

Lab Assignment #8: Creative Part Modeling

ME170

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Date Due: One week from Start Day of Lab (turn in deadline – 11pm night before next lab)

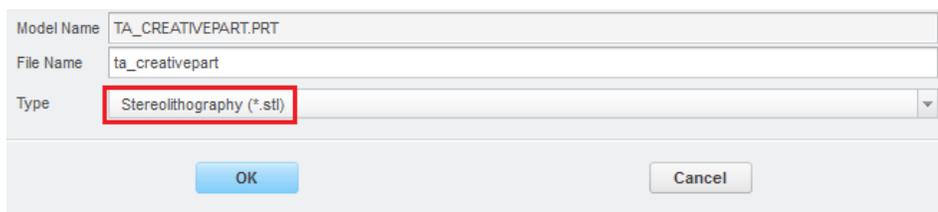
Creative Part Rapid Prototyping (3D Printing Exercise).

UNFORTUNATELY YOU CAN NOT ACTUALLY DO THIS IN THE LAB IN THE CURRENT SITUATION BUT PLEASE FOLLOW THESE PROCEDURES AS IF YOU WERE ☺

- 1) Use your '170startpart' to create a file named "<netid>_creativepart". Create a small model of an interesting, creative part of your own. Since we must control the cost of making your parts, you must follow the following guidelines (Units in inches are provided for comparison):
 - a. Maximum size: (101.6 mm x 101.6 mm x 101.6 mm) or (4 inches x 4 inches x 4 inches)
 - b. Maximum volume: $1.0488 \times 10^6 \text{ mm}^3$
 - c. Follow the instructions in section II.2 to verify the volume of the model.
 - d. Wall Thickness: 1.0 - 4.0 mm
No more, no less. Do not make any feature/dimension less than about 0.75mm because the material may not be self-supporting during build.
- 2) Prepare the file for rapid prototyping.
 - a. **Verify** that the model units are set correctly.
 - i) Navigate to "File" → "Prepare" → "Mass Properties."
 - ii) Ensure that the model's units are set to "millimeter Newton second".
 - iii) Change the model's units to "millimeter Newton second" if necessary.
 - (1) Click "Change" to the right of "Units".
 - (2) Select "millimeter Newton second". Click "Set...".
 - (3) Carefully read and understand the two options in the "Changing Model Units" window.
 - (4) Select the appropriate option: "Convert" or "Interpret". Your selection depends on how you modeled your part. Select "OK". Click "Close".
 - iv) Close the "Mass Properties" window.
 - b. **Verify** the maximum size of the model.
 - i) Navigate to the "Analysis" ribbon and use the "Measure" tool to measure the height width and length dimensions of your part.
 - ii) Adjust your part's dimensions so that they do not exceed the maximum size dimensions given above. Instructions for scaling your part are given in section 'd' below.
 - c. **Verify** your model's volume.
 - i) Navigate to the "Analysis" ribbon. Click "Mass Properties".
 - ii) Select the coordinate system "PRT_CSYS_DEF" from the model tree.
 - iii) Verify that the computed volume is less than the maximum volume listed above.
 - iv) Adjust the design of your part if necessary. Instructions for scaling your part are given in section 'd' below.

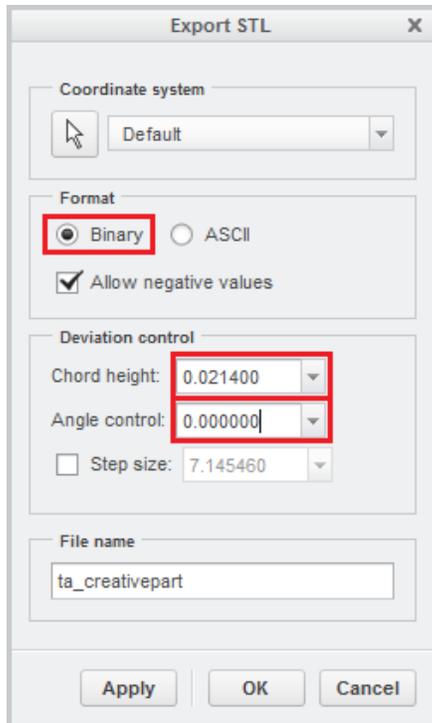
Note that there should not be any large, solid volumes. Large volumes should be shelled to create a cavity with an appropriate wall thickness. If shelling an interior, the interior hole **MUST** have a hole to the outside of the part so that unfused material can be removed.

- d. Optional instructions for scaling your part (if the size or volume requirements are exceeded).
 - i) Navigate to "File" → "Prepare" → "Model Properties".
 - ii) Under the "Tools" header. Select "change" on the "Shrinkage" line.
 - iii) Click "By Scaling". Select the part's coordinate system (eg. "PRT_CSYS_DEF").
 - iv) Define a shrink ratio. Note that the shrink formula is " $1 + S$ ". Therefore, to shrink the part, you must enter a negative value between 0 and -1. "-0.2" will shrink the part by 20%, "-0.4" by 40%, etc.
 - v) Click the check box to confirm.
 - vi) Click "Done/Return". Close the Model Properties box. Save the part.
 - e. If you make any significant changes to your part. **Re-verify** that your part's maximum dimensions and volume are within the specified limits.
- 3) Create an STL file, which is required by the rapid prototyping machines. STL is an abbreviation for stereolithography, which is one of many rapid prototyping methods capable of directly manufacturing parts from a solid model file. Your part may be created using a different rapid prototyping process. However, the STL file is a standard file that can be used by most rapid prototyping machines.
- a. Click "File" → "Save As" → "Save a Copy".
 - b. Select "Stereolithography" from the "Type" pull-down menu. (See image below.)



- c. Enter the file name "<netid>_creativepart".
- d. Click OK.
- e. In the "Export STL" box, ensure that "Binary" is selected.
- f. Enter "0" for "Chord height" and "Angle control" (image below). Creo will not allow a zero value for "Chord height", but it will instead default to the smallest allowable value.

These parameters govern the mesh size of the resulting STL file. Smaller deviation control values create a finer mesh, which results in a larger file and a more accurate representation of your model.



- g. Click OK. A "<netid>_creativepart.stl" file will be created and saved to your working directory.

Part III. Lab Submission Requirements

1) Create a zip file named "<netid>_lab8.zip" with the following files. Submit it for grading through the my.mechse website. Be sure to include the latest version of each part. You may need to instruct Windows to unhide the file extensions.

netid_creativepart.prt

netid_creativepart.stl