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INTRODUCTION TO COMPUTER AIDED DESIGN

Skills Workshop 2
EG-UY 1004

AGENDA

1. Objectives
2. Background Information
3. Materials
4. Activity
5. Procedure
6. Assignments



Figure 1. Autodesk Fusion Icon Courtesy of AppRecs



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OBJECTIVE

1. **Build** a 3D model using computer-aided design software AutoDesk Fusion
2. **Evaluate** the safety factor of a 3D model using the AutoDesk Fusion simulation software



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BACKGROUND INFORMATION

Computer Aided Design (CAD)

- Software that allows engineers create or modify, analyze, or optimize a design
- CAD models are used as the basis for physical designs



Figure 2. A CAD model of an electronic saxophone (left), later assembled and enclosed in 3D printed plastic (right).



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BACKGROUND INFORMATION

Design Workspace

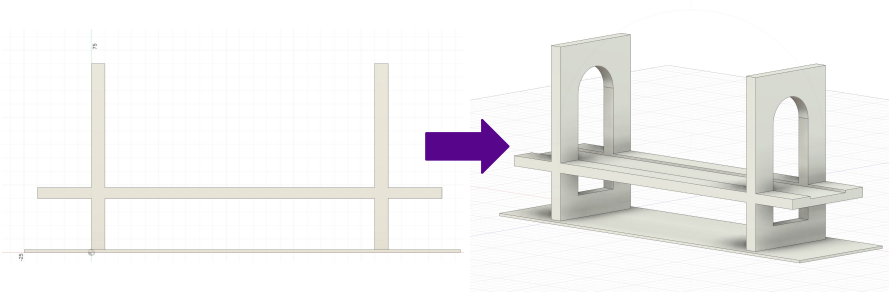


Figure 3. 2D sketch (left) and respective 3D model (right) designed in AutoDesk Fusion

Simulation Workspace

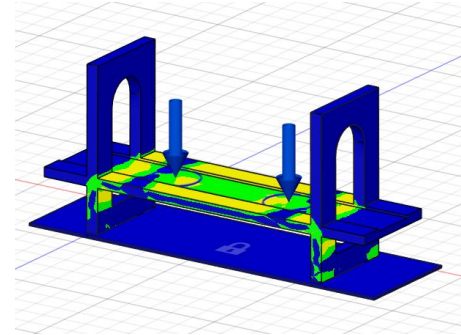


Figure 4. Simulation results of 3D model with load applied in AutoDesk Fusion



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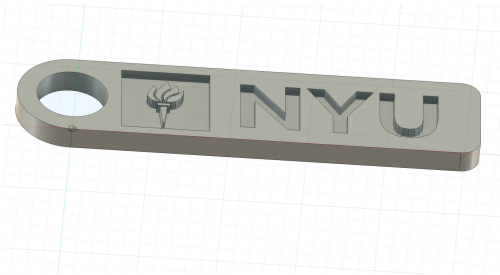
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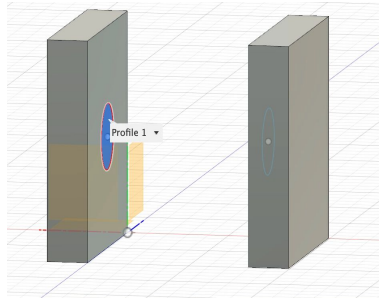
Design Workspace Tools

Extrude



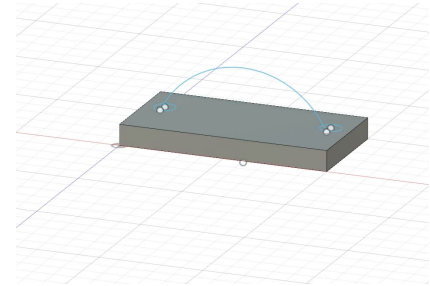
Projects sketch outward

Loft



Creates a 3D extrusion to connect two surfaces (profiles)

