-in box.

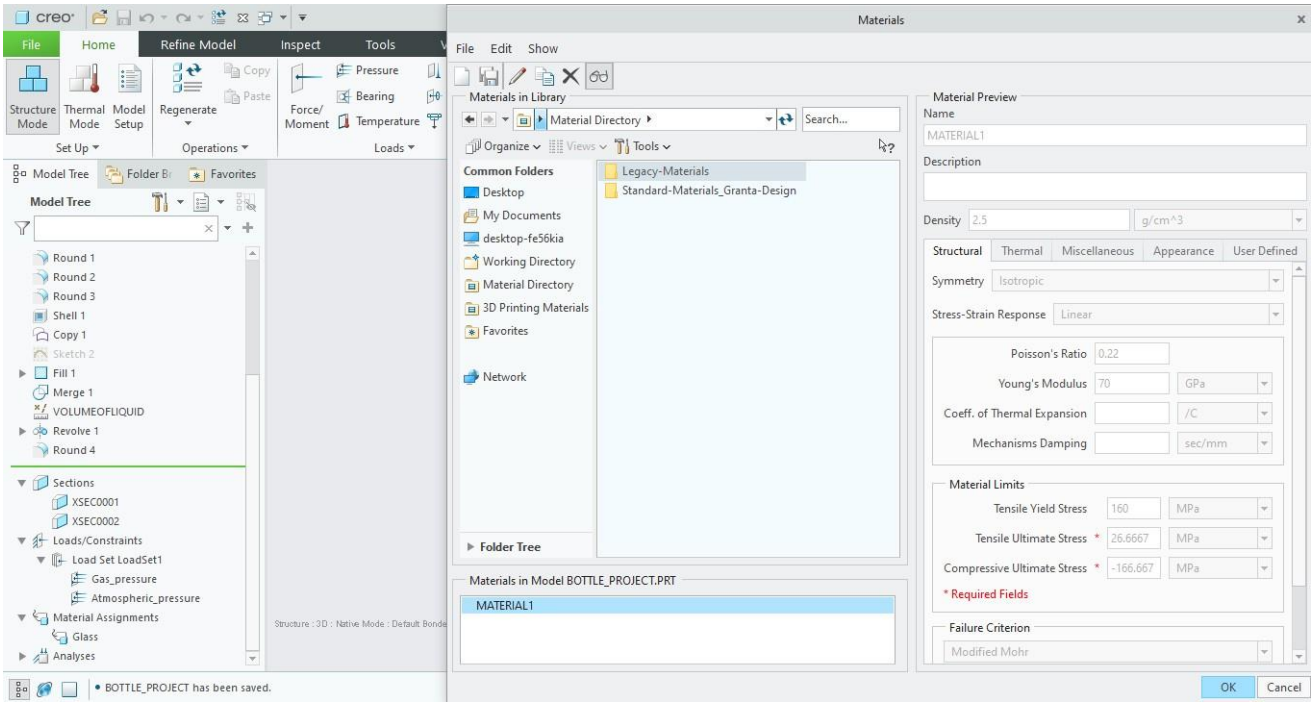
◦ The Materials in Model list displays the list of materials present in the model.

3. If required, use look-in to browse to the directory that contains the required material files. The names of the materials in the directory are displayed in **Materials in Library** list. Material files have a .mtl and .mat extension. The files with the .mat extension are files from release prior to Pro/ENGINEER Wildfire 3.0.

4. To add materials to a model, move the required materials from the **Materials in Library** list to the Materials in Model list.

4. To assign a material, select the material that you want to assign to the model from the **Materials in Model** list and click  or click **File** > **Assign**. The assigned material is denoted by a red arrow that precedes the name of the material in the **Materials in Model** list.





Sensitivity analysis:

Sensitivity analysis allows you to analyze how various measured quantities (parameters) varywhen a model dimension or an independent model parameter is varied **within** a specified range.The result is a graph for each selected parameter showing the value of the parameter as a function of the dimension.

