ME 24-688 – Week 10

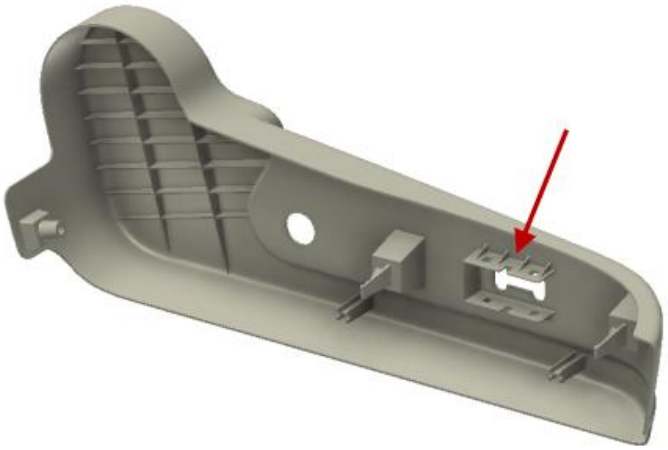
Problem Set Assignment

1 Electrical Switch Snap Fit Mounting Study

The electrical switch component needs to be snapped into the plastic side shield component by hand. During the initial design phase the design engineer is worried that the current design requires too much force to snap the switch into position.

In this assignment you will run computational simulation to ensure the electrical switch component can be pushed into the plastic side shield component by hand without causing damage to the side shield component. Use Autodesk Inventor and Autodesk Simulation.

New Side Shield Plastic Component



Existing Designed Electrical Switch

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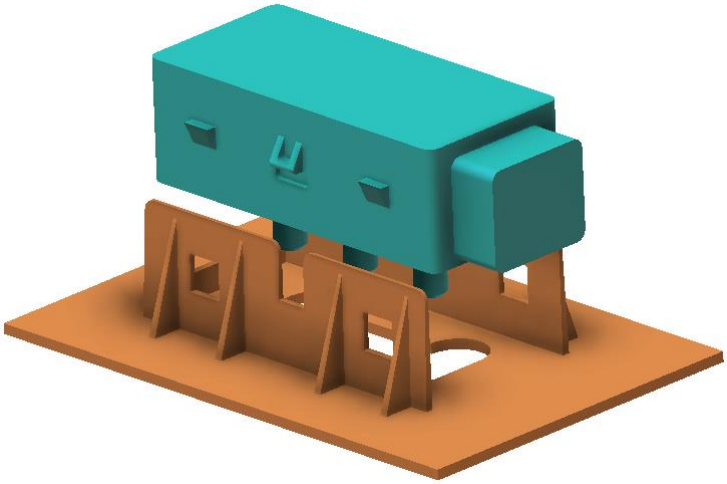
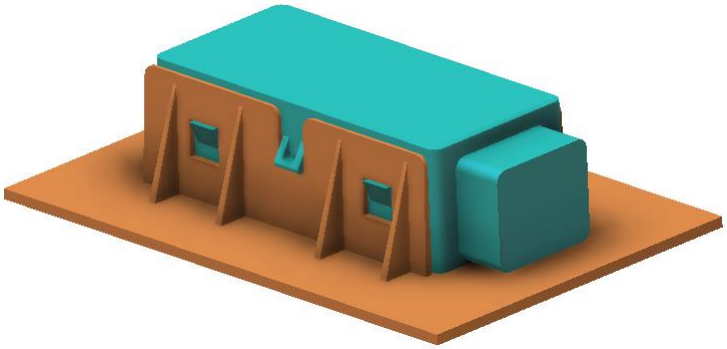
1.1 Provided Items

An Autodesk Inventor model file, *Design Study 1.iam*, has been provided. The initial assembly file has the cyan color switch part 25mm above the final assembly position as shown in the below images.

Initial Starting Position



Final Mounted Position



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1.2 Requirements

First, perform a Mechanical Event Simulation (MES) with Nonlinear Materials Models analysis on the provided models to establish a baseline of the design. Each of the parts material should be set to the Autodesk Simulation *Plastic – ABS (Molded)* material to start with. The *Switch Box* part needs to move down by *25mm* to be in the final locked mounting position. The movement should have a load curve where the switch moves 100% of the distance over 1.0 seconds then stays in the down position for 0.1 seconds. The total analysis timeframe is 1.1 seconds. Make sure that the capture rate of the analysis is 60 frames per second to achieve good results. Also the areas on the *Side Shield* part with high stress may need a refined mesh to ensure optimal results, and this will make the computational time longer. To verify if a smaller mesh in high stress areas is needed, complete an initial analysis with the default mesh size. The outer edges should be used as the fixed constraint to allow the side shield part to deform as required. Complete this study first to capture the baseline data as noted in the final deliverable section.

Once you have the baseline data captured within a report you will notice the deformation, stress levels, and reaction forces of the components. You will then need to measure the reaction forces on the top face of the electrical switch in the Z direction to calculate the force needed to snap the part into position. To improve the design make at least one design change to the *Side Shield* part and complete an analysis using the same parameters. The suggested design change(s) on the *Side Shield* part should reduce the amount of force needed by over 30% at the maximum level to snap the electrical switch into the side shield. Also the new design should minimize the stress applied to the part. You need to make at least one design change however you are free to make additional ones to further improve the design.

Tips

- Simplify the Autodesk Inventor model by splitting the model in half along the XZ plane and setup a symmetry constraint in Autodesk Simulation.
- Remember if you simplify the design in half you will need to multiply your reaction forces by two to calculate the force needed to snap the complete electrical switch into place.
- When setting the surface contact spilt the surfaces to reduce the number of elements included in the contact.

1.3 Final Deliverable

The final deliverables should consist of two PDF reports: (1) for the baseline starting design, and (2) for the purposed new design. Complete the following report field information before submitting your reports in PDF form.

Report Fields

- Project Name = Week 10 Problem Set Assignment
- Author = Enter your name
- Executive Summary = Enter description of analysis with a summary statement about the results.

The following result values should be included in each of the final reports with images:

- Max Von Mises Stress Value of the Side Shield Part = N/(mm^2)
- Max Displacement of the Side Shield Part = mm
- Reaction Force in Z direction of Top Face of Switch = N

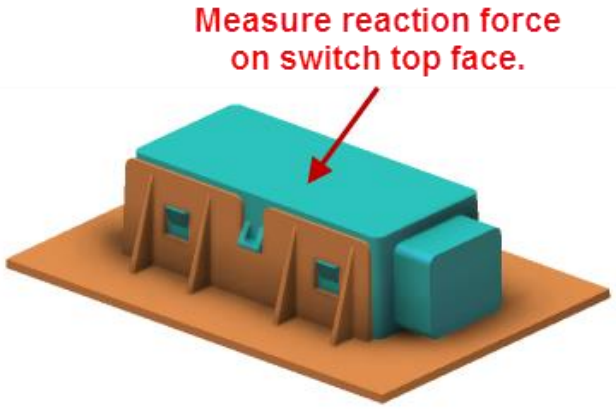
Name the two PDF reports:

ps8_FirstName_LastName_baseline_design.pdf

ps8_FirstName_LastName_new_design.pdf

Create a sub-directory called “ps8” under your AFS hand-in directory and submit the two files there.

Note:



1.4 Grading

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

- 40% = Correct baseline as-is condition data
- 40% = New design recommendation with 30% less force required
- 20% = Analysis Setup