ME 24-688 – Week 9

Problem Set Assignment

1 Mounting Bracket Linear Structural Simulation

The gray mounting bracket shown in the image below is an existing design that has been functioning in an existing product line. The bracket is going to be used in a new product so the engineering team would like to validate and try to optimize the design to save money in raw materials before ordering 10,000 new parts. The part is a casted part from mild steel and the goal is to reduce as must weight as possible while maintaining the displacement and safety factor levels at minimum to the existing design. There is a provided list of possible parameter values that can be used to alter the size of the part to achieve the objective.

Material
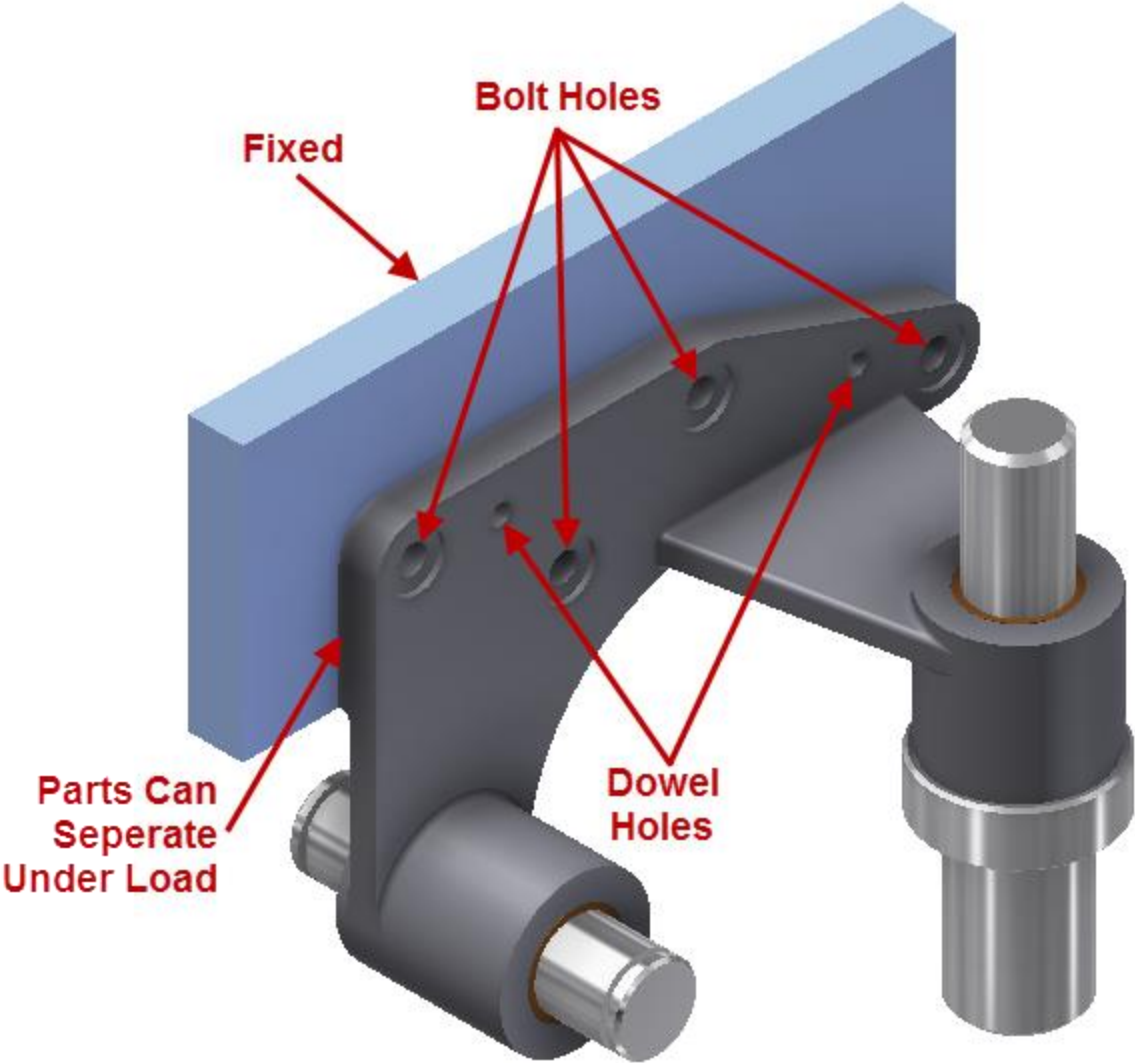- Current Material = Steel, Mild
- Cost per pound = $0.30
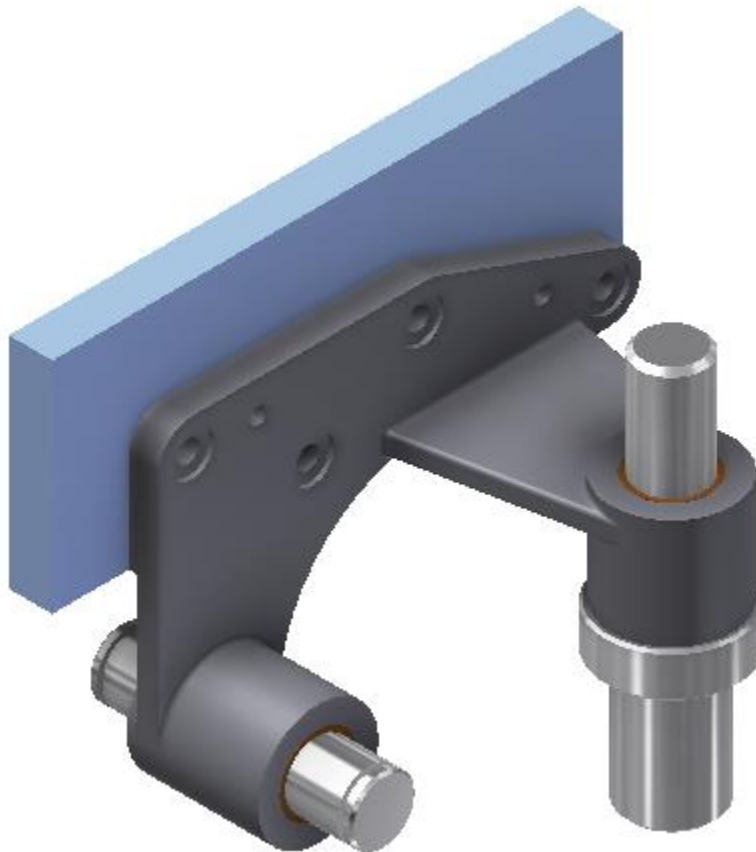
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1.1 Environment

