Laboratory 4 – Creo Parametric (Bearing Solid Model)
Assigned October 6-10
Due October 14-17*
*Monday Oct 13 is Thanksgiving Day. For Monday lab sections, Laboratory 4 is due Oct 14 by 16:30, see Section IV for details.

I — Introduction:

PTC's Creo (formerly known as Pro/Engineer or Pro/E) is a suite of programs that are used in the design, analysis, and manufacturing of mechanical systems. One of these programs, Creo Parametric, is a robust and versatile parametric solid-modeling solution for product development. An assortment of supplementary modules exists for managing tasks ranging from sheet metal operations, piping layout, mold design, wiring harness design to NC (numerical controlled) machining. While IntelliCAD involves geometric modeling, Creo Parametric involves feature-based, parametric, solid modeling. Those in Aerospace, Mechanical, Biomedical and Mechanical, or the Efficient Energy Generation and Conversion stream of the Sustainable and Renewable Energy Engineering program will study both of these software programs more in detail during their second-year course—MAAE 2001.

II — Problem Statement:

In this lab, you will create and print two solid-model renderings of a bearing using Creo Parametric. The steps to produce a similar solid model are found in Chapter 16 of your textbook: "Introduction to Engineering" (see section 16.3). The model in the textbook is not the same as the model you are to produce in this lab. For this lab, you are required to add 4 circular holes to the textbook bearing that completely penetrate the base on each of the 4 corners; the bearing should looks like the one in Figure 1, but without the numbers 55 on the front face. A wireframe rendering of the bearing with holes in the four corners is the first of two solid model renderings you are asked to produce. The second rendering shows the model as an opaque solid with a text protrusion (Section 17.8) on a face of the base showing the last two numbers of your student ID; the result should look like Figure 1, with your numbers.

The task for this lab is to produce a 3D solid model of a bearing similar to the one shown in Figure 1: first as a wireframe model, with no numbers, and second as an opaque solid with the last two digits of your student number as a text protrusion.

The following list provides a specific description of your bearing:

- The base of the rectangular block is 8.0 cm × 10.0 cm (Note: these dimensions and units are different from those in the Textbook: Introduction to Engineering.)
- A circular protrusion (diameter 4.0 cm and height 3.0 cm) is connected to the base such that the symmetry axis is normal to the top face plane and intersects the geometric centre of the base.
- There is a hole through the center of the protrusion that extends through the base to the bottom of the base. The diameter of the hole is 2.0 cm, and the depth of the hole is 5.0 cm.

- Four through-holes, one at each corner of the rectangular top face: Diameter = 0.5# cm. Replace "#" with the last digit of your student number **(Note: these 4 extra holes that go all the way through the base are added to the model described in the textbook)**
- The center of each of the 4 through-holes is 0.7# cm from each edge. Replace "#" with the second last digit of your student number
- The bearing is made of mild steel, which has **density 7.85 g/cm^3**.

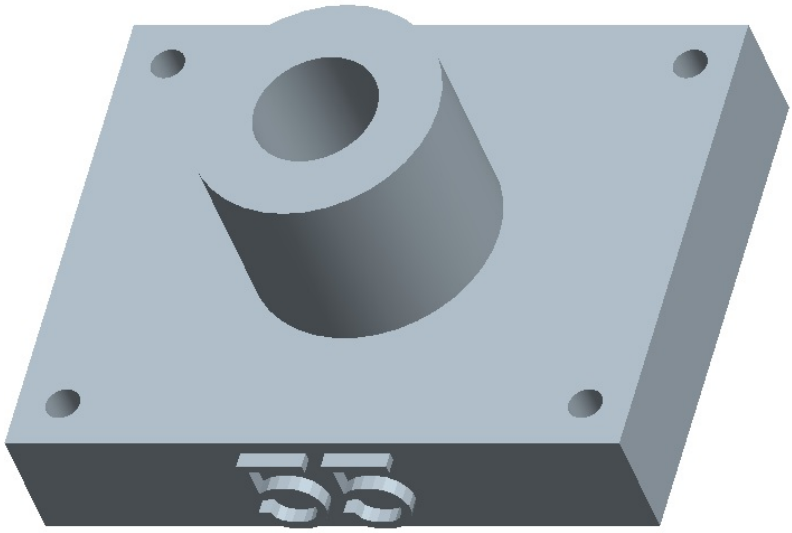

Figure 1: 3D-rendered model of the bearing to be drawn: first as a wireframe, but without the numbers 55, and second as an opaque solid with the last two digits of your student number replacing "55" in this figure.

III — Steps and Calculations:

Part 1:

- Construct a wireframe 3D model of your bearing using the steps in Section 16.3 of the textbook as a guide. The instructions and pictures in the textbook were created for a slightly earlier version of the software you will be using. While all of the steps are essentially the same, the location of buttons and menus has changed slightly. **Remember that the dimensions and units of your bearing are different from those of the bearing in the textbook.**
    - **NOTE 1:** All the dimensions in Creo are in 'inches' by default. See the FAQ pdf file on cuLearn to learn how to convert to other units.
    - **NOTE 2:** Locating hole centers relative to edges requires additional 'references' (See the FAQ pdf file on cuLearn).
- Take a "Screen Shot" of the window in Creo that shows the total volume, area and mass of your model (See Figure 2). Include this screen shot in an appendix of your report (see Section "IV-

Report Requirements and Deliverables" for details). **For help finding the Creo window and instructions on how to take a screen shot, see the file called FAQ.pdf on cuLearn.**

Part 2:

- Add a 'text protrusion' with the last two digits of your student ID as shown in Figure 1. This text is for identification only and the volume and surface area of the text **is not** included in any calculation. See section 17.8 on pages 365-366 for help on how to add a text protrusion.

