

Assignment 8: Manufacturing and Cost Analysis

24-370 Engineering Design I

Due @ 12:30, Wednesday April 27th 2011

Bonus assignment: this HW is not required, but may be used to improve the HW portion of your final grade. You must answer at least half of the questions for credit. Please turn in your answers electronically by replying to the soliciting email. You will need to combine your answers into a single PDF file with all responses.

To answer these questions, you will need to download from the course website the SolidWorks models used to design the robot wrist.

Part 1: Robot Wrist Drive Shaft

In this section, you will determine appropriate manufacturing processes and perform a manufacturing cost estimation for the "Robot Wrist Drive Shaft.SLDPRT".

1.a - Manufacturing process selection. Use the charts from Dieter & Schmidt Ch. 13 (covered in lecture) to select candidate manufacturing processes. Specifically address the following constraints:

- i. Quantity - use 1,000
- ii. Shape and complexity
- iii. Size and thickness
- iv. Material - use steel
- v. Quality requirements - base these on mating parts

You may need to use both primary and secondary processing to create the final part. Based on the above factors, select one manufacturing strategy that appears optimal.

1.b - Cost estimation. Use the IPD costing worksheet to estimate the per-part cost of producing this component. Follow each step required to create the bulk shape and all features. Please show your work.

1.c - Cost comparison. Now consider an alternate design and manufacturing scheme. What would the cost of manufacturing be if we used die-cast aluminum without any secondary machining? Use the same IPD worksheet and again please show your work.

Part 2: Robot Wrist Bearing Plug

In this section, you will determine appropriate manufacturing processes and perform a manufacturing cost estimation for the "Robot Wrist Bearing Plug.SLDPRT".

1.a - Manufacturing process selection. Use the charts from Dieter & Schmidt Ch. 13 (covered in lecture) to select candidate manufacturing processes. Specifically address the constraints of Quantity (use 100,000), Shape and complexity, Size and thickness, Material (use an appropriate aluminum), and Quality requirements (based on mating parts). You may need to use both primary and secondary processing to create the final part. Based on the above factors, select one manufacturing strategy that appears optimal. Allow for minor modifications to the design to aid manufacture.

1.b - Worksheet cost estimation. Use the IPD costing worksheet to estimate the per-part cost of producing this component. Follow each step to create the bulk shape and all secondary features. Please show your work. What is the per-part cost?

1.c - Online cost estimation. Use custompart.net to estimate the per-part cost of producing this component. You may use the simplified model for the estimate, but you must use accurate numbers from the SolidWorks model. Please provide a screen print displaying the values you used and the result. What is the per-part cost? How does this compare with 1.b? Why do you think there is a difference, if any?

1.d - Implications of a material change. Now consider an alternate design, in which the component is made of ABS. What, if any, changes would likely need to be made to the overall shape? What would be the cost of manufacture if we used injection molding and no secondary processing?

Part 3: Robot Wrist

In this section, you will determine appropriate manufacturing processes and perform a manufacturing cost estimation for the "Robot Wrist - Modified.SLDPRPT".

1.a - Manufacturing process selection. Use the charts from Dieter & Schmidt Ch. 13 (covered in lecture) to select candidate manufacturing processes. Specifically address the constraints of Quantity (use 100), Shape and complexity, Size and thickness, Material (use an appropriate aluminum), and Quality requirements (based on mating parts). You will need to use both primary and secondary processing to create this complex component. Based on the above factors, select one manufacturing strategy that appears optimal. Allow for minor modifications to the design to aid manufacture.

1.b - Worksheet cost estimation. Use the IPD costing worksheet to estimate the per-part cost of producing this component. Follow each step to create the bulk shape and all secondary features. Please show your work. What is the per-part cost?

1.c - Online cost estimation. Use custompart.net to estimate the per-part cost of producing this component. You may use the simplified model for the estimate, but you must use accurate numbers from the SolidWorks model. Please provide screen prints displaying the values you used and the result for each stage of the process. What is the per-part cost? How does this compare with 1.b? Why do you think there is a difference, if any?

1.d - Design for Manufacture. What major design changes, if any, could be made to this part to allow for more economical manufacture on a large scale, i.e. quantities in the millions? Provide a rough estimate of the per-part cost savings, based on a conceptual model of the altered design. You may use either the worksheet method or an online cost estimate.

Part 4: Worksheet vs. Online

Two estimators enter, one estimator leaves. Which part cost estimation method do you prefer? Comment on ease of use, transparency of models and origins, and breadth of available manufacturing processes.