The illustration below outlines the loads that are applied to the bracket and also how the bracket is mounted.   The blue plate part shown below is fixed and is assumed to be a rigid body. The gray bracket is held onto the blue rigid plat with two (2) dowels for position and four (4) bolts. The dowels are made out of very hard material and provide a tight fit for the bracket to slide onto for location. The four bolt holes are clearance holes for the fastener so they can move some but the mounting surface for the bolt head can only slide holding the part as required. Overall the gray bracket can separate or pull away from the blue plate in some areas under load so this needs to be taken into account.

The pin, shaft, and two bushing components are excluded from this simulation and are only provided to show how the loads are applied to the bracket. The vertical shaft part is pushed into the bracket with an air cylinder assembly which results in 500 pounds of force being applied to the lower surface.   The more horizontal shaft holes an assembly that hangs from the bracket resulting in an 800 pound bearing load down in the Y axis direction.

**800 Pound
Bear Load
Pushing Down**

**500 Pound Load
Pushing Up on
Lower Surface**
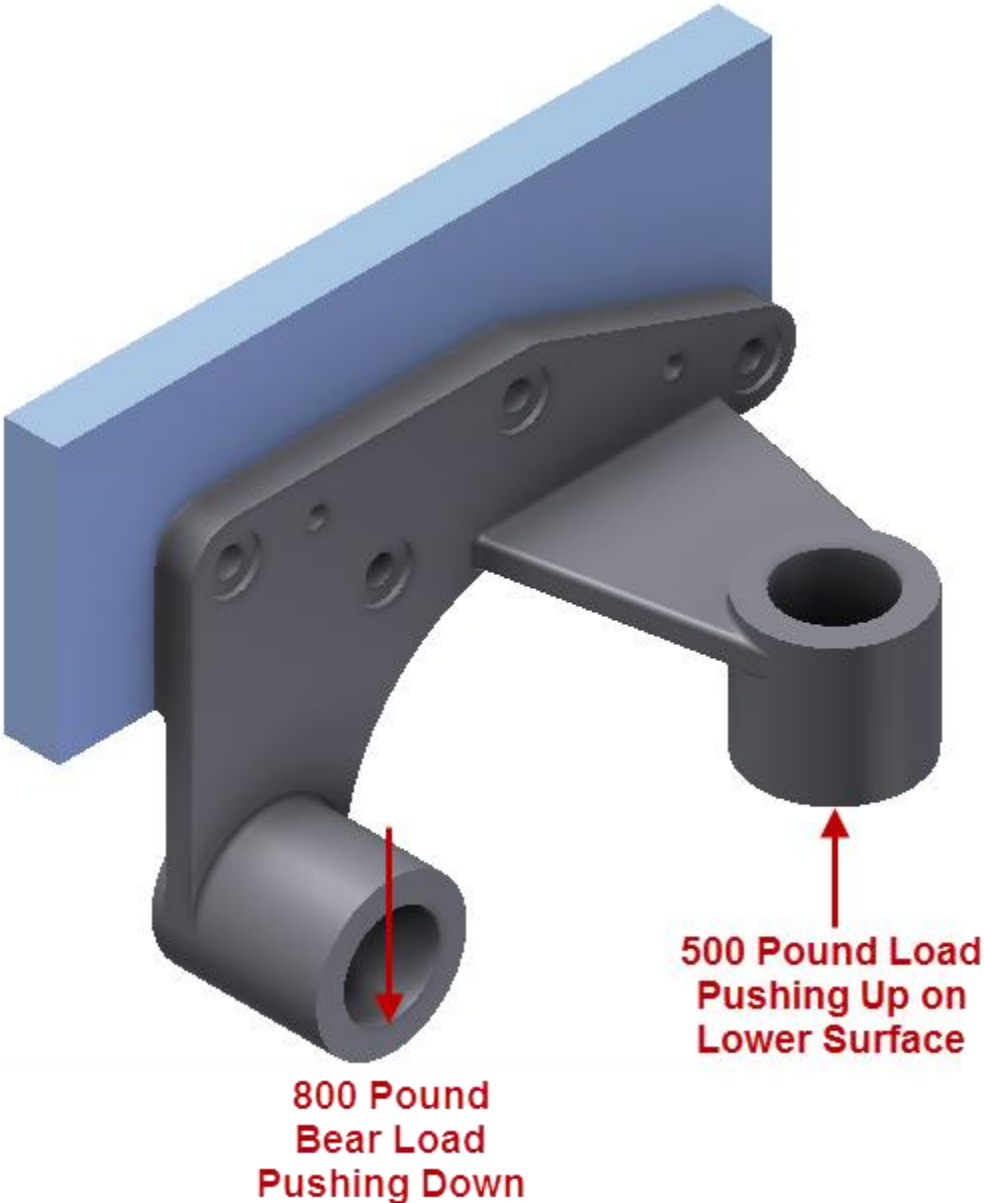
Problem Set Assignment

1.2 Provided Items

The following parameters and values are the only items that can be altered on the model to identify the most optimal design. Do not use other values or parameters during this assignment.

Web_Thickness (Controls the thickness of all the ribs, the main plate, cylinders and the plate attached to the cylinder that the 500 pound load is applied to.)