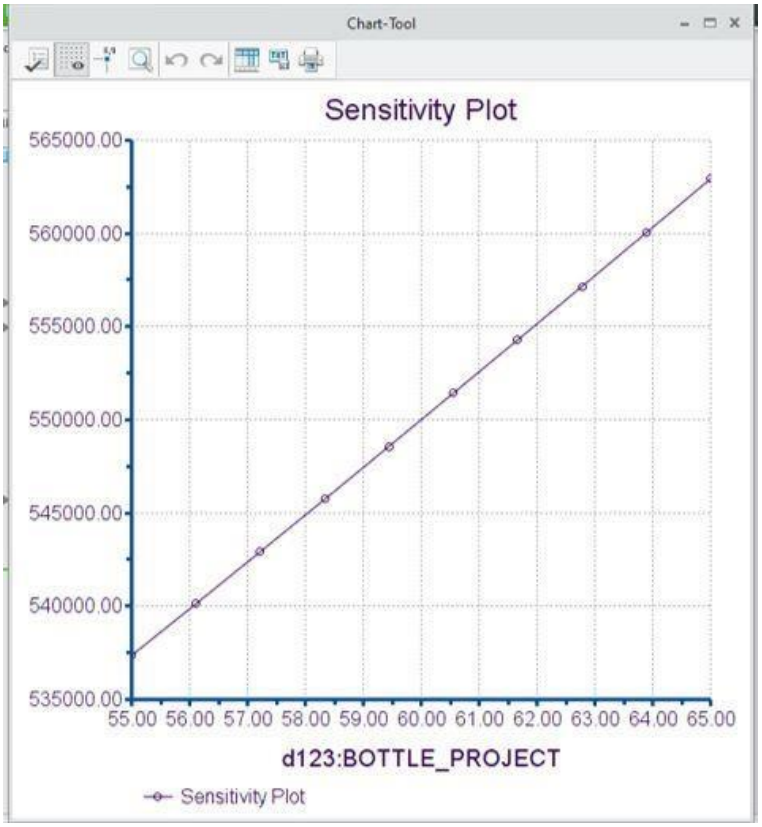
Generalised steps are as follows:

To create the analysis, you define the following attributes:

- A model dimension or parameter to vary.
- The range of values within which the dimension will vary.
- The number of steps (computations in the range).
- Parameters that have been created as the results of analysis features.

To generate the sensitivity analysis, the system does the following:

- Varies the selected dimension or parameter within the range
- Regenerates the model at each step.
- Computes the selected parameters.
- Generates a graph.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d123:BOTTLE_PROJECT
Sensitivity Plot

Feasibility:

. An optimization study with no goal is called a **Feasibility** study.

In the feasibility study, we will be setting the value of distance of center of mass from the axis of rotation to be zero.

Optimization:

An optimization design study adjusts one or more variables to best achieve a specified goal or to test feasibility of a design, while respecting specified limits.

Creo Simulate adjusts the model's variables in a series of iterations through which it tries to move closer to the goal while respecting any limits. If you have not specified a goal, Creo Simulate simply tries to satisfy the set limits.

The goal and design limits are optional, but you must have at least one goal or one limit.