Sweep



Creates a 3D model of a profiles along a specific path



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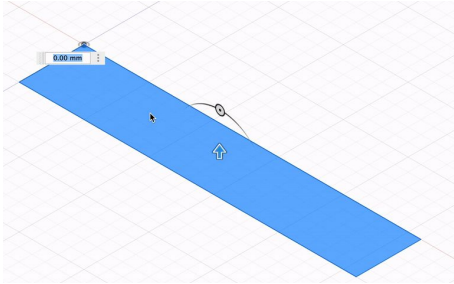
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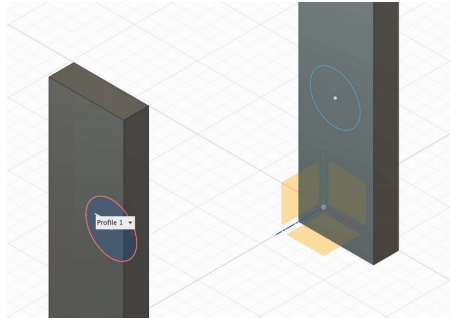
Design Workspace Tools

Extrude



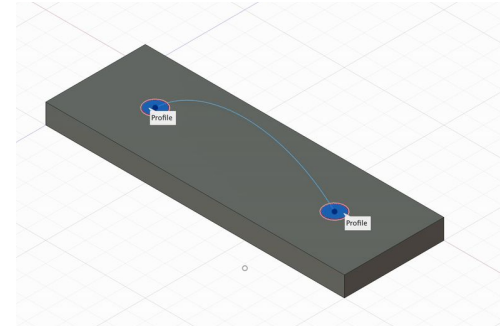
Projects sketch outward

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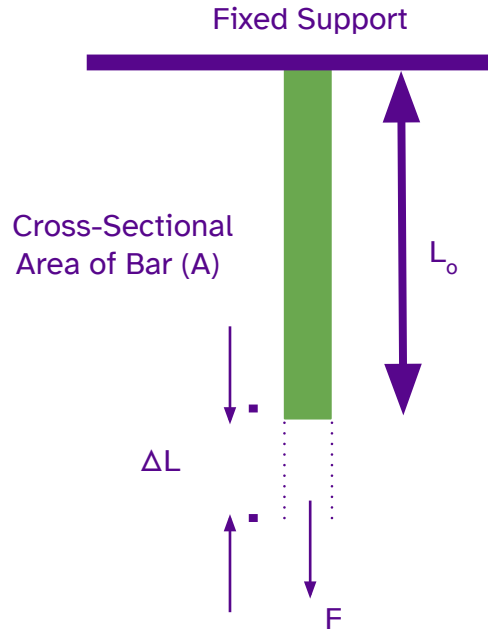
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BACKGROUND INFORMATION

Stress

External force acting on an object per unit cross-sectional area

$$\text{Stress } (\sigma) = \frac{F}{A}$$



Strain

Measure of deformation from an applied force

$$\text{Strain } (\epsilon) = \frac{\Delta L}{L_o}$$

F = applied force
 A = cross-sectional area
 ΔL = change in length
 L_o = original length



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BACKGROUND INFORMATION

Safety Factor Simulation

- Static simulation that calculates the ratio of the yield strength to the applied stress
- Yields strength represents the point at which the material experiences permanent deformation under an applied stress

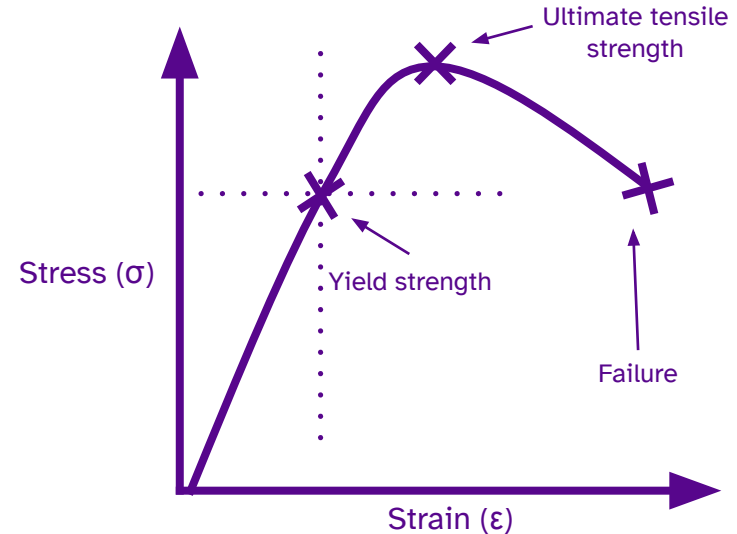


Figure 5. Stress-strain curve.