- 0.375
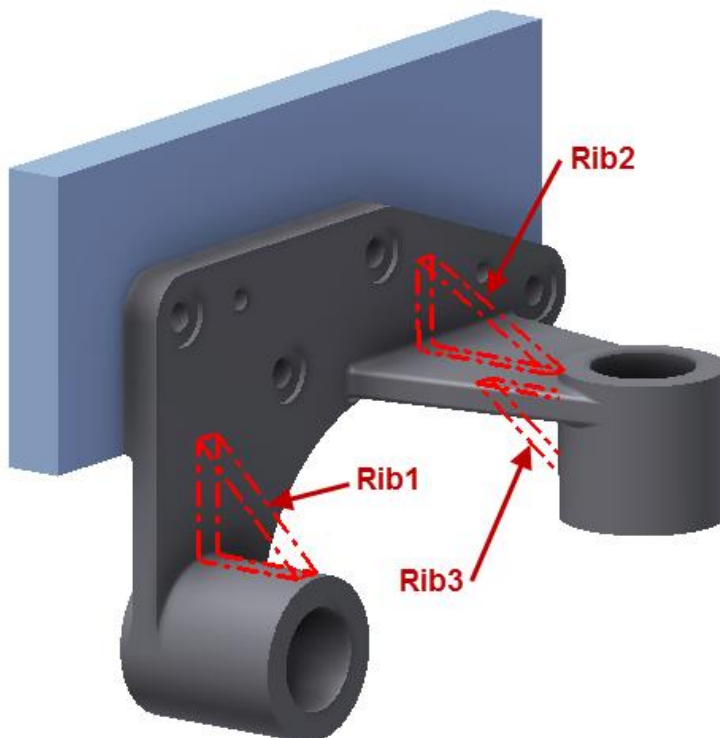- 0.50

Rib1_On (Controls if Rib1 is present or not)
- 0
- 1

Rib2_On (Controls if Rib2 is present or not)
- 0
- 1

Rib3_On (Controls if Rib3 is present or not)
- 0
- 1

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1.3 Final Deliverable and Submission of Your Work

The main requirements of this design problem are to determine the current as-is condition first then develop the optimal design from the provided parameter options. Use the Safety factor found in the base line as a lower limit for the optimized design. Please complete the following data values in a Rich Text Format (RTF) file and name it **final_report_firstname_lastname.rtf** – replace firstname_lastname with your own.

Initial Design
- Max Von Mises Stress = ~XX.XX ksi
- Min Safety Factor = ~X.XX ul
- Max Defections = ~X.XXXX in
- Mass = XX.XXX lbmass
- Raw Material Cost per Unit = $X.XX
- Total Raw Material Cost for 10,000 parts = $XX,XXX

Optimal Design
- Max Von Mises Stress = ~ XX.XX ksi
- Min Safety Factor = ~ X.XX ul
- Max Defections = ~ X.XXXX in
- Mass = XX.XXX lbmass
- Raw Material Cost per Unit = $ X.XX
- Total Raw Material Cost for 10,000 parts = $ XX,XXX

Optimal Design Parameter Values
- Web_Thickness = X.X
- Rib1_On = X
- Rib2_On = X
- Rib3_On = X

Also create two Stress Analysis Reports using Inventor:

- Report 1: Initial design with no parameter changes to establish as-is base line.
  Name this report: **stress_analysis_report_initial_firstname_lastname.rtf**
- Report 2: Optimal design to provide insights on new proposed design.
  Name this report: **stress_analysis_report_optimized_firstname_lastname.rtf**

Under your AFS hand-in directory, create a sub-directory called "ps7" (lower case) and upload the three RTF files:

- final_report_firstname_lastname.rtf
- stress_analysis_report_initial_firstname_lastname.rtf
- stress_analysis_report_optimized_firstname_lastname.rtf

Note: Do NOT submit any other files.

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1.4 Grading

The problem set grading level will be established from the following items:

- 40% = Correct As-Is condition Data
- 40% = Correct Optimal condition Data
- 20% = Correct Analysis Setup