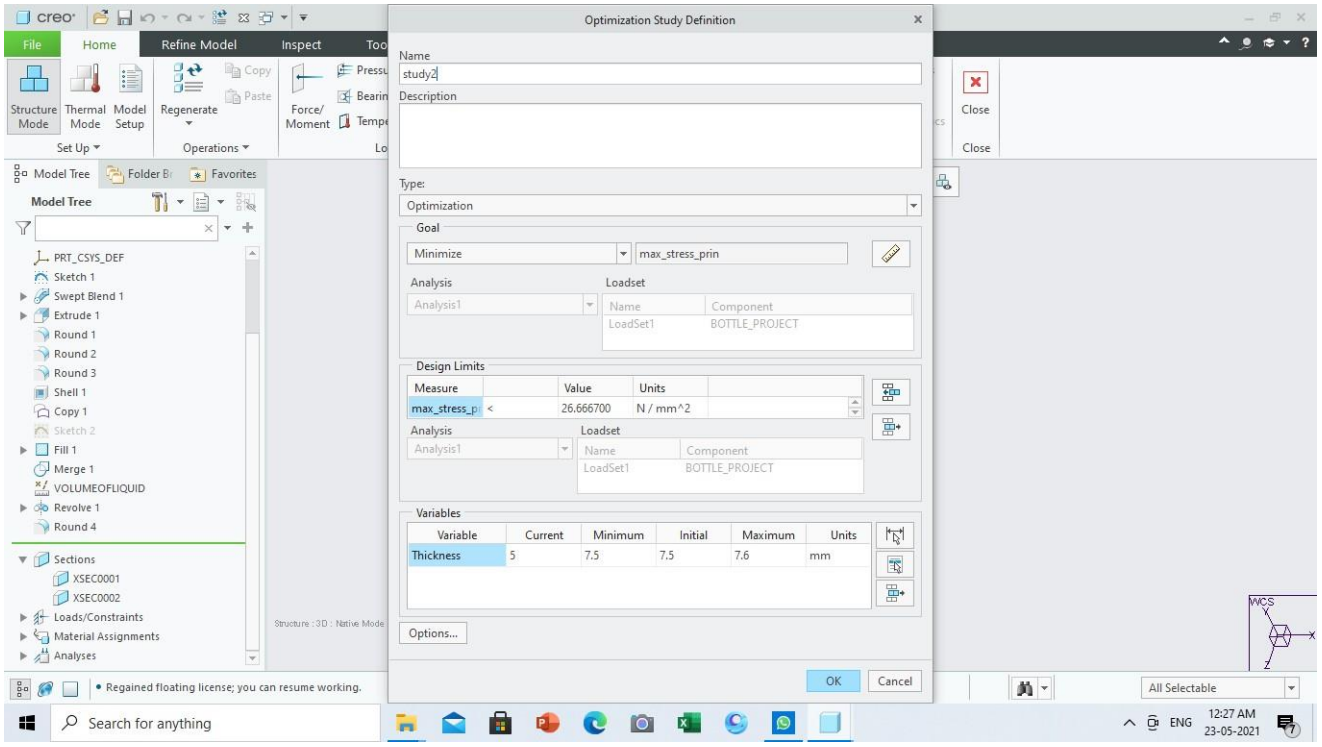
Creo Simulate calculates values for all measures that are valid for the analyses included in the study. Be aware of the following:

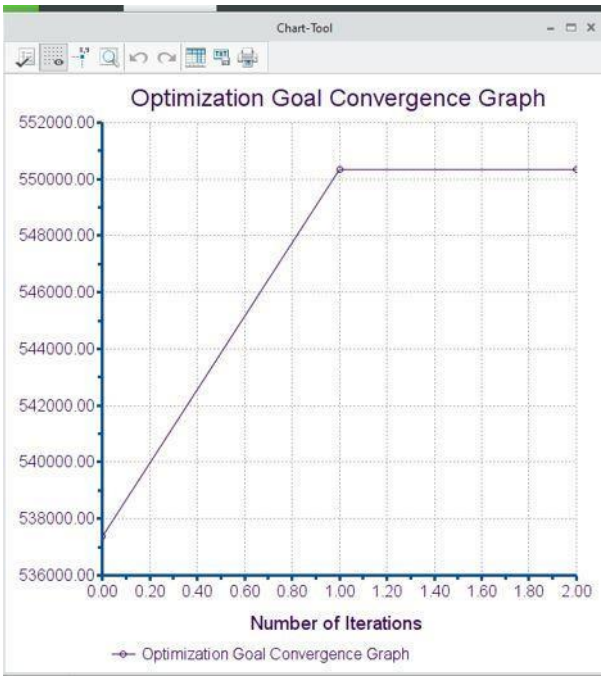
- Creo Simulate does not calculate the value for measures using the At Each Step option when you use dynamic time, frequency, or random response analyses in an optimization study.
- You cannot select the At Each Step option for measures for the optimization goal or limits.

Creo Simulate runs a regenerate analysis automatically if the study meets certain criteria regarding goals, limits, and variables.