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MATERIALS

- Writing utensil
- Sheet of paper
- A lab PC
- Autodesk Fusion
- Predesigned part files (download directly from the manual)

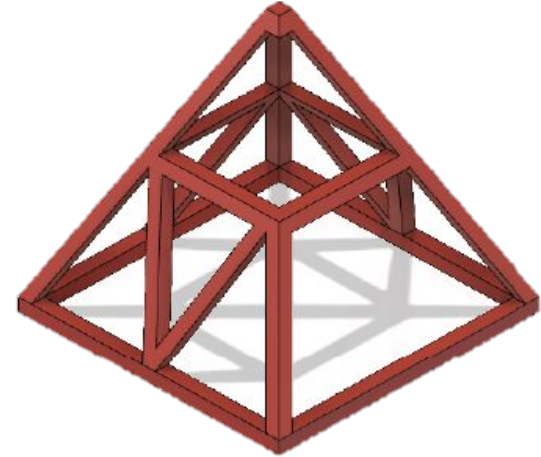


Figure 6. Sample part for Skills Workshop 2.



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ACTIVITY

Part 1: Tutorial

Part 2: Safety Factor Simulation

We will assign you into groups of 3-4 students for today's activity and provide you with the necessary files.

Please have one member sign into AutoDesk Fusion!

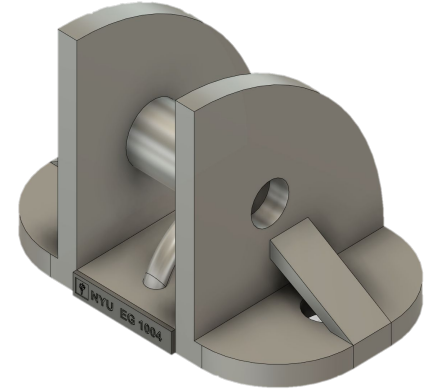


Figure 7. Redesigned part in AutoDesk Fusion.



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PROCEDURE

Save and store the .F3D file!

Download the .F3PD file
from the manual for your
part

Determine the load,
material, and constraints
on the model

Run initial static stress
simulation

Record initial safety factor

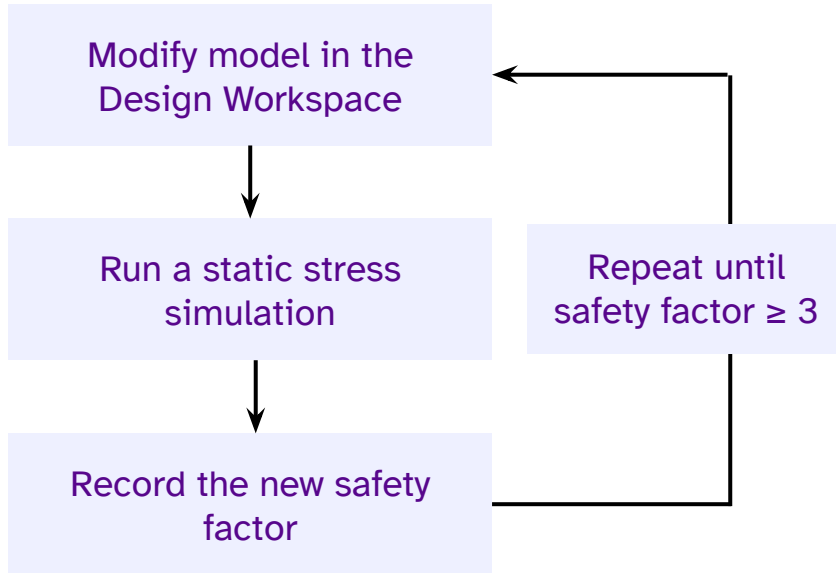


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PROCEDURE



Modification Constraints

- Redesigned part must be made of aluminum, steel, copper, or lead
- Volume of the redesigned part must be less than double the initial volume
- Cannot alter any applied loads or constraints
- Cannot remove areas highlighted in red on the model



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ASSIGNMENTS

Two assignments due after this workshop:

- Technical memo (individual) due at 11:59 PM the night before Skills Workshop 3
- Slide deck (team) due at 11:59 PM the night before Recitation 3

Refer to the manual page for detailed information on each assignment!

Save and store the F3D file for these assignments!

Take a screenshot and record the safety factor after each modification!



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Questions?



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