NOTE: Set all the datum planes and the origin to "OFF".

III — Report Requirements and Deliverables:

- Include a title page in the format discussed in Laboratory 1. There is no requirement for a page with an introduction, results and discussion, and conclusions.

- Include prints of your two solid model renderings:
  - One wireframe isometric view of your bearing
  - One solid opaque isometric view with a text protrusion that contains **the last two digits** of your student number. The protrusion should be on the front face as shown in Figure 1, and appropriately sized so that the number is easily readable.

- On your wireframe drawing, include the total volume (cm^3) calculated in Lab 2 for the same solid object: on your drawing, clearly show the result you obtained in Lab 2 with 7 sig figs: "Volume = … cm^3"; this shall be handwritten, dated and signed.

- Provide a 'screen-shot' of the Creo Parametric window showing your solid model properties, similar to that shown in Figure 2.

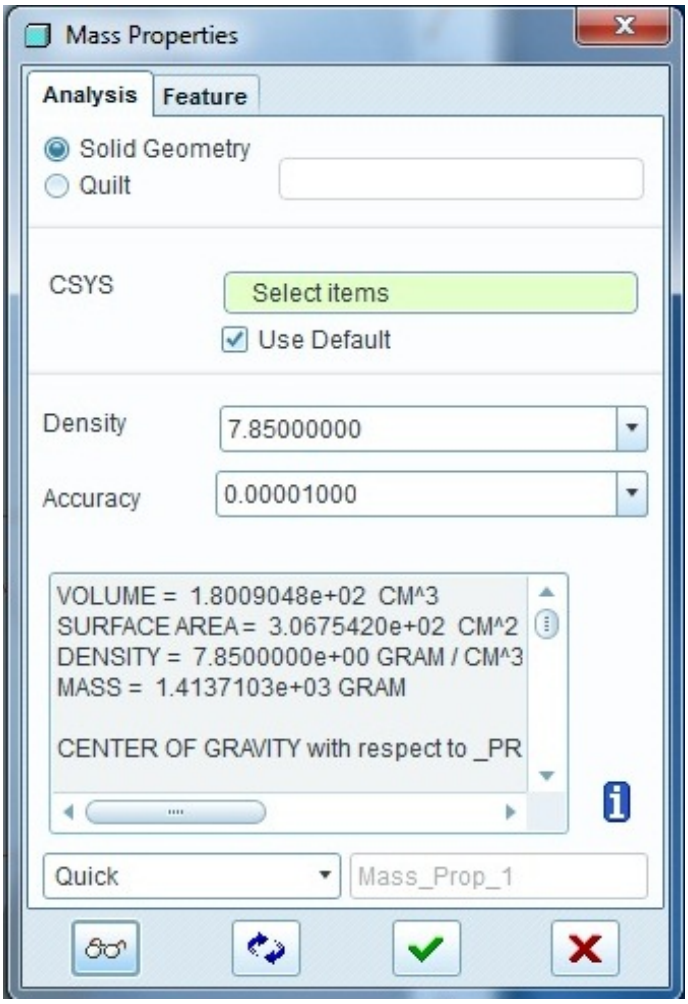

Figure 2: A 'screen shot' of the Creo Parametric window showing the volume, surface area and mass of the model.

Deliverables: The lab assignment includes the following:

1. **Title page**
2. **Creo wireframe rendering of your bearing produced in III Part 1**

The volume of the model you calculated in Lab 2 (*with 7 decimal places*) should be handwritten, signed and dated, on this drawing.

3. **A Screen shot of the Creo 'Mass Properties' window that shows the volume, surface area and mass of your bearing produced in III Part 1**
4. **Creo rendered opaque solid model of your bearing with a text protrusion showing the last two digits of your student ID produced in III Part 2**

Upload your completed lab assignment to cuLearn with file name: "Lab Section_Student number.docx" (e.g. "C3_100812345.docx" is for C3 Lab section)

VI — Submission and Timing:

If your lab is scheduled for Monday, remember that there are no undergraduate classes Monday October 13, 2014, because this is Thanksgiving Day. For students with labs normally held on Monday, this laboratory is assigned on Monday October 6, 2014, and will be due on Tuesday October 14, 2014 by 16:30 (4:30 PM).

If you lab is scheduled for Tuesday, Wednesday, Thursday, or Friday, your report is to be submitted to the Teaching Assistant within the first 30 minutes of your next laboratory period, in the usual way.

LATE SUBMISSIONS WILL NOT BE ACCEPTED.

VII — Marking:

Laboratory submissions will be marked on a 10-point scale: 9-10 (excellent); 7-8 (good); 5-6 (marginal); less than 5 (poor). **Be sure that you are familiar with the University's policy on plagiarism and academic integrity. Your instructors are obligated to report all suspected violations to the Associate Dean's office for investigation (see also chapter 14 at www4.carleton.ca/calendars//ugrad/current_ /regulations).**