You can examine the following types of results for an optimization study:

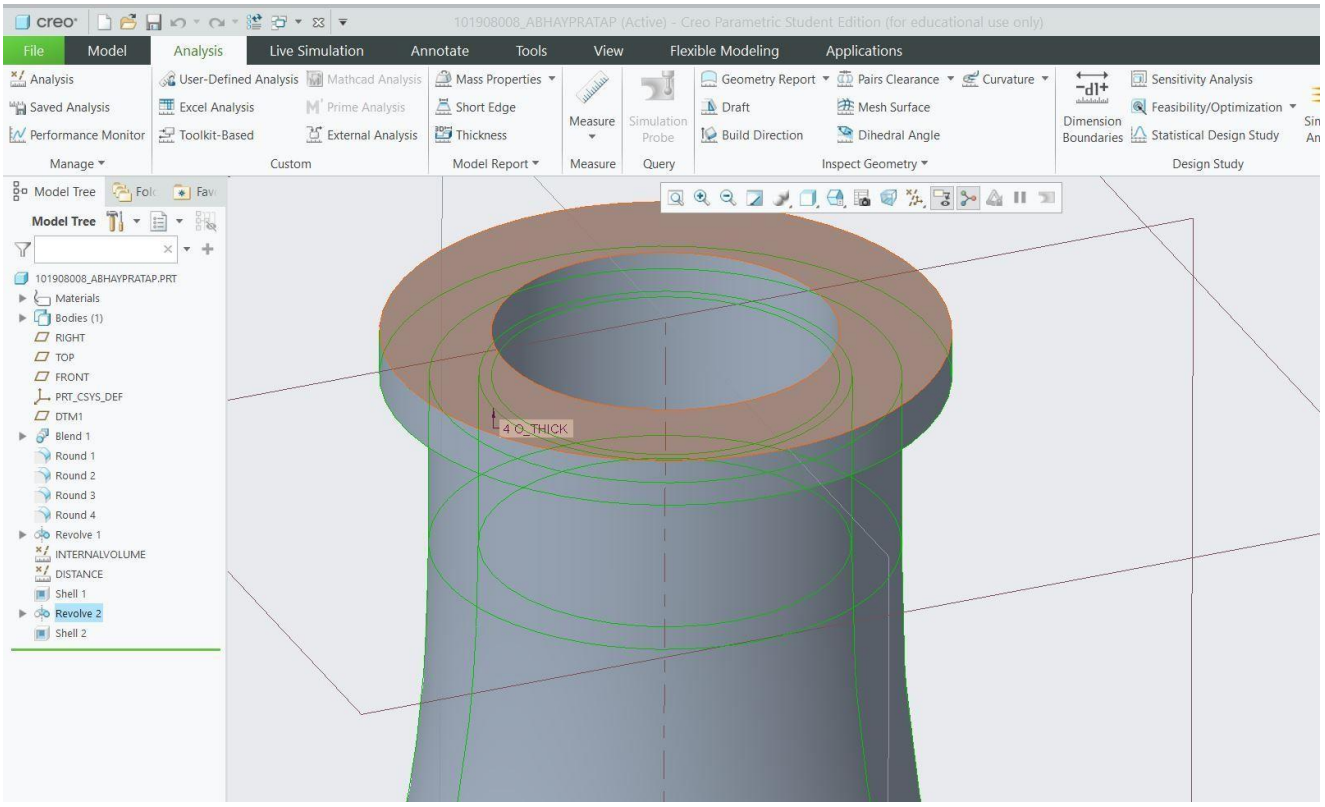
- graphs of a measure against the study's iterations
- standard results for the final optimized model



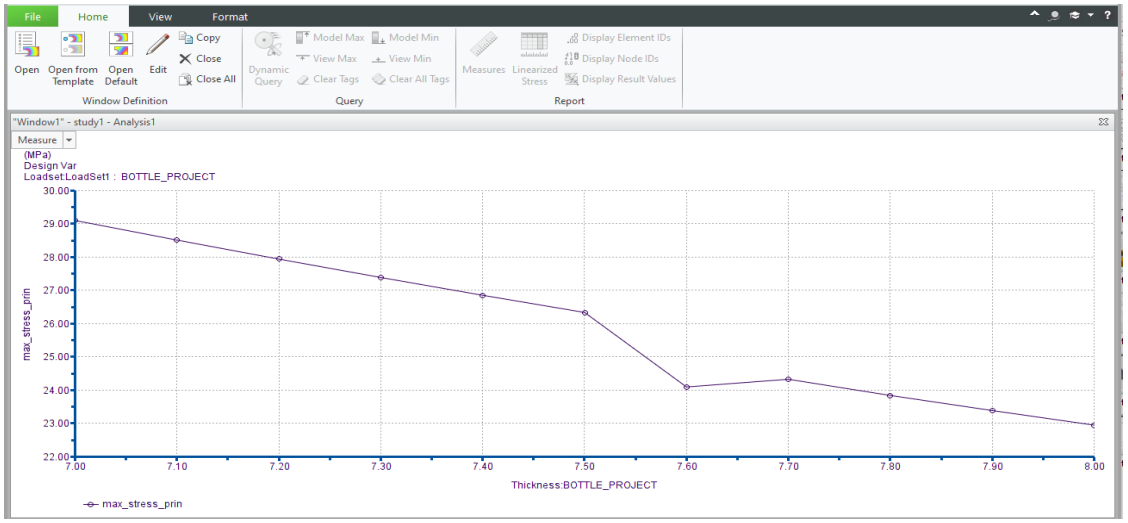


THICKNESS ADJUSTMENTS AND STUDY:

1. SETTING THICKNESS

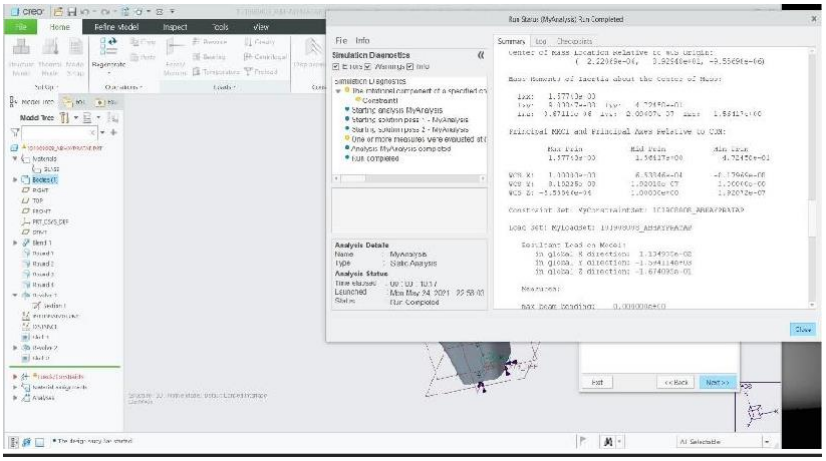


2. THICKNESS SENSITIVITY:



3. ASSIGNING OPTIMIZED THICKNESS:

4. <u>OPTIMIZED THICKNESS:</u>

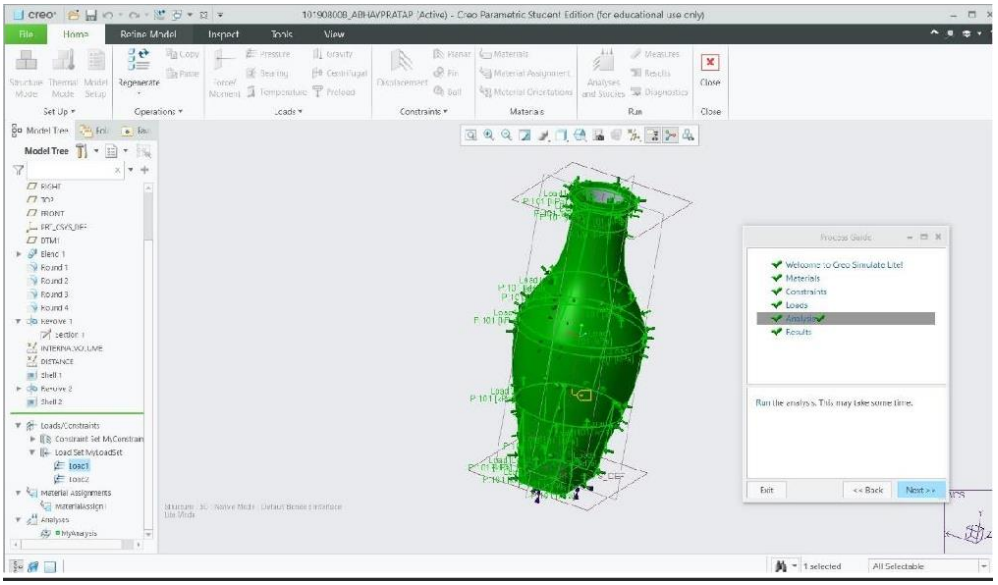


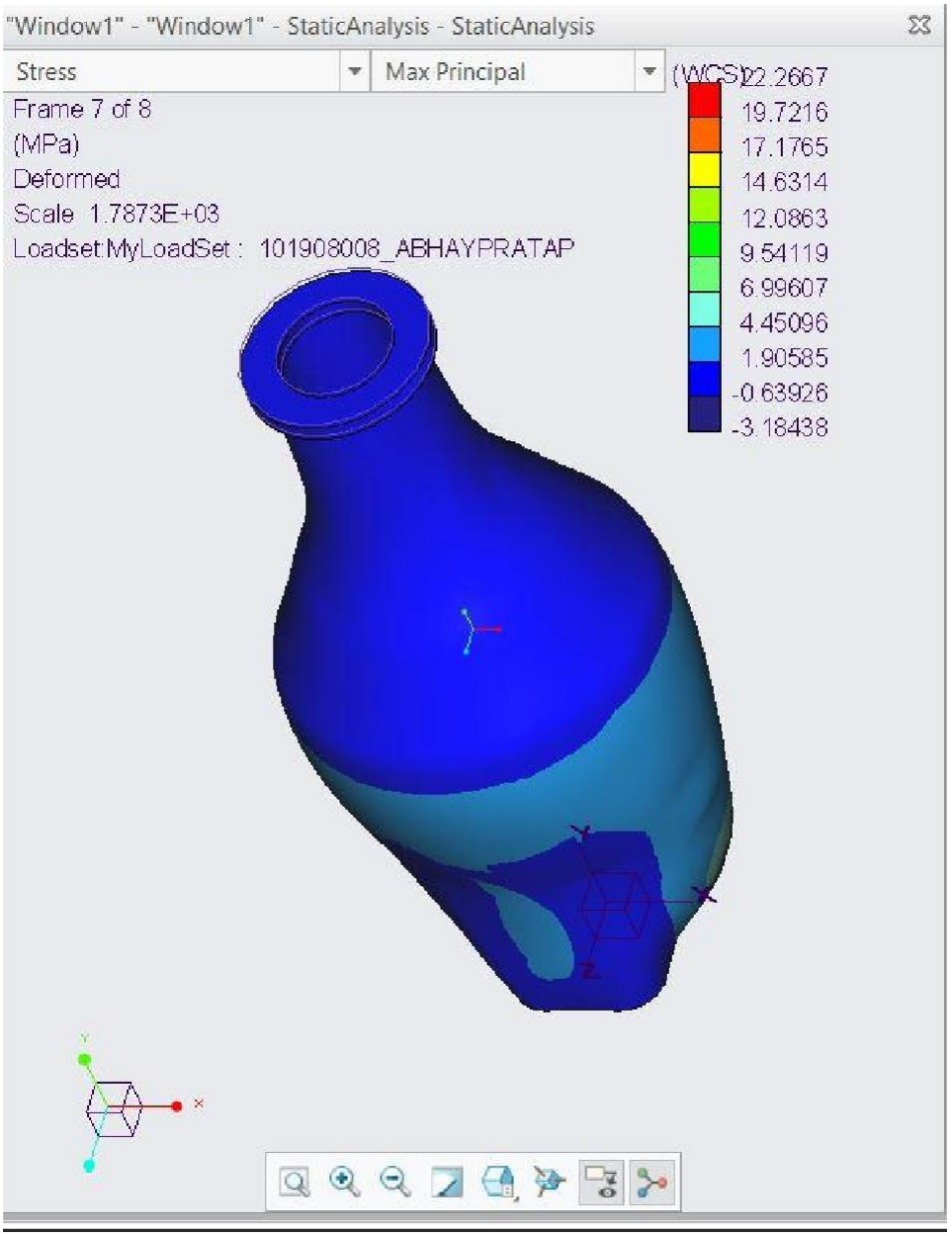
VOLUME OPTIMIZATION AND STUDY:

FINAL VOLUME:

ATMOSPHERE PRESSURE STUDY AND STRESS STUDY:

1. **<u>Loads:</u>**

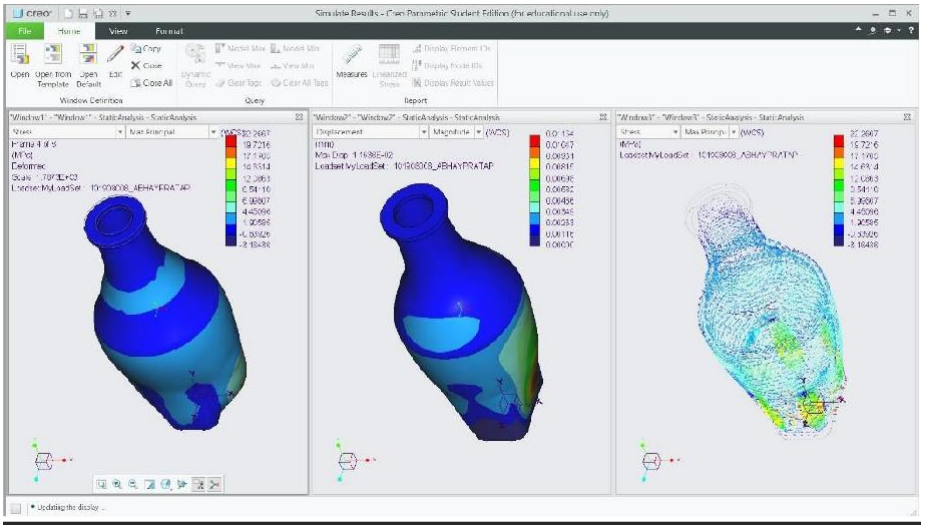


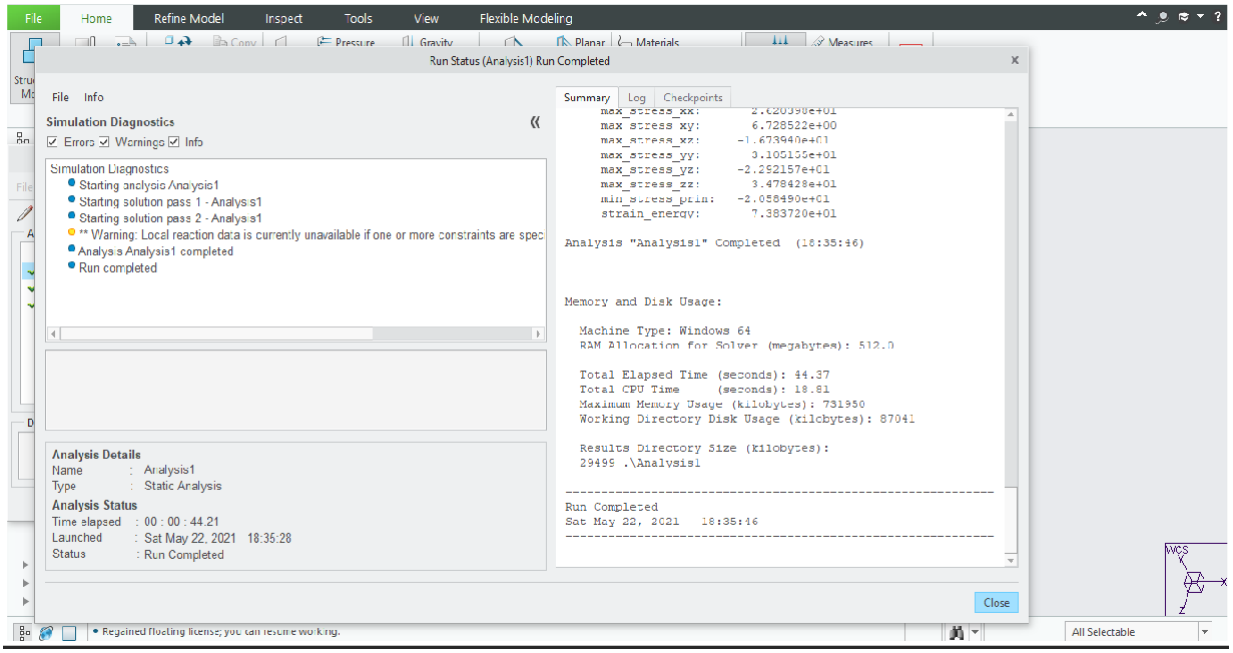


FINAL FEA ANALYSIS AND SNIPS:

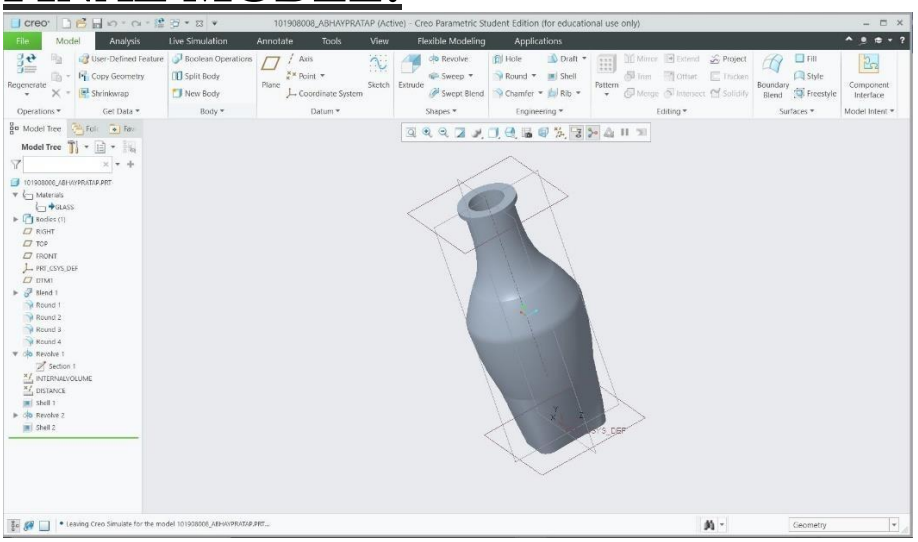
NEW STATIC:

FINAL NEW STATIC:




File
Home
Refine Model
Inspect
Tools
View
Flexible Modeling
Run Status (Analysis1) Run Completed
File
Info
Simulation Diagnostics
Errors
Warnings
Info
Simulation Diagnostics
Starting analysis Analysis1
Starting solution pass 1 - Analysis1
Starting solution pass 2 - Analysis1
** Warning: Local reaction data is currently unavailable if one or more constraints are spec
Analysis Analysis1 completed
Run completed
Analysis Details
Name : Analysis1
Type : Static Analysis
Analysis Status
Time elapsed : 00 : 00 : 44.21
Launched : Sat May 22, 2021 18:35:28
Status : Run Completed
Summary
Log
Checkpoints
max_stress_xy: 6.728522e+00
max_stress_yy: 3.105155e+01
max_stress_yz: -2.252157e+01
max_stress_zz: 3.478428e+01
min_stress_prin: -2.058490e+01
strain_energy: 7.383720e+01
Analysis "Analysis1" Completed (18:35:46)
Memory and Disk Usage:
Machine Type: Windows 64
Total Elapsed Time (seconds): 44.37
Total CPU Time (seconds): 18.81
Maximum Memory Usage (kilobytes): 731950
Working Directory Disk Usage (kilobytes): 87041
Results Directory Size (kilobytes):
29499 .\Analysis1
Run Completed
Sat May 22, 2021 18:35:46
Close
All Selectable

FINAL MODEL:



Conclusion:

. Hence, by many steps, I have finally have optimized the bottle to fulfill the given requirements. This project was full of skills, and also a lot of study (like I got introduced to some of the new features, I used simulate to do the design studies) was involved in doing it, right from the starting till the end of this project. I can say that, while doing this project, it gave me feel of working in an industry as a result, I enjoyed a lot while doing the project. Hopefully, I will learn more and more skills further also..

References:

http://support.ptc.com/help/creo/creo_pma/usascii/index.html#page/simulate/simulate/analysis/st ruct/reference/inertia_relief.html

Project 2.mp4 - Google Drive

https://youtu.be/dqQJ5KRfMJ4